

SEXUAL IDENTITY DISPARITIES IN BINGE DRINKING:  
A MULTILEVEL ANALYSIS OF THE ALCOHOL POLICY ENVIRONMENT AND  
NONDISCRIMINATION STATUTES

by  
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A dissertation submitted to Johns Hopkins University in conformity with the requirements for  
the degree of Doctor of Philosophy

Baltimore, Maryland  
November 2020

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## ABSTRACT

### *Background*

Binge drinking is a major public health issue with individual and societal costs. Substantial evidence exists documenting binge drinking disparities between lesbian, gay, bisexual compared with heterosexual populations in the United States. Most studies examining the causes of these disparities look to individual and interpersonal experiences of discrimination, prejudice, violence, and homophobia directed at sexual minority people. Few studies examine structural factors, such as public policies, as possible causes for binge drinking disparities by sexual orientation despite evidence that alcohol policies may reduce binge drinking in the general population and nondiscrimination policies may improve mental health outcomes among sexual minority populations. To address these gaps, the current dissertation examines how alcohol policy environments and state-level nondiscrimination statutes are associated with binge drinking disparities between lesbian, gay, bisexual and heterosexual adults in the United States.

### *Methods*

To answer the research question, this dissertation employs a cross-sectional design with some lagged effects. Data from several publicly available administrative data sources were combined to provide information on several individual and state-level factors known to be associated with individual-level binge drinking. Logistic regression models with interaction terms were used to examine the associations between individual-level binge drinking, the alcohol policy environment and nondiscrimination statutes by sexual identity stratified by sex at birth.

### *Results*

Overall, associations between binge drinking and the alcohol policy environment and nondiscrimination statutes were stronger among women than men. Binge drinking disparities between lesbian and bisexual women compared with heterosexual women persisted even in states with stronger alcohol policy environments. However, in the presence of nondiscrimination statutes, disparities disappeared between lesbian and heterosexual women while disparities were much narrower between bisexual and heterosexual women when accounting for the alcohol policy environment.

### *Discussion*

This dissertation provides evidence that structural factors, such as the alcohol policy environment and nondiscrimination statutes, can further elucidate binge drinking disparities between sexual minority and heterosexual populations in the United States. Furthermore, a health equity perspective is needed in alcohol policy research to ensure that effective policies are working the same way for all population subgroups, especially those with higher alcohol consumption.

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## ACKNOWLEDGEMENTS

Completing this work has been one of the most difficult things I've ever done, and one of the most fulfilling. My desire for a career in public health began ten years ago. As a StoryCorps facilitator, I traveled to Philadelphia to record stories at the American Public Health Association Annual Conference. Although Philly has a great food culture, I was not looking forward to the trip. Interviews between colleagues talking about their work were never as captivating as those between family members or close friends. I was wrong. It may sound far-fetched, but when these public health professionals spoke about their work, their eyes sparkled – like people talking about their first love. Their passion for improving health and saving lives was evident. When I returned home, I started researching Master of Public Health programs. This dissertation is the culmination of the journey I started ten years ago. And I have many people to thank who have helped me along the way.

First, I would like to thank Dr. Joanna Cohen, my advisor. I feel there could not be a better match between student and advisor. Since day one, Joanna has always been honest and fair in her assessments of my work. She has asked challenging questions not only to push me to think about my research in different ways, but to also think about my career in different ways. Despite the many commitments she has, Joanna has always made herself available to meet and discuss even the smallest of questions. Where I saw roadblocks, Joanna always saw opportunities. Because of her critical eye and guidance I've never felt unprepared for any step in the doctoral process.

Second, I'd like to thank each member of my dissertation committee. I remember meeting with Dr. Renee M. Johnson to ask if she would be on my committee. It was one of the most exciting meetings I had at Hopkins. Her enthusiasm for this research was palpable. She was a wealth of knowledge and ideas. Throughout the dissertation process, Renee has pushed me out of my comfort zone in how I think about alcohol use. She has asked me to consider different definitions of problematic alcohol use that I will continue to explore in future research. Dr. Danielle German brought her experience working with LGBT populations and asked me to consider what makes the community unique. She has stimulated my thinking about the social and cultural reasons that people drink. Finally, I'm so pleased that I got to work with Joanne Rosen. Her background as a lawyer and her passion for improving the health of LGBT and other

marginalized groups made her a great asset to this team. One memory I will always carry with me is her poise in teaching with her carefully crafted hand-written notes. Each member of this committee has helped strengthen this work by asking critical questions as well as celebrating the successes. I want to thank each of you for trusting me to run this ship, but always providing guidance when needed.

Third, I would also like to thank members of my departmental exam committee, Dr. Sara Benjamin-Neelon, Dr. Brian Weir, and Dr. Michelle Kaufman. During the exam, they asked thoughtful questions, some of which I continued to wrestle while analyzing the data and writing the dissertation. Thank you for preparing me to take that very first step into independent research.

My ability to complete this work would not have been possible without the financial support on the Cancer Prevention, Epidemiology, and Control Training Grant (NCI National Research Service Award T32 CA009314). I would like to thank Dr. Katherine Smith for nominating me to the program. I would like to thank Dr. Elizabeth Platz for welcoming this social and behavioral scientist into the program. Between the didactic courses on cancer epidemiology, the journal clubs, the Research in Progress events, and the newly formed Special Studies, I have learned so much about the cancer control continuum. I am indebted to the program for helping me reach the next step in my career.

I want to take some time to thank Dr. Lorraine T. Dean and Dr. Tonia Poteat – two amazing researchers and mentors. I first met Dr. Poteat in her Epidemiology of LGBT Health course during my first year. She didn't mince words and she always said exactly what was on her mind. She supported me when I went after scholarships and funding sources. If I could give an award for hardest working mentor, it would go to Dr. Dean. She mentors several students as part of the Dean Lab and yet, she always makes time for every single one of us. She is passionate about her research, but she cares just as much about what is going on in the lives of her students. I will always be grateful to her for having my back and lifting me up.

A huge heartfelt thank you to Jessica Harrington. I could not have blossomed from student to scholar without your light during the darkest days in the program. You showed me how to stand in my power and know that I belonged here no matter what the negative voice in my head tried to tell me.

I also cannot forget my colleagues at the Center on Alcohol Marketing and Youth, my home during the first year in the doctoral program. Though our relationship at CAMY was short-lived, I'm honored that I had the chance to work with Dr. David Jernigan. His passionate advocacy inspired me during the doctoral program. I'm thankful that I was able to work with Dr. Pamela Trangenstein and Dr. Raimee Eck on projects specific to Baltimore. I hope for opportunities to work with them again. And I was to give a special thank you to Amber for always making sure I got paid!

It has been a pleasure to be a student in the Department of Health, Behavior and Society. I want to thank our department chair, Dr. Rajiv Rimal, and our administrative staff for supporting students through COVID-19. Furthermore, I want to thank my doctoral cohort – Danielle, John Mark, Caitlin, Laura, and Amelia. Thank you for putting up with my existential crisis during our doctoral seminar when I couldn't decide whether I was an epidemiologist or a social and behavioral scientist. Thank you for all the impromptu conversations at the Hampton House cafe. Thank you for celebrating milestones together. I look forward to celebrating many more milestones and seeing where your careers take you.

Before Johns Hopkins, there was the New Mexico Department of Health and the CUNY School of Public Health. Both these institutions, and the people in them, were instrumental in making me the public health professional I am today. I cannot send enough thanks to my mentor in New Mexico, Dr. Laura Tomedi, and my colleagues at the department. From the moment I arrived in New Mexico, Laura, Jim, Luigi, and Jessica made me feel like part of the team. Although I was a fellow, my contributions were just as valued as other members of the team. Not only do I carry the memories of working together, but also memories of the train-riders book club, board-game nights, and hiking. Thank you to my advisor at the CUNY School of Public Health, Dr. Heidi Jones, who inspired my love for epidemiology and saw my potential for a PhD.

Last, but clearly not least, I want to thank my family and friends without whom none of this would be possible. To Anushka and Ohemaa, thank you for the week-night dinners, the virtual hangouts, the early morning hikes, and all the laughs. To Fernanda, thank you for always trying to drag me to DC, for TA-ing with me, and commiserating. To Danielle, thank you for your tireless effort to make our department better, for lending your balcony to watch fireworks, and keeping our cohort cohesive. To John Mark, thank you for the memes and watching Drag Race All-Stars (even though my Shangela didn't win). To Caitlin, I'm really going to miss

attending the training grant events you, laughing at your sarcastic jokes, and fabulous sustainable homemade gifts. To Siu, my best friend and hetero-life mate, thank you for making the Blue House my home away from home, for Thanksgiving and Christmas dinners, for always being my loudest cheerleader, for always understanding, and always letting me be myself (no matter how weird).

To my grandfather, I miss you dearly. I know you are with me in spirit. To my grandmother, aunts, and cousins, thank you for your love. To my brother, hopefully I'll earn my Star Wars cred back someday. I still think Episodes I, II, and III could have had better scripts (just sayin').

To my mother, the smartest and strongest woman I know. I could spend a lifetime thanking you for all you've given me, and it still wouldn't be enough. You always said there was nothing that I couldn't do in this world. But everything I've done, from school science fairs, debate competitions, violin recitals, theatre performances, to finishing this dissertation, I've done because you always stood by me, you believed in me when I didn't, and you were always right. I love you.

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## **CHAPTER 1 – BACKGROUND AND LITERATURE REVIEW**

## Introduction

Excessive alcohol consumption is a major contributor to mortality and morbidity. Approximately 5.9% of deaths worldwide and 5.1% of the global burden of disease are attributable to alcohol.<sup>1</sup> According to a 2014 study, 88,000 deaths and 2.5 million years of potential life lost are due to excessive alcohol use in the United States.<sup>2</sup> Moreover, the World Health Organization has stated that alcohol is a causal factor in more than 200 diseases and conditions including liver cirrhosis, alcohol dependence, cancer, and injuries.<sup>1</sup>

Improving the health and well-being of lesbian, gay, and bisexual (LGB) adults is a Healthy People 2020 goal. Sexual minority populations in the United States experience a higher prevalence of excessive alcohol consumption and alcohol-related harms compared with the general population. According to a report by the Substance Abuse and Mental Health Services Administration (SAMSHA), the prevalence of binge drinking among sexual minority adults is significantly higher compared with sexual majority adults (36.1% vs 26.7%).<sup>3</sup> Data from the National Health Interview Survey show that gay and bisexual men and women have significantly higher odds of being current drinkers and current heavy drinkers compared with heterosexual men and women when controlling for demographic characteristics, healthcare access, and relationship status.<sup>4</sup> Furthermore, lesbian, gay, and bisexual adults are more likely than heterosexual adults to have a DSM-IV diagnosis for alcohol use disorder and to report negative consequences related to alcohol use including legal problems, problems at work, health problems, or problems in relationships.<sup>5</sup>

Current literature on sexual minority populations posits that the higher prevalence of excessive alcohol consumption may be partially explained by the experience of minority stress. Meyer conceptualized minority stress as the excess stress experienced by lesbian, gay and bisexual populations as a result of discrimination, prejudice, and internalized homophobia.<sup>6</sup> Several qualitative and quantitative studies provide evidence of a connection between minority stress and excessive alcohol consumption. In qualitative studies, interviews with sexual minority women revealed that many self-medicate with alcohol to cope with negative life stressors including homophobia and traumatic experiences.<sup>7,8</sup> In quantitative studies, minority stress was cross-sectionally associated with frequent drinking and alcohol problems among men and was longitudinally associated with alcohol-related consequences among women.<sup>9,10</sup> Given the



disparity of excessive alcohol consumption among sexual minority populations, it is critical to examine potential interventions that can reduce disparities in alcohol consumption and alcohol-related harms between LGB and heterosexual adults.

Laws and regulations that impact the affordability, availability, and accessibility of alcohol are thought to be cost-effective and efficacious in reducing excessive alcohol consumption in the general population. The Community Preventive Services Taskforce has conducted several systematic reviews showing that individual policies such as increasing alcohol taxes,<sup>11</sup> regulating alcohol outlet density,<sup>12</sup> and limiting the days<sup>13</sup> and hours<sup>14</sup> when alcohol can be sold greatly reduces binge drinking and alcohol-related motor vehicle crashes, injuries, and violence. However, a major limitation of examining individual alcohol policies on population-level alcohol consumption and alcohol-related harms is that individual policies are not implemented in a vacuum; therefore, it is difficult to isolate their effects.

In response to this limitation, alcohol policy researchers have developed a tool to measure the strength of the alcohol policy environment at the state level.<sup>15</sup> The Alcohol Policy Scale (APS) score is a composite quantitative measure of the combined strength of individual alcohol policies enacted in US states. The score incorporates both the number of efficacious policies enacted and the degree of implementation of those policies within a particular state and year.<sup>15</sup> Higher APS scores reflect stricter policy environments. Two studies provide evidence that the strength of the alcohol policy environment, as measured by APS scores, is strongly associated with lower binge drinking among the general population and among age and sex subgroups.<sup>15,16</sup> However, these same studies allude to the possibility that the alcohol policy environment may not be equally protective for all subgroups. Furthermore, these studies have not explored the association between the alcohol policy environment and binge drinking by sexual identity. Therefore, it remains unclear whether alcohol policy environments may be effective tools for lowering binge drinking among sexual minority subgroups or narrowing disparities in binge drinking between sexual minority and heterosexual populations.

## **Background**

### *Epidemiology of alcohol use in the United States*

Alcohol is the third major contributor to mortality and morbidity in the United States following tobacco and diet.<sup>17</sup> Alcohol consumption impacts both acute and chronic illnesses. In

the US, 40% of motor vehicle fatalities are attributable to alcohol consumption either by the driver or the occupant.<sup>18</sup> Varying levels of alcohol consumption, from low to high volume, are associated with coronary heart disease,<sup>19</sup> and seven different cancers are attributable to alcohol consumption.<sup>20</sup> Notwithstanding the mortality and morbidity, excessive alcohol consumption costs the US approximately \$223.5 billion in lost productivity, health care costs, and criminal justice costs.<sup>21</sup>

Alcohol use differs substantially across person, place, and time. Data from the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC) show alcohol consumption increased between 2001-2002 and 2012-2013.<sup>22</sup> During this time period, fewer adults abstained from drinking. Additionally, current drinkers drank more frequently and engaged in binge drinking more often.<sup>22</sup> Much of this change was related to increased consumption among women, individuals with less education, and individuals with lower incomes. Data from the National Health Interview Survey show between 1997 and 2014, the prevalence of alcohol use and binge drinking increased among adults 60+ years and older driven by marked increases among women during that time period.<sup>23</sup>

A review of the literature on alcohol use by age, race-ethnicity, and gender provides evidence that alcohol use disorders and negative alcohol-related consequences, such as motor vehicle crashes, are prevalent among those 18-25 years. Although White populations had the highest prevalence of alcohol consumption, people of color are more likely to experience negative outcomes even at low levels of alcohol consumption.<sup>24</sup> For example, Native American populations were more likely to exhibit alcohol use disorders and be involved in motor vehicle crashes.<sup>24</sup> Black populations had a significantly higher prevalence of being involved in alcohol-related homicide and alcohol-related intimate partner violence.<sup>24</sup> Alcohol use and related harms have been increasing among the general population and among certain subgroups.<sup>25</sup>

Studies examining trends in alcohol consumption among sexual minority populations have focused on youth, mainly high school students. Three recent studies using data from the Youth Risk Behavior Surveillance System (YRBSS) find evidence that while it appears that alcohol consumption and other substance use is decreasing among youth overall, these same reductions are not seen among sexual minority youth.<sup>26-28</sup> Moreover, disparities in binge drinking appear to be widening between sexual minority and heterosexual youth.<sup>26</sup> Two recent studies have examined alcohol consumption differences across the life span for sexual minority

adults.<sup>29,30</sup> Both studies allude to the possibility that disparities in alcohol use and other substance use between sexual minority and heterosexual populations continue after adolescence into young and middle adulthood.

### *Alcohol policy and alcohol use in the general population*

Alcohol policy refers to the “laws, regulations and practices used to reduce excessive alcohol consumption and related harms in society.”<sup>31</sup> Unlike individual-level interventions, alcohol policy influences the environments in which alcohol is sold. Until recently, most literature in the field examined individual alcohol policies and their impact on excessive alcohol consumption and related negative consequences. The Community Preventive Services Taskforce has conducted several systematic reviews of individual alcohol policies including alcohol taxes and price,<sup>11</sup> the regulation of alcohol outlet density,<sup>12</sup> limiting the days and hours when alcohol can be sold,<sup>14</sup> and holding alcohol outlets liable for overserving customers.<sup>32</sup> While this literature shows that individual policies can reduce excessive alcohol use, a major limitation of examining individual alcohol policies is that it can be difficult to isolate the effects of any one policy on population-level alcohol consumption or harms as no policy is implemented within a vacuum. Therefore, more recent literature has attempted to examine the entire alcohol policy environment (i.e., all laws and regulations influencing the sale and distribution of alcohol) on excessive alcohol consumption and related harms.

To capture the universe of alcohol policy in the US, Nelson and colleagues convened a Delphi panel of 10 alcohol policy experts who created a list of 47 policies. Experts rated idealized versions of these policies based on the strength of the evidence about their impact on alcohol consumption among adults and youth. Policies were rated individually, and then similar policies were grouped together (e.g., pricing policies, physical availability, drinking and driving, promotion). Policies that impacted the price of alcohol were rated as most effective among the four groups of policies.<sup>31</sup>

Two recent studies show a significant association between the strength of the alcohol policy environment as measured by the Alcohol Policy Scale score and excessive alcohol consumption among adults. Naimi and colleagues found that a stricter alcohol policy environment (represented as higher APS scores) was associated with lower prevalence of adult binge drinking across a 10 year period.<sup>15</sup> In a 2015 study using similar data sources, researchers

examined the relationship between subgroups of alcohol policies (pricing, promotion, physical availability, and drinking and driving) and individual-level binge drinking among adults.<sup>16</sup> After adjusting for individual and state-level covariates, a 10-percentage point increase in APS score was associated with an 8% reduction in the odds of binge drinking, an 8% reduction in the odds of frequent binge drinking (i.e.,  $\geq 5$  times within the last 30 days), and a 10% decrease in the odds of high volume drinking (i.e. 10 or more drinks in one occasion). Some policy subgroups had a larger effect on binge drinking measures than others. These included policies directed at the whole population vs targeted at those under the legal drinking age ( $<21$ ), policies that changed the price and availability of alcohol, policies that targeted alcohol consumption versus impaired driving, and those policies with higher efficacy ratings.<sup>16</sup>

### *Minority stress and sexual minority alcohol use*

Posited by Ilan Meyer, minority stress theory describes processes by which social experiences of discrimination and stigma based on sexual minority identity “get under the skin” through increases in stress and reliance on coping mechanisms.<sup>6</sup> Several studies have explored how constructs of minority stress may relate to harmful alcohol use among sexual minority populations.

Wray, Pantalone, Kahler, Monti, and Mayer explored cross-sectional psychosocial pathways between experiences of discrimination and alcohol use among two independent samples of gay, bisexual and other MSM, one HIV-negative and the other HIV-positive.<sup>33</sup> Path modeling suggested that experiences of discrimination among MSM increased enhancement motives (e.g., liking the feeling of drinking) and sexual motives (e.g., drinking to increase confidence in approaching sex partners) leading to higher alcohol use. However, Wong, Kipke, Weiss, and McDavitt found that among gay, bisexual, and MSM greater homophobic discrimination among peers was associated with 42% lower odds of binge drinking.<sup>34</sup> Drawing from minority stress theory and intersectionality theory, English, Rendina, and Parsons examined longitudinal associations between racial discrimination, gay rejection sensitivity (a measure of minority stress), emotional regulation, and mental health among a sample of gay and bisexual men of color.<sup>35</sup> Greater experiences of racial discrimination and gay rejection sensitivity at baseline were associated with heavy drinking at 12-month follow-up by increasing emotional dysregulation and symptoms of depression.<sup>35</sup>

Wilson, Gilmore, Rhew, Hodge and Kaysen examined whether minority stress was longitudinally associated with alcohol use among a national sample of young lesbian and bisexual women.<sup>10</sup> In this sample, experiences of minority stress were not associated with whether individuals drank, typical weekly drinking or frequency of alcohol use at one-year follow-up after adjusting for the quantity and frequency of alcohol use at baseline. However, experiences of minority stress were significantly associated with increased negative consequences at one-year follow-up. The authors concluded that minority stress may influence drinking styles that lead to negative consequences rather than overall alcohol intake among young sexual minority women.<sup>10</sup>

Bryan, Kim and Fredriksen-Goldsen examined social factors associated with high risk drinking among a cohort of older (50+ years) lesbian, gay, and bisexual adults. In this cohort, 20.6% of older LGB adults were classified as high-risk drinkers.<sup>36</sup> Among women, higher levels of social support were positively associated with being a high-risk drinker. However, among men, daily discrimination was positively associated with being a high-risk drinker. The authors concluded that social network norms among lesbian and bisexual women may influence drinking behavior. However, minority stressors may be more salient for gay and bisexual older adult men who may use alcohol to cope.<sup>36</sup>

#### *Social norms, drinking contexts, and excessive alcohol use among sexual minority groups*

Besides minority stressors, disparities in excessive alcohol use among sexual minority populations may originate in the social norms around alcohol within LGBT communities, including where and with whom sexual minority individuals drink. Feinstein, Bird, Fairlie, Lee and Kaysen examined drinking contexts among a national nonprobability sample of lesbian and bisexual women ages 18-25 years recruited through social media.<sup>37</sup> Approximately 50% of the sample reported drinking either weekly or daily at a friend's home. Lesbian women had 31% higher odds of drinking in bars compared with bisexual women. Another study by Feinstein, Dyar, and London examined how outness and LGBT community involvement influenced alcohol abuse among lesbian and bisexual women.<sup>38</sup> While LGBT community involvement was protective for lesbian women, greater LGBT community involvement was associated with alcohol abuse for bisexual women.<sup>38</sup>

Parks and Heller recruited a nonprobability sample of lesbian and bisexual women 18+ years to understand how the drinking contexts during the "coming out" phase may impact later levels of alcohol use.<sup>39</sup> Participants completed face-to-face interviews about when they first started living openly as a sexual minority, where and with whom they drank during this period, and their past 12-month alcohol use. Lesbian and bisexual women who consumed alcohol in lesbian settings and gay bars during their formative coming out years had higher 12-month drinking frequency compared with those who did not. The authors concluded that the places and the people with whom sexual minority women drink influences their later alcohol use and alcohol problems independent of how old they were when they first came out.<sup>39</sup>

Tobin, Latkin, and Curriero examined the spatial characteristics of where African American gay, bisexual and other MSM in Baltimore, MD used alcohol and other drugs with individuals in their social network.<sup>40</sup> Sixty-eight percent of places where the sample used alcohol or drugs with their social network members were classified as residences (either the participant's residence or the residence of a social network member). Moreover, Tobin et al. found that places where gay-identified African American men used alcohol/drugs were more spatially clustered than places where other MSM used alcohol/drugs.<sup>40</sup> The authors concluded that residences may afford both protection and risk for alcohol/drug use and other HIV risk behaviors among African American sexual minority men in Baltimore, MD.<sup>40</sup>

Finally, a qualitative study conducted with a convenience sample of 15 sexual minority women living in California found that factors influencing excessive alcohol use included a need to reduce anxiety, belief that drinking would make a situation more enjoyable, and feelings of pressure to fit in with other LGBTQ individuals, particularly in LGBTQ spaces.<sup>41</sup> In sum, unlike heterosexual individuals, sexual minorities often go through a 'coming out' process which may include seeking out both an abstract and functional place within the larger LGBT community. While these spaces may insulate individuals from heterosexism and homophobia, they also include community norms about alcohol use that may confer risk.

### *Policy and sexual minority health*

Several studies provide compelling evidence that state laws impact health outcomes among sexual minority adults in the US. Hatzenbuehler, McLaughlin, Keyes, and Hasin examined changes in psychiatric disorders during the 2004/2005 elections when some states

passed bans on same-sex marriage.<sup>42</sup> Using longitudinal data from two waves of the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC), the authors found that among lesbian, gay, and bisexual adults living in states that banned same-sex marriage, there were significant increases in mood disorders, generalized anxiety disorders, alcohol use disorders, and psychiatric comorbidities. Among lesbian, gay, and bisexual adults living in states that did not ban same-sex marriage, there were no significant changes in psychiatric outcomes.<sup>42</sup>

A companion study conducted by Hatzenbuehler and colleagues using NESARC found that state-level policies moderate the association between sexual minority identity and psychiatric disorders. Lesbian, gay, and bisexual (LGB) individuals living in states with discriminatory laws were significantly more likely to have a psychiatric disorder compared with LGB individuals living in states with protections against hate crimes and employment discrimination.<sup>43</sup>

Using data from the Behavioral Risk Factor Surveillance System, Raifman and colleagues found that state laws permitting refusal of services to sexual minorities were associated with greater mental distress among sexual minority groups, but were not associated with mental health among the heterosexual population.<sup>44</sup> A quasi-experimental study conducted in Massachusetts found that following the enactment of same-sex marriage laws, mental health visits and mental health care costs decreased significantly among sexual minority men.<sup>45</sup>

Limited evidence suggests that state-level tobacco policy may reduce smoking disparities by sexual identity. In a 2014 study, the authors examined relationships between the state-level tobacco control environment, current smoking, nicotine dependence and sexual identity. The tobacco control environment was operationalized as a scale score that accounted for tobacco control policies (e.g., taxes), tobacco use prevalence and social norms. States varied widely in the permissiveness of the tobacco environment. Lesbian, gay, and bisexual adults living in states with less permissive tobacco environments were 6% less likely to have ever smoked and 12% less likely to be current smokers. Although disparities in tobacco use between LGB and heterosexual adults existed in all states, disparities were highest in states with the most permissive tobacco environments.<sup>46</sup>

Few studies have investigated how public policies affecting other areas of life, such as state nondiscrimination statutes, influence excessive alcohol use among sexual minority populations. Everett, Hatzenbuehler and Hughes conducted a quasi-experimental study to

examine the impact of the Religious Freedom Protection and Civil Union Act on excessive alcohol use among sexual minority women living in Chicago, IL.<sup>47</sup> The law grants the same legal status to civil unions between same-sex partners as to marriages between different-sex partners. Time of recruitment (pre-legislation, signing of legislation, enactment of legislation) was the primary independent variable. Sexual minority women recruited after the signing of the legislation had significantly lower odds of excessive drinking compared to those recruited before the legislation was passed. The authors concluded that laws upholding the equality of sexual minority populations have positive benefits on the health of sexual minorities.<sup>47</sup> This literature suggests that not only do state laws impact the health of sexual minority populations, but they may also moderate the relationship between sexual orientation and substance use behavior.

### *Gaps in the literature*

Population based surveys show that excessive alcohol use and related consequences are increasing among the general population fueled primarily by rapid increases among certain subgroups. The few studies that have examined differences in excessive alcohol use across sexual orientation have been conducted among youth. These studies show that disparities between sexual minority and heterosexual populations are widening despite overall decreases in substance use among youth generally. However, more studies are needed comparing sexual minority and heterosexual adults as differences in developmental stage and life circumstances may impact disparities among adults. These indicators are critical for evaluating the effectiveness of potential interventions.

Literature examining the link between minority stress and alcohol use among sexual minority populations relies on intra-individual and interpersonal measures. Most studies administer scales to participants to measure discrimination. Few studies account for the environment in which people live. Literature on mental health outcomes indicates that state laws may create or worsen structural level stigma and have a significant impact on the health of sexual minority populations in the US.

A major limitation in the alcohol policy literature is that it remains unclear whether the alcohol policy environment has similar protective effects on all population subgroups. Although the strength of alcohol policy environments had similar effects across age and gender groups, there appeared to be no association between the strength of the APS scores and excessive alcohol



use among Black and Hispanic populations.<sup>16</sup> Sexual minority subpopulations were not studied. However, similar work in tobacco policy indicates that state policy environments may impact sexual minority groups differently than heterosexual groups.<sup>46</sup> Therefore, more research is needed to understand trends in excessive alcohol use by sexual identity, the impact of structural stigma on alcohol use among this population, and whether the alcohol policy environment, like the tobacco policy environment, may be protective.

## **Theoretical Foundations**

This research is grounded in social theories which arise from the current literature supporting the research question. The literature on the impact of alcohol policy on alcohol use among the general population is underscored by economic theory and the understanding that individuals react rationally to changes in economic systems. The literature on disparities in alcohol use among sexual minority adults is underscored by minority stress and structural stigma.

### *Traditional economic theory*

Traditional economic theory takes a rational view of human behavior. Change in individual consumption of a good is predicated on rational reactions to the economic forces of supply, demand, and price.<sup>48</sup> For example, if demand remains constant and supply increases, then the price of a good will decrease. In this case, the consumption of that good will increase as individuals attempt to maximize their purchasing power. However, if demand remains constant yet supply decreases, then prices will increase to compensate. In this case, the consumption of a good will decrease since individuals have less purchasing power within the market.

Under these assumptions, the goal of alcohol policy is to impact the affordability, availability, and accessibility of alcohol products. Affordability refers to an individual's purchasing power and whether they can pay for a particular alcohol product. Availability describes whether an alcohol product is part of the market (e.g., sitting on a shelf ready to be purchased). Accessibility indicates an individual's ability to physically get to the economic market in which the alcohol product is sold. Changing any or all of these factors influences the economic forces within the market which are assumed to impact consumption behavior. In this regard, alcohol policy should have the same impact on all populations.

### *Minority stress theory vs structural stigma as a fundamental cause*

Minority stress theory is situated within a larger literature of general stress theory that discusses physiological reactions to experiences that may be etiologically linked with particular health outcomes, specifically mental health outcomes. Meyer defines minority stress as the excess stress a member of a minority group experiences as a result of minority status within society.<sup>6</sup> Meyer's framework is additive. Environments produce stressors for all individuals regardless of status or identity. However, there are specific minority stressors that individuals experience as a result of their sexual minority status that are added to these general stressors. Some stressors are objective (i.e., distal), such as the experience of violence or trauma as a result of one's sexual orientation. Other stressors are subjective (i.e., proximal), such as the belief or expectation that one will be targeted because of their sexual orientation. Both objective and subjective stressors are hypothesized to lead to health outcomes through physiological stress processes. Coping resources and social support may moderate the hypothesized relationship between objective/subjective (i.e., distal/proximal) stressors and positive/negative health outcomes.

As previously discussed in the background, a significant amount of literature examining differences in excessive alcohol use by sexual orientation is grounded in Minority Stress Theory. This has both strengths and limitations. First, a major strength of the minority stress model is that by focusing on the experiences of minority populations, this theoretical perspective forces researchers to search for explanations of health disparities within social differences rather than as inherent, biological differences. In other words, health disparities between sexual minority populations and heterosexual populations are created through social processes rather than 'natural' differences.

A second major strength of the minority stress model is that it incorporates resiliency among minority populations. Coping mechanisms and social support play a critical role in determining how minority stressors will influence health behaviors and outcomes among minority populations. From this perspective, excessive alcohol use may be viewed as a coping mechanism, perhaps self-medication, to handle the trauma caused by experiences of homophobia. Qualitative work conducted with sexual minority women has shown that this is a reasonable perspective.<sup>7,8</sup> Moreover, excessive alcohol use may also occur as the outcome of greater interaction with LGBT community as a means of social support.<sup>38</sup> However, as alluded to

in the background, a major limitation of the literature grounded in the minority stress model is a reliance on measuring individuals' reports of homophobic and/or discriminatory events. Thus, in this viewpoint, an individual must experience interpersonal homophobic acts and prejudice as an explanation for their health behaviors. This conceptualization does not quite get at the macro-level processes that may underscore health disparities for LGB populations in the United States. Therefore, the proposed research pivots to fundamental cause theory as a concurrent theory to the minority stress model and argues that structural stigma is a fundamental cause of health disparities.

In their seminal paper, "Social Conditions as Fundamental Causes of Disease," Dr. Bruce Link and Dr. Jo Phelan, argue that the study of disease in the population should move away from a focus on individual risk factors and the mechanisms that link these risk factors to disease.<sup>49</sup> Instead, epidemiologists and public health researchers should 1) examine the physical and social context in which people live that puts them at risk and 2) examine fundamental causes of health outcomes and health disparities. Fundamental causes "involve access to resources that can be used to avoid risks or to minimize the consequences of disease once it occurs. We define resources broadly to include money, knowledge, power, prestige, and kinds of interpersonal resources embodied in the concepts of social support and social network."<sup>49</sup> Thus, fundamental cause theory is concerned with macro-level factors that influence health outcomes and posits that only when these factors are eliminated will there be improvements in health and a reduction in health disparities.

More recently, Hatzenbuehler, Phelan, and Link have argued that structural stigma should be considered along with socio-economic position as a fundamental cause of disease because 1) stigma impacts a large proportion of the population and 2) stigma is associated with multiple health outcomes.<sup>50</sup> Link and Phelan conceptualize stigma as a process that involves labeling, stereotyping, separating, and employing structural discrimination to inflict social status loss and reinforce power differentials between the majority and the minority group.<sup>51</sup> Stigmatized groups lack access to resources as a result of their stigmatized status. This lack of access further engrains power disparities between privileged and marginalized groups. Stigmatized groups, such as sexual minorities, may experience more social isolation compared with privileged (i.e., heterosexual) groups which the empirical literature shows is associated with worse health outcomes.<sup>50</sup> Stigmatized groups may respond to the stereotyping and labeling impacts of stigma

by overexerting self-control. For example, fear of prejudice may lead LGB individuals to exert additional effort when deciding whether to move to a particular state, accept a job offer at a company, discuss their personal lives in professional settings, or buy a house in a particular neighborhood. Exerting high levels of self-control over time may deplete emotional resources and lead to emotional dysregulation or maladaptive coping behaviors such as excessive alcohol or substance use.<sup>50</sup> Stigmatization is a tool of oppression used by those in power to “keep people down, keep people in, or keep people away.”<sup>50</sup>

### *Application of theories to proposed research*

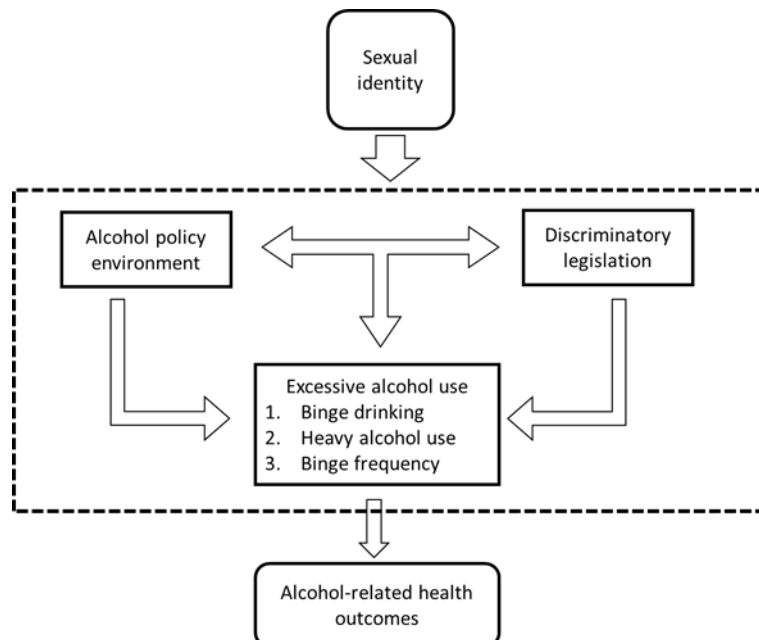
Incorporating the perspective that structural stigma is a fundamental cause of disease has major strengths in grounding not only the conceptual aspect of the proposed research, but also the empirical elements of the research. Similar to the minority stress model, structural stigma as a fundamental cause reinforces the viewpoint that health disparities occur as a result of social processes. Again, it is not that sexual orientation per se produces different alcohol-related behaviors, but rather that alcohol-related behaviors are different by sexual orientation because sexual minority groups face stigma in relation to their sexual orientation that heterosexual groups do not. However, Hatzenbuehler, Link, and Phelan’s conceptualization of structural stigma as a fundamental cause goes beyond the minority stress model to encapsulate macro-level forces that lead to health outcomes. Individuals do not have to *directly* experience homophobia or recognize and report discrimination to suffer under structural discrimination. Rather, “disadvantage can result outside of a model in which one person does something bad to another.”<sup>51</sup>

This research proposes that state-level policy in areas of employment, housing, and public accommodations can act as structural discrimination and ultimately structural stigma. An individual lesbian, gay, or bisexual person does not necessarily have to lose their job, be refused housing or other services, or be treated differently in education to suffer in states with a lack of protections in these areas. Moreover, while alcohol policy may lead to some absolute reductions in excessive alcohol use across subgroups, alcohol policy that does not account for stigma’s fundamental role in disparities in excessive alcohol use by sexual orientation may not reduce the disparities in excessive alcohol use.

### *Conceptual framework*

Starting from the bottom of the model and working towards the top, excessive alcohol use is hypothesized to influence alcohol-related health outcomes. This hypothesis is supported by an extensive literature on the links between binge drinking, heavy alcohol use, and binge frequency with alcohol-related mortality and morbidity. Furthermore, empirical evidence shows that alcohol policy environments can reduce these patterns of excessive alcohol use at the individual and population level. Based on prior research on tobacco use and psychiatric disorders, this research proposes that discriminatory legislation may also be related to patterns of excessive alcohol use. Discriminatory legislation is a form of structural discrimination given that it can be used to maintain the negative labelling, stereotyping, and separating of the stigmatized group. As discussed above, many forms of substance use occur as maladaptive coping behaviors among stigmatized populations. Additionally, this research hypothesizes that the alcohol policy environment may interact with discriminatory legislation. While each exposure has a direct effect on the outcome, they may also work synergistically to determine alcohol use behavior. The relationships between the exposure and outcomes have been enclosed in a box.

**Figure 1.1: Conceptual Framework**



The research hypothesizes that the way in which these relationships work to influence excessive alcohol use at the individual-level is moderated by an individual's sexual identity. One concrete way that sexual identity may influence the relationships presented in the box is that for

heterosexual individuals, the relationships between discriminatory legislation on the basis of sexual orientation hypothetically would not exist. In other words, heterosexual individuals would not face status loss, separation, nor discrimination on the basis of their heterosexual status or identity. While there may be other reasons for heterosexual populations to develop maladaptive coping behaviors that include substance use, this particular mechanism would not exist and would not create synergy with alcohol policy.

For simplicity, other individual and state-level characteristics have been hidden on this conceptual framework. However, the research does propose that individual characteristics such as age, gender, and race-ethnicity play an important role in determining the stressors that may lead to maladaptive coping behaviors. Moreover, state-level characteristics such as religiosity and police per capita may influence population level alcohol use outside of the alcohol policy environment. These characteristics must be taken into consideration as alternative reasons for any differences seen in the relationships under study within and across states.

## **Specific Aims and Hypotheses**

The purpose of this research is to examine how state-level alcohol policy environments interact with structural level stigma, conceptualized as state-level discriminatory laws, to contribute to disparities in binge drinking between sexual minority adults and heterosexual adults in the United States. This study defines binge drinking as 4+/5+ drinks for women/men on a single occasion (about 2 hours). The proposed study will use a quantitative repeated cross-sectional design with individuals nested within US states.

**Aim 1:** To examine of the association between the state-level alcohol policy environment and the prevalence of binge drinking among sexual minority adults compared with heterosexual adults in the United States

**Hypothesis 1:** The association between the state-level alcohol policy environment and binge drinking will be the same for sexual minority adults compared with heterosexual adults in the United States

**Aim 2:** To examine whether the association between state statutes that prohibit discrimination based on sexual orientation and the prevalence of binge drinking is higher, lower, or the same comparing sexual minority and heterosexual adults in the United States

**Hypothesis 1:** Among sexual minority adults, those living in states with non-discrimination statutes will have a lower prevalence of binge drinking compared with those living in states without non-discrimination statutes.

**Hypothesis 2:** Among heterosexual adults, there will not be an association between the presence of state non-discrimination statutes and the prevalence of binge drinking.

**Aim 3:** To explore how state-level alcohol policy environments interact with state laws that prohibit discrimination on the basis of sexual orientation to contribute to differences in binge drinking between sexual minority and heterosexual adults in the United States

**Hypothesis 1:** Non-discrimination legislation that includes sexual orientation strengthens the association between the state-level alcohol policy environment on binge drinking among sexual minority adults

**Hypothesis 2:** Non-discrimination legislation that includes sexual orientation does not moderate the association between the state-level alcohol policy environment and binge drinking among heterosexual adults

## **Public Health Significance**

The proposed research contributes to an understanding of disparities in excessive alcohol consumption by sexual identity in three important ways. First, although we know that state-level alcohol policy environments can reduce excessive alcohol use among the general population, studies have yet to show whether alcohol policy has similar protective effects across subgroups. The proposed research will fill this gap by examining whether alcohol policy environments have similar protective effects for sexual minority individuals, a group with a higher prevalence of excessive alcohol consumption. Second, previous studies have measured distal minority stressors

at the intra-individual and interpersonal level. However, few studies have examined distal stressors such as the lack of state legal protections on the basis of sexual orientation. The proposed research will fill this gap by examining how state nondiscrimination laws are associated with excessive alcohol use by sexual identity. Third, it is not clear whether alcohol policy can reduce excessive alcohol use or disparities in excessive alcohol use in the face of structural stigma. Therefore, the proposed research explores how alcohol policy environments and state laws interact. Understanding how alcohol policy and state public policy interact can direct advocacy efforts towards supporting protective policies to reduce excessive alcohol use among sexual minority groups.



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## **CHAPTER 2 – METHODS**

## **Sample Description**

The Behavioral Risk Factor Surveillance System (BRFSS) is a repeated cross-sectional survey that began collecting data in 1984 overseen by the Centers for Disease Control and Prevention (CDC). Since its inception, BRFSS uses a sampling frame of landline telephone numbers. In 2011, the CDC augmented the sampling frame to include both landline and cellphone numbers. The BRFSS is administered by interviewers either in state health departments, academic institutions, or through private survey companies. Regardless of the institution that administers the survey, all data must be collected systematically as outlined by the CDC. Interviews are conducted in English and Spanish.<sup>9</sup>

The BRFSS uses multistage sampling and random digit dialing to select participants with a known probability. First, interviewers identify eligible households. These include housing units with a separate entrance and considered an individual's primary residence. Institutions such as prisons and group homes do not meet eligibility criteria for the BRFSS. Since 2011, college campuses are considered eligible households and individual students are treated as single-adult households. Second, interviewers identify eligible participants within a household. An eligible participant is an individual at least 18 years of age living in the household. To maximize the opportunity to reach residents, interviewers may make up to 15 call attempts to a single household. Additionally, 80% of BRFSS call attempts are made on weeknights and weekends. Each year states attempt to collect approximately 4,000 interviews; however, actual sample sizes and response rates differ by year (Table 2-1). Participants are not provided incentives.<sup>9</sup>

**Table 2.1: Behavioral Risk Factor Surveillance System total sample and median response rates, 2015-2018**

<b>Survey Year</b>	<b>Total Landline Sample<sup>1</sup></b>	<b>Total Cellphone Sample</b>	<b>Median Landline Response Rate</b>	<b>Median Cellphone Response Rate</b>	<b>Weighted Combined Landline and Cellphone Response Rate<sup>2</sup></b>
2015	254,660	186,836	48.2%	47.2%	47.2%
2016	252,265	234,039	47.7%	46.3%	47.1%
2017	197,825	253,194	45.3%	44.5%	45.9%
2018	165,299	272,201	53.3%	43.4%	49.9%
Response rate is the percentage of people who completed a BRFSS interview among all people who were eligible to be interviewed in that year					
Available in BRFSS Combined Landline and Cell Phone Weighted Response Rates by State. Available at: <a href="https://www.cdc.gov/brfss/annual_data/annual_data.htm">https://www.cdc.gov/brfss/annual_data/annual_data.htm</a>					
Available in BRFSS Summary Data Quality Reports. Available at: <a href="https://www.cdc.gov/brfss/annual_data/annual_data.htm">https://www.cdc.gov/brfss/annual_data/annual_data.htm</a>					

The BRFSS includes up to four sections of questions. The first section, referred to as the Standard Core Questions, are asked in every participating state in every year. The second section, referred to as the Rotating Core Questions, are asked in every state in every other year. States can choose to add a third section that includes CDC-approved optional modules for specific health behaviors. Finally, states may design and add their own questions to the end of the survey. State-added questions are not tracked by the CDC and responses to these questions are not included in the publicly available BRFSS datasets on the CDC BRFSS website.<sup>9</sup>

The Sexual Orientation and Gender Identity module is a CDC approved optional module. Table 7.1 in Appendix A provides sample sizes for each state by sexual identity and indicates which states have included sexual orientation in their non-discrimination statutes for employment, education, and public accommodations. Between 2015-2018, 35 states included the Sexual and Gender Identity module at least once in the BRFSS. Three states used the module in only one year (Colorado, Kentucky, Tennessee). Ten states used the module in two years (California, Florida, Iowa, Kansas, Maryland, Montana, North Carolina, Oklahoma, South Carolina, West Virginia). Ten states used the module in three years (Georgia, Idaho, Indiana, Louisiana, Massachusetts, Mississippi, Missouri, Rhode Island, Vermont, Washington). Twelve



states used the module in all four years (Connecticut, Delaware, Hawaii, Illinois, Minnesota, Nevada, New York, Ohio, Pennsylvania, Texas, Virginia, Wisconsin).

## Exposure Measures

### *Alcohol policy scale (APS) score*

In 2010, investigators from several academic institutions convened a Delphi panel of ten alcohol policy experts from academic, government, non-profit research organizations, and consulting firms including the University of Connecticut School of Medicine, University of Illinois at Chicago, University of Minnesota, Centers for Disease Control and Prevention Alcohol Program, Prevention Research Center, Pacific Institute for Research and Evaluation (PIRE), and the CDM Group, Inc.<sup>10</sup> Each alcohol policy expert rated 29 individual alcohol policies on a scale of 1 (low) to 5 (high) for how efficacious they believed a policy is in reducing population alcohol use.<sup>10,11</sup>

Investigators developed implementation criteria specific to each alcohol policy on a continuous scale of 0 to 1.<sup>11</sup> A state's total alcohol policy score is calculated in two steps. First, the efficacy rating (ER) is multiplied by the implementation rating (IR) for each individual alcohol policy by state and year. Second, the products are summed for each state and year. The formula for this calculation is:

$$APS\ score_{jh} = \sum_{k=1}^{n=29} (ER_k * IR_{kjh})$$

where j=state, h=year, and k=policy. Previous studies have rescaled the raw APS scores to fit within a 0% - 100% range to make comparisons between states easier.<sup>12</sup>

Dr. Tim Naimi and colleagues at Boston University continue to collect information about passage of new alcohol policies for each state and year using the Alcohol Policy Information System, an online database maintained by the National Institute on Alcohol Abuse and Alcoholism (NIAAA).<sup>13,14</sup> APIS is periodically updated to reflect the most recent passage of state laws that impact the regulation of alcohol products within the state. The most recent update occurred on December 20, 2018 and reflects all changes to alcohol-related state laws that took

effect starting January 1, 2018. Dr. Naimi provided the researcher with calculated APS scores for all states for years 2014-2017.

### *Inclusive nondiscrimination statutes*

Several organizations track the enactment of state-level nondiscrimination statutes that include sexual orientation or gender identity. Two such organizations are 1) The Human Rights Campaign Foundation (HRC), a 501(c)(3) civil rights organization supporting equality for lesbian, gay, bisexual, transgender, and queer (LGBTQ) adults and youth in the United States<sup>15</sup> and 2) The Movement Advancement Project, a nonprofit thinktank that conducts research on laws' and policies' impact on LGBT communities in an effort to affect change.<sup>16</sup>

Legal experts in both organizations review federal, state, and local legislation each year to determine how policies will impact the lives of LGBT people. HRC releases the State Equality Index report each year which outlines whether newly enacted laws and regulations furthers or hinders equality for LGBTQ people in areas of housing, employment, education, and public accommodations. Similarly, MAP tracks the enactment of policies and produces reports and interactive maps on its website detailing new laws and policies impacting multiple areas of life including, but not limited to, employment, housing, education, and public accommodations. Given that neither organization is the definitive source of information about inclusive nondiscrimination laws, this dissertation will triangulate data from both sources and make comparisons with actual written state statutes.

Non-discrimination legislation ensures that LGBTQ adults and youth are protected from state-sanctioned discrimination. Non-discrimination in employment ensures that LGBTQ individuals cannot be denied employment, fired from a job, or subject to other forms of employment discrimination due to their sexual orientation or gender identity. Non-discrimination in housing ensures that LGBTQ individuals cannot be denied the right to buy or rent property on the basis of their sexual orientation or gender identity, or subject to other forms of housing discrimination. Non-discrimination in public accommodations ensures that LGBTQ individuals cannot be denied service in public or private entities including retail stores and recreational facilities on the basis of sexual orientation or gender identity.

One previous study uses data provided by the Human Rights Campaign to examine the relationship between the presence of non-discrimination laws and health status by sexual

orientation (Gonzales & Ehrenfeld, 2018). In this study, the authors create binary indicator variables for whether a state had passed non-discrimination legislation on the basis of sexual orientation in the areas of housing, employment, and education. The current study will begin with this approach. The researcher will create indicator variables for each of 4 types of legislation: 1) Non-discrimination in employment; 2) Non-discrimination in housing; 3) Non-discrimination in public accommodations; and 4) Non-discrimination in education. Values of 1 will indicate whether a state has included sexual orientation in the non-discrimination law and values of 0 will indicate otherwise. These data will be extracted from HRCs and MAPs state reports then merged with state-level alcohol policy data. The researcher will use SAS to merge data from these multiple sources with outcome information from BRFSS.

## **Outcome Measure: Binge Drinking**

The Behavioral Risk Factor Surveillance System (BRFSS) includes a series of questions on individual-level alcohol consumption. This module is part of the Core Questions and is asked of every participant in every jurisdiction in each year. CDC defines excessive alcohol consumption as a construct that includes binge drinking and chronic heavy alcohol use. NIAAA and CDC define binge drinking as 4+/5+ drinks for women/men on one occasion (about 2 hours) (Centers for Disease Control and Prevention, 2018; National Institute on Alcohol Abuse and Alcoholism, n.d.).

## **Potential Covariates**

### *Individual level*

The Behavioral Risk Factor Surveillance System (BRFSS) collects demographic information from participants. The collection of sexual identity on BRFSS is not part of the demographic module. Instead, CDC provides an approved optional module that jurisdictions can use to collect this information. Twenty-five states included the sexual identity module in 2017. Twenty-three states included the sexual identity module in 2016. Twenty-two states included the module in 2015. Nineteen states included the module in 2014. From 2006-2016, participant's sex was determined through tone of voice by the BRFSS interviewers. In 2017, a question was added to the demographics module that asked participants to specify their sex. Race and ethnicity are asked separately within the demographics module (Table 2-2).

**Table 2.2: Individual demographic characteristics in the Behavioral Risk Factor Surveillance System**

Construct	Definition	BRFSS Question	Responses	Years Available	Calculations
Age	Chronological age	What is your age?	__ Code age in years Don't know/Not sure Refused	2006-2017	Continuous
Sexual Identity	Individuals who identify as gay, lesbian, bisexual, pansexual, same-gender loving or another term	Do you consider yourself to be:	Straight Lesbian or Gay Bisexual	2014-2017 (not all states)	None
Sex		Are you...?	Male Female	2017* (2006-2016)	None
Ethnicity		Are you of Hispanic, Latino/a, or Spanish origin?	Yes No	2006-2017	Ethnicity and race are combined into one variable calculated by the CDC
Race		Which one or more of the following would you say is your race?	White Black or African American American Indian or Alaska Native Asian Pacific Islander	2006-2017	
Education	Highest level of schooling achieved	What is the highest grade or year of school you completed?	Never attended school Elementary Some high school High school graduate Some college College graduate	2006 - 2017	
Relationship status		Are you...?	Married Divorced Widowed Separated Never married Member of an unmarried couple Refused	2006 - 2017	Categorical – some categories may be combined if small sample sizes
Employment		Are you currently...?	Employed for wages Self-employed Out of work for 1 year or more Out of work for less than 1 year A homemaker A student Retired Unable to work	2006 - 2017	Categorical – some categories may be combined if small sample sizes

Construct	Definition	BRFSS Question	Responses	Years Available	Calculations
Household income	Income from all sources that support all those living in the household	Is your annual household income from all sources -	Less than \$10K \$10,001-\$15K \$15,001-\$20K \$20,001-\$25K \$25,001-\$35K \$35,001-\$50K \$50,001-\$75K \$75K+	2006 - 2017	Categorical – some categories may be combined if small sample sizes
*In other years, sex/gender was assumed by the BRFSS interviewer based on voice. BRFSS interviewers were instructed to only ask about the participant's sex if necessary.					
Source: <a href="https://www.cdc.gov/brfss/questionnaires/index.htm">https://www.cdc.gov/brfss/questionnaires/index.htm</a> Accessed October 31, 2018					

### *State level*

US states differ in many ways that may confound the association between state-level alcohol policy environment, non-discrimination laws, and excessive alcohol use. Previous studies<sup>12,17,18</sup> examining the association between alcohol policy and excessive alcohol use at the state level have included the following state-level covariates: state-level demographic characteristics (proportion of adults  $\geq 21$ , population distribution by gender and race/ethnicity), proportion of the state residing in urban centers, median household income, religious composition (proportion Catholic), police officers per capita, and geographic region (Northeast, Midwest, South, West). These data are available from the US Census, the American Community Survey, and the Bureau of Justice Statistics of the U.S. Department of Justice.

## **Statistical Analyses**

### *Exploratory data analysis*

The first exploratory analysis will aid in determining possible selection bias with using data from the Behavioral Risk Factor Surveillance System (BRFSS), given that not all states used the Sexual and Gender Identity module from 2014-2018. First, the analysis will examine the presence/absence of non-discrimination laws among states comparing those that included the CDC module on sexual orientation with states that did not between 2014-2018. Second, the analysis will examine the mean APS scores among states that included the CDC module on sexual orientation compared with states that did not. Finally, the analysis will examine the prevalence of excessive alcohol use among states that included the CDC module on sexual orientation compared with states that did not. This analysis will help determine how

representative states included in the analyses are of all states within the US and aid in understanding the generalizability of study results.

The second exploratory analysis will describe the differences in excessive alcohol use comparing sexual minority adults and heterosexual adults within the BRFSS. First, the analysis will compare sexual minority adults and heterosexual adults across demographic characteristics (age, sex, race/ethnicity, education, household income) self-rated health status, and current smoking. Second, the analysis will examine differences in the prevalence of binge drinking, chronic alcohol use and high frequency binge drinking comparing sexual minority adults and heterosexual adults. Third, the analysis will use regression adjustment (logistic regression for binary outcomes, linear regression for continuous outcomes) to control for population differences in demographic characteristics, self-rated health, and current smoking between sexual minority adults and heterosexual adults. This analysis will use the survey weights provided with the BRFSS to weight the data to be representative of the included states.

The third exploratory analysis will examine the Alcohol Policy Scale (APS) scores among states using descriptive statistics (mean, standard deviation). The purpose of this exploratory analysis is to provide insight into how best to include APS scores within the statistical models. These analyses will help determine how to center the APS scores and how to scale them within the statistical models. The intercepts will be interpretable at an observed value of APS score (rather than at zero) and the slopes will be interpretable as the change in the outcome for a certain unit increase (e.g., 10 percentage point) in APS score.

### *Statistical models*

The study will fit logistic regression models that account for the complex survey design employed in BRFSS. Using SAS, the models will be fit using survey commands in which information about primary sampling units, strata, and cluster can be input.

For Aim 1, the study will build a model to investigate the association between the state-level Alcohol Policy Scale (APS) score and binge drinking. For each model, sexual identity is hypothesized as a moderator because the interest is in examining whether the association between APS score and the outcome of interest differs between sexual minority and heterosexual adults. For this aim, the basic model will be as follows:

$$\text{Logit}[Pr(Y_{sti} = 1)] = \beta_0 + \beta_1 APS_{st} + \beta_2 LGB_{sti} + \beta_3 (APS_{st} * LGB_{sti}) + \dots$$

#### Definitions

$Y_{sti}$ : {binge drinking for person i at year=x+1 within state s}

$APS_{st}$ : {alcohol policy score for state at year=x}

$LGB_{sti}$ : {sexual minority identity for person i at year x within state s}

For Aim 2, the study will build a model to investigate the association between nondiscrimination law and binge drinking. Models will include sexual identity as a moderator to investigate whether these associations differ between sexual minority and heterosexual adults. For this aim, the basic model will be as follows:

$$\text{Logit}[Pr(Y_{sti} = 1)] = \beta_0 + \beta_1 NDP_{st} + \beta_2 LGB_{sti} + \beta_3 (NDP_{st} * LGB_{sti}) + \dots$$

#### Definitions

$Y_{sti}$ : {excessive alcohol use for person i at year=x+1 within state s}

$NDP_{st}$ : {presence of non-discrimination policy based on sexual orientation within state s at year=x}

$LGB_{sti}$ : {sexual minority identity for person 1 at year=x within state s}

For Aim 3, the study proposes to include a three-way interaction to investigate whether the association between the non-discrimination laws modify the association between APS scores and binge drinking for sexual minority adults and heterosexual adults. For this aim, the basic model will be as follows:

$$\text{Logit}[Pr(Y_{sti} = 1)] = \beta_0 + \beta_1 APS_{st} + \beta_2 NDP_{st} + \beta_3 (APS_{st} * NDP_{st}) + \beta_4 LGB_{sti} + \beta_5 (LGB_{sti} * APS_{st}) + \beta_6 (LGB_{sti} * NDP_{st}) + \beta_7 (LGB_{sti} * APS_{st} * NDP_{st}) + \dots$$

#### Definitions

$Y_{sti}$ : {excessive alcohol use for person i at year=x+1 within state s}

$APS_{st}$ : {alcohol policy score for state at year=x}

$NDP_{st}$ : {presence of non-discrimination policy based on sexual orientation within state s at year=x}

$LGB_{sti}$ : {sexual minority identity for person 1 at year=x within state s}

Another approach to modeling the associations of interest is to use random effects (i.e., mixed effects models). Random effects models provide estimates of associations conditioned on

the cluster. Random effects could be useful in examining within and between state variability in the association between the exposures of interest and excessive alcohol use.

Although CDC attempts to collect information from all individuals on all health behaviors and outcomes in the BRFSS survey, some outcome information, including variables for excessive alcohol use, may be missing for some participants. To fit models that produce unbiased estimates of the associations under study, certain assumptions may be made as to the reasons that may have led to missing data. This research assumes that the missing data are missing at random (MAR) based on the following assumptions. First, the people who participated in BRFSS who reside in any given state are representative of the population of that state due to multistage sampling strategies employed by CDC. It is reasonable to assume that if a participant is missing information on the outcome variables (binge drinking, heavy alcohol use, high frequency binge drinking), this missingness is not dependent on the outcome response for other participants within the BRFSS. Second, it may not be reasonable to assume that a participant's missing outcome information is independent of the response they would have given had they answered the question. Two methods for handling missing data under the MAR assumption are weighting and multiple imputation.

## **Methodological Considerations**

There are three methodological limitations that arise for the proposed study. First, there are issues of causality and possible reverse causation. Data for these analyses come from repeated cross-sectional surveys, and thus causal interpretations of associations between exposures and outcomes are not possible. Moreover, states may pass alcohol policies to create a stricter alcohol policy environment in response to population-level alcohol consumption. However, lagging the APS scores by one year can ensure that the associations found are not the result of reverse causation, a solution employed by previous studies in this area.<sup>12</sup> Thus, the study will examine alcohol outcomes one year after the enactment of alcohol policies so that exposures are measured before outcomes.



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### **CHAPTER 3 – STATE-LEVEL ALCOHOL ENVIRONMENTS AND SEXUAL IDENTITY DISPARITIES IN BINGE DRINKING IN THE BEHAVIORAL RISK FACTOR SURVEILLANCE SYSTEM<sup>1</sup>**

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<sup>1</sup> Manuscript has been submitted to *LGBT Health* and is formatted for this journal.

## **Abstract**

*Purpose:* Binge drinking disparities by sexual identity are well documented. Stronger alcohol policy environments reduce binge drinking in the general population. We examined whether state-level alcohol policy environments have the same association with binge drinking among gay, lesbian, and bisexual adults as heterosexual adults.

*Methods:* Binge drinking, sexual identity, and demographic characteristics were extracted from the 2015-2018 Behavioral Risk Factor Surveillance System. The strength of the alcohol policy environment was measured using the Alcohol Policy Scale (APS) score. We estimated the association between APS score and binge drinking using logistic regression and included an interaction term between APS score and sexual identity.

*Results:* The interaction between APS score and sexual identity was not significant and findings differed between women and men. Among women, higher APS score was associated with lower odds of binge drinking (adjusted odds ratio [aOR]: 0.96, 95% CI: 0.94 – 0.99). Differences in binge drinking by sexual identity remained after adjusting for individual and state-level factors (e.g., the percentage of LGB adults in the state). Compared with heterosexual women, the odds of binge drinking were 43% higher (aOR: 1.43, 95% CI: 1.17 – 1.75) among lesbian women and 58% higher (aOR: 1.58, 95% CI: 1.40 – 1.79) among bisexual women. Higher APS score was not associated with binge drinking among men.

*Conclusions:* Stronger state-level alcohol policy environments are associated with lower binge drinking among women. Lesbian and bisexual women are still more likely to engage in binge drinking compared with heterosexual women even in states with stronger alcohol policy environments.

*Keywords:* alcohol policy environment, Behavioral Risk Factor Surveillance System, binge drinking, health disparities, LGB, multilevel models

## Introduction

In 2018, more than 39 million U.S. adults engaged in binge drinking,<sup>1</sup> defined as 4+ or 5+ alcoholic drinks for women or men on one occasion.<sup>2</sup> Binge drinking results in injuries, suicide, interpersonal violence, and cancer.<sup>3</sup> Although men in the US are more likely to engage in binge drinking than women, over the past decade the gap between women and men is narrowing as a higher proportion of women are engaging in binge drinking.<sup>4,5</sup>

Further, there are differences in binge drinking prevalence by sexual identity which are more pronounced among women than men. Data from the National Survey on Drug Use and Health (NSDUH) show that for lesbian, gay, and bisexual (LGB) adults, the prevalence of binge drinking is 36.1% compared with 26.7% among heterosexual adults, a statistically significant difference.<sup>6</sup> Among women, 36% of lesbians and bisexuals binge drink compared with 21% of heterosexual women, a statistically significant difference.<sup>6</sup> Moreover, sexual minority women (whether defined by identity, attraction, or behavior) are more likely to engage in high-intensity binge drinking (i.e., 8+ drinks within 2 hours) compared with exclusively heterosexual women.<sup>7</sup> Some population-based studies show that gay and bisexual men have increased odds of excessive alcohol use compared with heterosexual men<sup>8</sup> while other studies show no significant difference between sexual minority and heterosexual men.<sup>9</sup> The “gender paradox” is the finding that there is a larger gap in alcohol use and alcohol-related harms between LGB and heterosexual women compared with the smaller gap between GB and heterosexual men.<sup>10</sup> This paradoxical finding underlies the importance of examining differences in binge drinking disparities by sexual identity separately for women and men.

Most studies examining the determinants of binge drinking differences between sexual minority and heterosexual populations focus on individual and interpersonal factors. Links between hazardous alcohol use among sexual minority adults and experiences of minority stressors include perceived discrimination,<sup>11,12</sup> and interpersonal violence.<sup>13,14</sup> Differences in community norms around drinking including differences in where and with whom sexual minority and heterosexual individuals drink,<sup>15,16</sup> the role alcohol plays in the LGBT community and identity development,<sup>17,18</sup> and the use of alcohol to cope with general and minority stressors<sup>19</sup> have also been studied. However, factors at all levels of the social ecology (individual, interpersonal, community, and policy) shape differential risk for binge drinking yet

few studies have examined policy level factors and their relationship with differences in binge drinking across sex and sexual orientation.

Alcohol policies are strongly related to population-level alcohol consumption in the general population.<sup>20–22</sup> Broadly, alcohol policies reduce physical availability of alcohol products, increase their price, and make it more expensive to use alcohol excessively.<sup>23</sup> A few specific alcohol policies reduce binge drinking and alcohol-related harms at the population level, including increased alcohol taxes,<sup>24</sup> regulations on amount of alcohol outlets in a given area (i.e., alcohol outlet density),<sup>25</sup> and limitations to days and hours of sale for alcohol products.<sup>26</sup> However, a recent study examining the effect of beverage-specific taxes on alcohol consumption and alcohol-related harms found that this type of alcohol policy was protective for some subgroups, primarily African American women, but not all subgroups leading the authors to call for future research on the association between alcohol policies and alcohol consumption across subgroups.<sup>27</sup>

Moreover, individual alcohol policies are not enacted and implemented in a vacuum. Therefore, alcohol policy researchers have developed a tool to measure the strength of the alcohol policy environment. The Alcohol Policy Scale (APS) is a composite policy measure that assesses the combined strength of multiple individual alcohol policies functioning within a jurisdiction, primarily at the state level.<sup>20</sup> Stronger alcohol policy environments are associated with reduced individual-level binge drinking in the general population and among certain subgroups, but not others.<sup>21</sup> However, similar to studies examining individual alcohol policies, few studies have examined whether the alcohol policy environment is associated with lower binge drinking among sexual minorities or wider differences in binge drinking between sexual minority and heterosexual populations. One study from the tobacco policy literature indicates that stronger tobacco policy environments are associated with narrower differences in tobacco use between sexual minority and heterosexual adults.<sup>28</sup> Given that there are limited studies examining the influence of policy factors on binge drinking among sexual minority adults and the indication that policy environments related to tobacco use may reduce disparities, the current study seeks to fill an important gap in the literature on how alcohol policy environments are related to binge drinking among sexual minority populations.

The purpose of this study was to examine the association between the state-level alcohol policy environment and individual-level binge drinking comparing LGB and heterosexual adults

in the United States. The primary aim was to examine whether the association between the alcohol policy environment and binge drinking is the same for LGB and heterosexual adults. A sub-aim of this study was to explore whether the alcohol policy environment is associated with differences in binge drinking risk between LGB and heterosexual adults. We hypothesized that the association between the state-level alcohol policy environment and binge drinking would be the same for LGB adults compared with heterosexual adults given that the alcohol policies included in the composite policy score are not targeted at any specific sexual identity group and are, theoretically, equitably implemented across a state's population.

## **Methods**

### *Data*

We used the 2015-2018 Behavioral Risk Factor Surveillance System (BRFSS), a repeated cross-sectional survey overseen by the Centers for Disease Control and Prevention (CDC). Each US state, the District of Columbia, and US territories conducts telephone interviews using landlines and cellphones. Multistage sampling and random digit dialing are used to produce nationally and sub-nationally representative samples of US adults 18+ years.<sup>29</sup> Inclusion of cellphones and new weighting methods since 2011 have improved representativeness of the target population.<sup>30</sup> Jurisdictions draw on items included in the core BRFSS instruments to enhance comparability across sites. Jurisdictions may also include CDC-approved optional modules which are questions that have been cognitively tested.<sup>29</sup> The Sexual Orientation and Gender Identity (SOGI) module is an optional CDC module that collects information about participants' sexual and gender identity. We restricted the analysis sample to the 35 US states that used the SOGI module in at least one year during the study period (2015-2018). Three states used the module in only one year; 10 states in two years; 10 states in three years; and 12 states for all four years. The Johns Hopkins Bloomberg School of Public Health Institutional Review Board determined that this study was exempt because it uses secondary publicly available data sources.

### *Measures*

We ascertained sexual identity using the question on the SOGI module. Participants were asked "Do you consider yourself to be?" with the following response options: Straight (i.e.,

heterosexual), Lesbian or Gay, Bisexual, or Something Else. People who identified as “something else”, or who responded “Don’t Know” or “Refused,” or were missing responses for this question were excluded from the analysis (women: 15.39%; men: 16.29%). Binge drinking was measured using the following question. Participants were asked: “Considering all types of alcoholic beverages, how many times during the past 30 days did you have X [X=5 for men, X=4 for women] or more drinks on an occasion.” Participants who answered that they engaged in this behavior one or more times were classified as binge drinkers.<sup>2</sup>

We measured the strength of the alcohol policy environment using the Alcohol Policy Scale (APS) score which measures both the presence of multiple alcohol policies and their degree of implementation within each state. The development of the APS score has been discussed in detail elsewhere.<sup>20</sup> Briefly, Boston University researchers convened a Delphi panel of alcohol policy experts. The panel agreed on 29 policies believed to reduce binge drinking at the population level. The expert panel rated each policy on a scale of 1 (low efficacy) to 5 (high efficacy) for how effective each policy is at reducing binge drinking. The final efficacy rating for each alcohol policy is the average of efficacy ratings across the members of the Delphi panel. Then the researchers developed implementation ratings for each policy. APS scores are calculated by multiplying the implementation rating by the efficacy rating for each policy implemented in a state in a given year and then summed across all policies.<sup>20</sup>

The APS score is calculated annually for each state. We used 2014-2017 APS scores for this analysis. As with previous studies, the APS scores were rescaled to be between 0 and 100 percent by dividing each state’s score by the highest possible score and multiplying by 100.<sup>21,22</sup> APS scores were then divided by 10 so that a 1 unit increase in the beta coefficient represented a 10 percentage point increase in APS score. Higher alcohol policy scores reflect stronger alcohol policy environments where many effective individual alcohol policies have been enacted and implemented such that alcohol products are less available, accessible and affordable, and penalties for violating alcohol laws are more severe.

We selected the following contextual factors *a priori* based on previous studies on alcohol policy environments: percentage of the state population across age, sex and race-ethnicity, median household income, law enforcement officers per capita, percentage of the state living in urban areas, prevalence of Catholic religious affiliation, and state region.<sup>21,22</sup> Differences in state-level demographic characteristics<sup>31</sup> and geography (including differences in



region and urban/rural classification)<sup>32</sup> offer competing explanations of differences in population-level binge drinking and may confound the associations under study. Moreover, differences in law enforcement per capita crudely measures a state's ability to enforce certain alcohol policies.<sup>33</sup> A previous study showed a strong positive correlation between the prevalence of Catholics in a state and a state's binge drinking prevalence and no association between the overall prevalence of any religious affiliation and binge drinking.<sup>34</sup> Having a higher proportion of lesbian, gay, and bisexual (LGB) individuals could be a proxy for greater access to LGB community spaces for LGB individuals.

Information about the percentage of the population across age, sex, and race-ethnicity came from the American Community Survey.<sup>35–38</sup> For 2015, 2016, and 2017, we used 5-year estimates. The latest data for 2018 were 1-year estimates. Specific state-level demographic variables included the percentage of the population age 21 years and older (i.e., legal drinkers), the percentage of the population that are adult males, and the percentage of the population that is Non-Hispanic White. The number of law enforcement officers per capita came from the Federal Bureau of Investigation Uniform Crime Reporting Statistics.<sup>39</sup> The 2010 Census provided information about the percentage of a state's population living in urban areas.<sup>40,41</sup> Religious affiliation was measured as the number of Catholic adherents per 1,000 population, from the U.S. Religion Census Religious Congregations and Membership Study.<sup>42</sup> State region (i.e., Northeast, Midwest, South, West) is determined by the US Census Bureau.<sup>43</sup> Data from the Williams Institute provided the estimated number of LGB adults (18+ years) for each state using the 2017 Gallup Tracking poll.<sup>44</sup> We divided the estimated number of LGB adults by the 2017 state population 5-year estimates to get the percentage of LGB adults in each state.

Individual demographic characteristics came from the BRFSS. These included age (18–24, 25–34, 35–44, 45–54, 55–64, 65+ years), sex (female, male), race-ethnicity (Non-Hispanic White, Non-Hispanic Black, Hispanic, Non-Hispanic Other race, Non-Hispanic Multiracial), education (less than high school, high school graduate, some college, college graduate), household income (<\$15K; \$15–24,999; \$25–34,999; \$35–49,000; \$50K plus), and relationship status (married, divorced, widowed, separated, never married, member of unmarried couple).

## *Statistical Analyses*

All analyses were stratified by sex. We used descriptive statistics to analyze individual characteristics and state-level factors. Descriptive statistics for individual characteristics were calculated in Stata 16 using *svy set* commands to account for the BRFSS complex survey design. Logistic regression was used to estimate the association between APS Score, sexual identity, and individual-level binge drinking. APS scores were lagged by one year to account for full implementation of any new alcohol laws enacted in the prior year. We examined whether the association between APS score and binge drinking differed across sexual identity by including an interaction term in the logistic regression models. To explore our sub-aim, we treated sexual identity as the primary independent variable, the APS score as the secondary independent variable, and included all the individual and state-level covariates to the model. We conducted this analysis in SAS 9.4 using PROC SURVEYLOGISTIC which accounts for the BRFSS' complex survey design using design weights that provide accurate standard errors. Covariates were grouped by whether they measured individual characteristics (i.e., age, race-ethnicity, income, education, relationships status), state-level characteristics (i.e., population demographics by age, sex, race, sexual identity; urban population; percent Catholic), state enforcement capacity (i.e., law enforcement officers per capita), and state geography (i.e., Census region). We present models accounting for individual characteristics, state-level characteristics, state enforcement capacity, and state geography as well as all topic areas to thoroughly account for and rule out confounding. All models accounted for secular trends in binge drinking prevalence by including survey year.

## **Results**

The sample included 435,921 women and 339,660 men. Lesbian and bisexual women were younger, more likely to identify as Non-Hispanic Black, and more likely to have never been married compared with heterosexual women (Table 1). Bisexual women (15.4%) were most likely to have household incomes less than \$15,000 dollars compared with both heterosexual women (11.5%) and lesbian women (12.7%). Gay and bisexual men were younger and more likely to have never been married compared with heterosexual men (Table 2). Gay men (37.9%) were most likely to have graduated from college followed by heterosexual men (26.5%) and

bisexual men (22.2%). Yet gay (11.4%) and bisexual men (11.9%) were more likely than heterosexual men (7.9%) to have household incomes less than \$15,000.

Alcohol policy scale (APS) scores did not vary widely from 2014 through 2017 (Figure 1). Pennsylvania and Oklahoma were outliers with very strong alcohol policy environments. Pooled data from 2014-2017 show that, overall, states had moderately strong alcohol policy environments (Table 3). From 2015-2018, states varied substantially in religious affiliation, percentage of the population living in urban areas, percentage of the population that is Non-Hispanic White, and median household income (Supplementary Table S1). Most states were in the Southern region.

The statistical test for interaction between state APS score and sexual minority identity was not statistically significant among women (lesbian:  $p=0.789$ ; bisexual:  $p=0.204$ ). A 10-percentage point increase in the APS score was associated with 0.96 [95% CI: 0.94 – 0.99,  $p=0.003$ ] times the odds of binge drinking among women from 2015 through 2018 after accounting for individual characteristics, state-level characteristics, state enforcement capacity, state geography, and survey year (Table 4). Lesbian women had 1.43 [1.17 – 1.75,  $p<0.001$ ] times the odds of binge drinking compared with heterosexual women adjusting for state APS score, individual characteristics, state-level characteristics, state enforcement capacity, state geography, and survey year. Bisexual women had 1.58 [95% CI: 1.40 – 1.79,  $p<0.001$ ] times the odds of binge drinking compared with heterosexual women adjusting for state APS score, individual characteristics, state-level characteristics, state enforcement capacity, state geography, and survey year.

The interaction between state APS score and sexual identity was not statistically significant among men (gay:  $p=0.670$ ; bisexual:  $p=0.723$ ). Among men, a 10-percentage point increase in the APS score was not associated with binge drinking odds from 2015 through 2018 after accounting for individual characteristics, state-level characteristics, state enforcement capacity, state geography, and survey year (OR: 1.00 [95% CI: 0.97 – 1.02,  $p=0.706$ ]) (Table 5). Gay men had 1.03 [95% CI: 0.91 – 1.17,  $p=0.627$ ] times the odds of binge drinking compared with heterosexual men after adjusting for state APS score, individual characteristics, state-level characteristics, state enforcement capacity, state geography, and survey year. But this association was not statistically significant. Bisexual men had 1.03 [95% CI: 0.88 – 1.22,  $p=0.681$ ] times the odds of binge drinking compared with heterosexual men after adjusting for state APS score,

individual characteristics, state-level characteristics, state enforcement capacity, state geography, and survey year.

## Discussion

We examined the association between the alcohol policy environment, sexual identity, and individual-level binge drinking and found support for our hypothesis that the alcohol policy environment has the same association with binge drinking for LGB and heterosexual women and men. Stronger and more comprehensive alcohol policy environments were associated with lower odds of binge drinking among women but were not associated with binge drinking among men regardless of sexual identity. Moreover, we found that stronger alcohol policy environments were not associated with narrower differences in binge drinking between lesbian/bisexual and heterosexual women. In other words, after accounting for the strength of the alcohol policy environment and other individual and state-level factors, higher odds of binge drinking among lesbian/bisexual women compared with heterosexual women remained.

We applied a multiple testing correction to our alpha value to reduce the possibility of finding significant results due to chance and constructed 99% confidence intervals around the point estimates (Supplementary Tables S2-S4). Overall, point estimates that were significant at  $\alpha=0.05$  remained significant at the Bonferroni-corrected  $\alpha=0.00625$  with two notable exceptions. First, among women, the point estimate for the association between alcohol policy score and binge drinking adjusted for only state-level covariates was not significant at the Bonferroni-corrected alpha value. This may suggest that there was residual confounding in the model that only included state-level factors given that this point estimate was significant when accounting for all covariates.

Second, our main analyses show a significantly higher odds of binge drinking comparing bisexual to heterosexual men in the model that only includes alcohol policy score and survey year. This point estimate is not considered significant using the Bonferroni-adjusted alpha value. However, both the main analyses and the analyses adjusting for the multiple testing correction provide evidence that this point estimate is confounded and that there is not a significantly different odds of binge drinking by sexual identity among men after accounting for possible confounding measured at the individual and state-level.

Our point estimates for the association between binge drinking and sexual identity among women are quite similar to previous studies using the Behavioral Risk Factor Surveillance System despite accounting for the alcohol policy environment.<sup>46</sup> These differences can be considered “disparities” because, as noted in the introduction, they are determined by social differences in treatment between lesbian/bisexual and heterosexual women, namely the additional stress that results from homophobia and discrimination.<sup>12,47</sup>

The study findings point to the importance of including a health equity perspective when examining the role of alcohol policy on binge drinking. One literature review found that many studies assume that alcohol policies will have the same effect on alcohol consumption and alcohol-related outcomes across subpopulations, but do not examine whether this assumption is true or whether these policies can reduce known health disparities (e.g., increased binge drinking among sexual minority adults).<sup>45</sup> Our findings suggest that, at the very least, the alcohol policy environment does not widen binge drinking disparities between lesbian/bisexual and heterosexual women in the United States, but stronger alcohol policy environments also do not narrow binge drinking disparities between these groups. Our findings combined with this understanding of how binge drinking differences between lesbian/bisexual women and heterosexual women occur underscores that other structural factors, such as nondiscrimination laws, may play an important role.

Moreover, our findings may support current theories of bisexual specific stressors. Similar to previous studies using BRFSS data,<sup>46</sup> our estimate of the binge drinking disparities between bisexual and heterosexual women is higher than that comparing lesbian and heterosexual women. A recent study examining bisexual women’s alcohol use and descriptive drinking norms found that bisexual women believe that other bisexual women drink more than lesbian women.<sup>48</sup> Moreover, bisexual women’s frequency of alcohol consumption, number of binge drinking episodes, and hazardous alcohol use as measured by AUDIT were significantly associated with these descriptive drinking norms for bisexual women, but not descriptive drinking norms for lesbian or heterosexual women.<sup>48</sup> Additionally, previous studies have shown that both heterosexual and lesbian/gay individuals hold negative attitudes towards bisexual individuals such as beliefs about hypersexuality, immorality, and being confused about one’s sexuality.<sup>49</sup> A 2016 study with a nationally representative sample of US adults found that, since the passage of marriage equality, while attitudes towards lesbian women and gay men were

becoming more positive, most adults had neutral or negative attitudes about bisexual individuals.<sup>50</sup>

Our findings also have implications for future research on how alcohol policies may be related to differences in alcohol consumption between women and men across sexual identity. Higher APS scores reflect that a state enacted and fully implemented several highly efficacious alcohol policies. These include 1) higher taxes on alcohol products, particularly those that are a function of price rather than volume; 2) state monopoly on alcohol products; 3) bans on alcohol sales during certain days or times.<sup>51</sup> These policies are related to either the affordability or physical availability of alcohol in a state. The fact that we found a significant association between the alcohol policy environment for women, but not men may be due to differences in socio-economic position and place of alcohol consumption between women and men by sexual identity.

Sexual minority populations are diverse across other demographic characteristics including socio-economic position. This study shows that a large proportion of lesbian and bisexual women have lower household incomes in comparison with both heterosexual women and heterosexual, gay, and bisexual men. While individuals at higher income levels are more likely to binge drink and have more binge drinking episodes, those at lower levels of income have more drinks per binge (i.e., high binge drinking intensity).<sup>52</sup> Previous evidence supports that sexual minority women are more likely to engage in high-intensity binge drinking, defined as 8+ drinks per binge episode, compared with heterosexual women.<sup>7</sup> Thus, a logical next step would be to examine policies that influence the price of alcohol and their association with binge drinking by sex and sexual orientation. Furthermore, questions remain about how place-based alcohol policies may affect sexual minority and heterosexual women and men. Population-based survey data show that heterosexual women spend less time in bars and at parties compared with lesbian, bisexual, and other sexual minority women and gay and bisexual men spend more time in bars and at parties compared with heterosexual men.<sup>53</sup> Therefore, alcohol outlet density and other place-based policies (e.g., days/hours of sale, prohibition of sales to intoxicated patrons) may have differential relationships with binge drinking and other alcohol-related outcomes across sex and sexual identity because of these differences in how often individuals spend drinking in public and semi-public locations. Interrogating how place-based alcohol policies are

related to binge drinking differences by sex and binge drinking disparities by sexual orientation is another important next step for future research.

### *Limitations*

Our findings should be interpreted in the context of several limitations. Our data are limited in making causal arguments about the association between the alcohol policy environment and binge drinking. While this study only finds a significant association between the alcohol policy environment and binge drinking for women, previous studies have found small significant protective effects for the alcohol policy environment among women, men, and the general population.<sup>21</sup> Because the SOGI module is not used in all 50 states, our sample size may not have been adequate to detect significance for a small estimated association for men. Despite this limitation, our study found that disparities in binge drinking across sexual identity persist, particularly among lesbian and bisexual women, even when accounting for strictness of the alcohol policy environment.

Although the analysis included multiple years of data, the variability in APS scores was primarily between states within each year rather than within states across years. However, our models lagged APS scores by one year to ensure that binge drinking was measured after the implementation of new alcohol laws thus creating some temporal ordering between our exposure and outcome. The lagged APS score also helps reduce the possibility of reverse causation in which stronger alcohol policy laws are implemented because of lower binge drinking prevalence in the state – a function of public attitudes about alcohol consumption. While the APS score is superior in measuring the combined strength of individual alcohol policies enacted and implemented in the state, the APS score on its own does not provide insights into which specific policy or policies have which impacts.

Although we adjusted for baseline differences between individuals and states, there is still the potential for unmeasured confounding. Moreover, by combining four years of survey data and including survey year as a covariate in the models, we are assuming that individuals are exchangeable across both state and time. Although our study period comes after the national recognition of marriage equality, a major victory for LGBT equality, there may be other secular trends in cultural and social norms in how LGBT communities are treated that are not accounted for in our models that could impact binge drinking.

While the sampling methodology makes our results generalizable to the states from which individuals were selected and provides state level prevalence estimates for health behaviors, our findings are not generalizable nationally because the SOGI module is not currently in use by all 50 states. However, our exploratory analyses show that the states that were included in the analyses do not differ significantly on alcohol policy score, proportion of LGB population, and binge drinking (Supplemental Tables S4-S6).

Finally, individuals are known to underreport their alcohol use in government surveys. Comparisons between alcohol sales data and the reported prevalence of alcohol use in the Behavioral Risk Factor Surveillance System suggests that survey data accounts for, on average, 32% of alcohol consumption in states.<sup>54</sup> Therefore, the measures of association in this analysis may be biased towards the null as the underestimation of alcohol consumption may lead to classifying some individuals as non-binge drinkers when in fact they do engage in this behavior.

## **Conclusion**

Inclusion of the SOGI module on all state's BRFSS surveys would allow researchers to further elucidate the relationship between the alcohol policy environment and binge drinking as well as provide greater insight into sexual and gender minority health. Similar analyses are warranted to assess these outcomes for gender minorities as well. Future alcohol policy research should examine potential differences in the association between the policy environment and individual policies and binge drinking and other alcohol-related outcomes across all facets of sexual orientation (e.g., attraction, behavior, identity). Furthermore, it is critical to take up the question of whether alcohol policy can reduce disparities as a primary question. This information can guide policy efforts to reduce binge drinking disparities.



**Table 3.1: Demographic characteristics by sexual identity among women in the Behavioral Risk Factor Surveillance System, 2015-2018**

	<b>HETEROSEXUAL</b>		<b>LESBIAN</b>		<b>BISEXUAL</b>		<b>ALL WOMEN</b>	
	<b>N<sup>a</sup>=421,737</b>		<b>N<sup>a</sup>=5,079</b>		<b>N<sup>a</sup>=9,105</b>		<b>N<sup>a</sup> = 435,921</b>	
	<b>Weighted % (95% CI)</b>	<b>n<sup>a</sup></b>	<b>Weighted % (95% CI)</b>	<b>n<sup>a</sup></b>	<b>Weighted % (95% CI)</b>	<b>n<sup>a</sup></b>	<b>Weighted % (95% CI)</b>	<b>n<sup>a</sup></b>
<b>Age Group</b>								
18 to 24	10.0 (9.8 - 10.3)	16,071	21.8 (19.1-24.8)	485	36.7 (34.8 - 38.6)	2,044	11.9 (11.7 – 12.1)	24,532
25 to 34	14.6 (14.3 - 14.8)	34,277	19.3 (17.1 - 21.6)	698	30.6 (28.9 - 32.4)	2,396	16.8 (16.6 – 17.0)	49,100
35 to 44	15.7 (15.5 - 16.0)	45,483	14.8 (12.9 - 16.9)	632	14.8 (13.5 - 16.1)	1,540	16.0 (15.8 – 16.3)	57,728
45 to 54	17.6 (17.3 - 17.8)	66,640	18.3 (16.4 - 20.4)	1,024	8.2 (7.3 - 9.2)	1,118	16.7 (16.4 – 16.9)	80,440
55 to 64	18.3 (18.0 - 18.5)	95,162	14.5 (12.9 - 16.1)	1,233	5.1 (4.5 - 5.7)	921	16.8 (16.6 – 17.0)	111,024
65+	23.9 (23.6 - 24.1)	164,104	11.4 (9.6 - 13.4)	1,007	4.7 (4.1 - 5.3)	1,086	21.8 (21.6 – 22.0)	192,220
<b>Race-Ethnicity</b>								
White, NH	65.4 (65.1 - 65.7)	327,164	62.3 (59.1 - 65.4)	3,799	62.3 (60.4 - 64.2)	6,354	62.9 (62.6 – 63.2)	388,762
Black, NH	12.7 (12.5 - 12.9)	37,050	15.9 (13.7 - 18.3)	437	13.3 (12.0 - 14.8)	784	13.2 (12.9 – 13.4)	47,217
Hispanic	14.6 (14.3 - 14.9)	26,325	13.4 (11.0 - 16.1)	349	14.7 (13.3 - 16.3)	889	15.9 (15.7 – 16.2)	37,450
Other race, NH	6.0 (5.8 - 6.3)	17,020	6.0 (4.2 - 8.5)	220	6.0 (5.1 - 7.0)	466	6.6 (6.4 – 6.8)	22,065
Multiracial, NH	1.3 (1.2 - 1.3)	8,867	2.5 (1.8 - 3.3)	207	3.7 (3.1 - 4.3)	464	1.4 (1.3 – 1.4)	11,023
<b>Education</b>								
Less than HS	12.0 (11.8 - 12.3)	27,250	10.3 (8.5 - 12.5)	256	13.0 (11.6 - 14.6)	646	13.2 (13.0 – 13.4)	38,016
High School Graduate	27.1 (26.8 - 27.4)	113,444	25.3 (22.6 - 28.1)	1,031	28.3 (26.6 - 30.1)	2,291	26.9 (26.6 – 27.1)	139,427
Some College	32.8 (32.5 - 33.1)	120,885	31.7 (29.0 - 34.6)	1,291	37.3 (35.4 - 39.2)	2,966	32.0 (31.7 – 32.2)	144,858
College Graduate	28.1 (27.9 - 28.4)	159,150	32.7 (30.3 - 35.2)	2,494	21.4 (20.1 - 22.7)	3,182	28.0 (27.8 – 28.2)	190,806
<b>Income Level</b>								
< \$15 K	11.5 (11.2 - 11.7)	36,488	12.7 (10.8 - 14.8)	492	15.4 (13.9 - 16.9)	1,146	12.3 (12.1 – 12.5)	46,625
\$15 – 24 - 999	17.5 (17.2 - 17.8)	61,672	18.0 (15.5 - 20.8)	756	23.9 (22.1 - 25.8)	1,713	18.3 (18.1 – 18.6)	76,089
\$25 – 34 - 999	10.7 (10.5 - 10.9)	39,381	10.5 (8.7 - 12.5)	447	12.0 (10.7 - 13.4)	895	10.7 (10.5 – 10.9)	46,971
\$35 – 49 - 999	13.2 (12.9 - 13.4)	49,601	12.1 (10.3 - 14.3)	585	13.3 (12.0 - 14.8)	1,059	12.9 (12.7 – 13.2)	58,155
\$50K+	47.1 (46.8 - 47.5)	163,559	46.7 (43.6 - 49.8)	2,246	35.4 (33.5 - 37.5)	2,800	45.7 (45.4 – 46.0)	189,608
<b>Relationship Status</b>								
Married	51.1 (50.8 - 51.4)	207,839	28.4 (26.0 - 30.9)	1,625	23.6 (22.1 - 25.2)	2,648	49.1 (48.8 – 49.4)	246,976
Divorced	11.9 (11.7 - 12.1)	63,822	8.8 (7.1 - 11.0)	564	8.3 (7.5 - 9.2)	1,201	11.3 (11.1 – 11.5)	75,616
Widowed	10.7 (10.5 - 10.9)	74,711	2.8 (2.1 - 3.8)	213	2.7 (2.3 - 3.2)	515	10.0 (9.9 – 10.2)	88,390

Separated	2.7 (2.6 - 2.8)	9,182	2.4 (1.8 - 3.2)	98	4.0 (3.3 - 4.8)	376	2.8 (2.7 – 2.9)	11,961
Never married	19.6 (19.3 - 19.9)	53,425	44.8 (41.9 - 47.8)	1,905	50.2 (48.3 - 52.1)	3,425	22.0 (21.8 – 22.3)	73,238
Member of unmarried couple	4.1 (4.0 - 4.3)	10,660	12.8 (11.1 - 14.7)	636	11.2 (10.1 - 12.4)	895	4.6 (4.5 – 4.8)	15,098

Sample restricted to states that used the Sexual and Gender Identity module which included: CA, CO, CT, DE, FL, GA, HI, ID, IL, IN, IA, KS, KY, LA, MD, MA, MN, MS, MO, MT, NV, NY, NC, OH, OK, PA, RI, SC, TN, TX, VT, VA, WA, WI, WV;

<sup>a</sup>Unweighted sample size

**Table 3.2: Demographic characteristics by sexual identity among men in the Behavioral Risk Factor Surveillance System, 2015-2018**

	<b>HETEROSEXUAL</b>		<b>GAY</b>		<b>BISEXUAL</b>		<b>ALL MEN</b>	
	<b>N<sup>a</sup>=327,574</b>		<b>N<sup>a</sup>=7,158</b>		<b>N<sup>a</sup>=4,928</b>		<b>N<sup>a</sup>=339,660</b>	
	<b>Weighted % (95% CI)</b>	<b>n<sup>a</sup></b>	<b>Weighted % (95% CI)</b>	<b>n<sup>a</sup></b>	<b>Weighted % (95% CI)</b>	<b>n<sup>a</sup></b>	<b>Weighted % (95% CI)</b>	<b>n<sup>a</sup></b>
<b>Age Group</b>								
18 to 24	12.2 (12.0 - 12.5)	20,000	17.7 (15.8 - 19.7)	713	30.3 (27.8 - 33.0)	919	13.3 (13.1 – 13.5)	28,051
25 to 34	16.2 (15.9 - 16.5)	32,903	22.5 (20.7 - 24.5)	1,081	22.0 (19.8 - 24.3)	851	18.2 (17.9 – 18.4)	46,265
35 to 44	16.4 (16.2 - 16.7)	38,224	14.3 (12.8 - 15.9)	788	12.1 (10.4 - 14.1)	497	16.8 (16.5 – 17.0)	48,802
45 to 54	17.6 (17.3 - 17.8)	53,953	19.8 (18.1 - 21.6)	1,437	11.9 (10.4 - 13.6)	664	17.1 (16.8 – 17.3)	66,472
55 to 64	17.8 (17.5 - 18.0)	74,162	15.4 (13.9 - 16.9)	1,609	12.3 (10.8 - 14.0)	872	16.5 (16.3 – 16.7)	88,336
65+	19.8 (19.6 - 20.0)	108,332	10.4 (9.4 - 11.4)	1,530	11.4 (10.0 - 12.9)	1,125	18.2 (18.0 – 18.4)	127,713
<b>Race-Ethnicity</b>								
White, NH	65.4 (65.0-65.7)	252,748	63.7 (61.3 - 66.0)	5,410	60.0 (57.2 - 62.7)	3,455	63.0 (62.6 – 63.3)	304,640
Black, NH	11.1 (10.9 - 11.4)	22,637	10.4 (9.0 - 12.0)	444	11.2 (9.6 - 12.9)	384	11.7 (11.5 – 11.9)	29,632
Hispanic	15.5 (15.2 - 15.8)	21,572	17.1 (15.2 - 19.3)	656	18.2 (15.7 - 21.0)	461	16.8 (16.5 – 17.1)	30,508
Other race, NH	6.6 (6.4 - 6.8)	17,013	6.7 (5.3 - 8.5)	332	8.0 (6.7 - 9.5)	339	7.1 (6.9 – 7.3)	22,362
Multiracial, NH	1.4 (1.4 - 1.5)	7,875	2.1 (1.6 - 2.7)	229	2.6 (2.0 - 3.4)	191	1.4 (1.4 – 1.5)	9,608
<b>Education</b>								
Less than HS	13.4 (13.1 - 13.7)	23,147	6.9 (5.8 - 8.2)	301	14.8 (12.6 - 17.3)	414	14.3 (14.0 – 14.5)	31,447
High School Graduate	30.2 (29.9,30.6)	91,452	22.9 (20.8 - 25.1)	1,285	29.4 (27.1 - 31.8)	1,406	29.8 (29.5 – 30.1)	112,989
Some College	29.9 (29.5 - 30.2)	84,342	32.3 (30.2 - 34.5)	1,794	33.6 (31.1 - 36.3)	1,370	29.1 (28.8 – 29.4)	102,507
College Graduate	26.5 (26.2 - 26.8)	127,766	37.9 (36.0 - 39.9)	3,755	22.2 (20.5 - 24.1)	1,728	26.9 (26.6 – 27.1)	157,038
<b>Income Level</b>								
< \$15 K	7.9 (7.7 - 8.1)	20,804	11.4 (10.0 - 13.0)	674	11.9 (10.2 - 13.8)	516	8.5 (8.3 – 8.7)	26,984
\$15 – 24,999	14.2 (13.9 - 14.4)	38,010	15.5 (13.8 - 17.4)	1,004	21.2 (18.7 - 23.9)	836	15.1 (14.8 – 15.3)	48,732
\$25 – 34,999	9.7 (9.4 - 9.9)	27,822	8.7 (7.5 - 10.0)	597	12.8 (10.9 - 15.0)	504	9.9 (9.7 – 10.1)	34,296
\$35 – 49,999	13.8 (13.5 - 14.0)	40,517	13.6 (11.9 - 15.5)	881	13.6 (11.9 - 15.4)	607	13.5 (13.3 – 13.8)	48,715
\$50K+	54.5 (54.1 - 54.9)	160,521	50.8 (48.5 - 53.2)	3,362	40.5 (37.7 - 43.3)	1,813	53.0 (52.7 – 53.3)	189,782
<b>Relationship Status</b>								

Married	54.1 (53.7 - 54.4)	187,951	19.5 (18.0 - 21.2)	1,530	27.5 (25.3 - 29.9)	1,498	52.0 (51.7 – 52.3)	224,679
Divorced	10.2 (10.0 - 10.3)	41,765	5.8 (4.9 - 6.9)	507	7.8 (6.5 - 9.2)	626	9.8 (9.6 – 10.0)	50,303
Widowed	3.6 (3.5 - 3.8)	20,879	1.9 (1.5 - 2.5)	222	3.1 (2.4 - 3.9)	265	3.4 (3.3 – 3.5)	24,844
Separated	2.2 (2.1 - 2.3)	6,304	1.1 (0.8 - 1.5)	83	2.4 (1.7 - 3.4)	131	2.3 (2.2 – 2.4)	8,072
Never married	25.5 (25.1 - 25.8)	58,943	58.9 (56.7 - 61.0)	3,897	51.4 (48.7 - 54.0)	2,062	27.6 (27.3 – 27.9)	80,693
Member of unmarried couple	4.5 (4.3 - 4.6)	10,142	12.7 (11.3 - 14.4)	874	7.9 (6.7 - 9.3)	318	4.9 (4.8 – 5.1)	14,172

Sample restricted to states that used the Sexual and Gender Identity module which included: CA, CO, CT, DE, FL, GA, HI, ID, IL, IN, IA, KS, KY, LA, MD, MA, MN, MS, MO, MT, NV, NY, NC, OH, OK, PA, RI, SC, TN, TX, VT, VA, WA, WI, WV.

<sup>a</sup>Unweighted sample size

**Table 3.3: Descriptive statistics for the Alcohol Policy Scale (APS) scores, 2014-2017**

	2014	2015	2016	2017	2015-2018
N	21	25	27	28	35
Mean	58.5	58.6	59.3	60.8	59.4
Standard Deviation	7.96	7.89	9.50	9.78	8.82
Min	44.7	43.1	43.1	44.8	43.1
Q25	52.7	53.9	53.1	53.5	52.7
Median	58.5	59.0	59.8	61.3	59.4
Q75	62.7	62.7	64.1	64.4	63.4
Max	77.4	77.4	83.8	83.8	83.8

**Table 3.4: Association between alcohol policy score, sexual identity, and individual-level binge drinking among women, 2015-2018**

	MODEL 1		MODEL 2		MODEL 3		MODEL 4	
	OR <sup>a</sup> (95% CI)	p	OR <sup>a</sup> (95% CI)	p	OR <sup>a</sup> (95% CI)	p	OR <sup>a</sup> (95% CI)	p
Lesbian	2.05 (1.72 – 2.44)	<0.001 <sup>c,d</sup>	2.06 (1.73 – 2.45)	<0.001 <sup>c,d</sup>	1.42 (1.17 – 1.74)	<0.001 <sup>c,d</sup>	1.43 (1.17 – 1.75)	<0.001 <sup>c,d</sup>
Bisexual	2.62 (2.36 – 2.90)	<0.001 <sup>c,d</sup>	2.60 (2.34 – 2.88)	<0.001 <sup>c,d</sup>	1.59 (1.41 – 1.79)	<0.001 <sup>c,d</sup>	1.58 (1.40 – 1.79)	<0.001 <sup>c,d</sup>
Heterosexual	Reference							
APS Score <sup>b</sup> (10 percentage points)	0.98 (0.95 – 1.00)	0.051	0.97 (0.95 – 0.99)	0.012 <sup>c</sup>	0.93 (0.91 – 0.96)	<0.001 <sup>c,d</sup>	0.96 (0.94 – 0.99)	0.003 <sup>c,d</sup>

States included in the models: CA, CO, CT, DE, FL, GA, HI, ID, IL, IN, IA, KS, KY, LA, MD, MA, MN, MS, MO, MT, NV, NY, NC, OH, OK, PA, RI, SC, TN, TX, VT, VA, WA, WI, WV

<sup>a</sup> Odds ratio

<sup>b</sup> Alcohol Policy Scale Score

<sup>c</sup> Significant at alpha = 0.05

<sup>d</sup> Significant at alpha = 0.00625 (Bonferroni correction where alpha = 0.05/n where n=8, the total number of models in analysis)

Model 1: Adjusted for survey year

Model 2: Adjusted for survey year, population age 21+, male population 18+, proportion of population white, percent population LGB, median household income, officers per capita, catholic adherents per 1,000 population, percent population living in urban areas, state region

Model 3: Adjusted for survey year, age, race, income, education, relationship status

Model 4: Adjusted for survey year, population age 21+, male population 18+, proportion of population white, percent population LGB, median household income, officers per capita, catholic adherents per 1,000 population, percent population living in urban areas, state region, age, race, income, education, relationship status

**Table 3.5: Association between alcohol policy score, sexual identity, and individual-level binge drinking among men, 2015-2018**

	<b>MODEL 1</b>		<b>MODEL 2</b>		<b>MODEL 3</b>		<b>MODEL 4</b>	
	<b>OR<sup>a</sup> (95% CI)</b>	<b>p</b>	<b>OR<sup>a</sup> (95% CI)</b>	<b>p</b>	<b>OR<sup>a</sup> (95% CI)</b>	<b>p</b>	<b>OR<sup>a</sup> (95% CI)</b>	<b>p</b>
Gay	1.25 (1.12 – 1.41)	<0.001 <sup>c,d</sup>	1.26 (1.24 – 1.41)	<0.001 <sup>c,d</sup>	1.02 (0.90 – 1.15)	0.737	1.03 (0.91 – 1.17)	0.627
Bisexual	1.26 (1.10 – 1.44)	0.01 <sup>c</sup>	1.25 (1.09 – 1.44)	0.001 <sup>c,d</sup>	1.03 (0.88 – 1.21)	0.706	1.03 (0.88 – 1.22)	0.681
Heterosexual								
APS Score <sup>b</sup> (10 percentage points)	0.98 (0.97 – 1.00)	0.115	0.99 (0.97 – 1.01)	0.311	0.98 (0.96 – 1.00)	0.078	1.00 (0.97 – 1.02)	0.706

States included in the models: CA, CO, CT, DE, FL, GA, HI, ID, IL, IN, IA, KS, KY, LA, MD, MA, MN, MS, MO, MT, NV, NY, NC, OH, OK, PA, RI, SC, TN, TX, VT, VA, WA, WI, WV

<sup>a</sup>Odds ratio

<sup>b</sup>Alcohol Policy Scale Score

<sup>c</sup> Significant at alpha=0.05

<sup>d</sup> Significant at alpha=0.00625 (Bonferroni correction where alpha = 0.05/n where n=8, the total number of models)

Model 1: Adjusted for survey year

Model 2: Adjusted for survey year, population age 21+, male population 18+, proportion of population white, percent population LGB, median household income, officers per capita, catholic adherents per 1,000 population, state region

Model 3: Adjusted for survey year, age, race, income, education, relationship status

Model 4: Adjusted for survey year, population age 21+, male population 18+, proportion of population white, percent population LGB, median household income, officers per capita, catholic adherents per 1,000 population, state region, age, race, income, education, relationship status

**Table 3.6: Supplementary Table S1 - State level characteristics, 2015-2018**

	YEARS								
	2015	2016	2017	2018	2015-2018				
Number of states	21	25	27	28	35				
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)				
					Min	Q25	Q50	Q75	Max
Population age 21 years and older (%)	72.6 (1.7)	72.8 (1.6)	73.3 (1.6)	73.8 (1.7)	73.2 (1.7)				
					69	72.1	73.4	74.3	76.5
Population male 18 years and over (%)	48.7 (0.8)	48.7 (0.7)	48.6 (0.7)	48.7 (0.7)	48.7 (0.7)				
					47.6	48.1	48.6	49.3	50.2
Population Non-Hispanic White 18+ years (%)	54.2 (12.5)	54.3 (13.2)	52.9 (12.6)	53.9 (12.3)	53.8 (12.5)				
					18.7	45.9	55.5	60.0	76.1
Population LGB (%)	3.9 (0.6)	3.9 (0.6)	3.9 (0.6)	3.7 (0.6)	3.9 (0.6)				
					2.5	3.5	3.8	4.1	5.1
Median Household Income (\$)	57022 (8806)	56797 (8406)	58376 (8741)	60817 (10104)	58381 (9087)				
					40528	51925	56951	64340	83242
Law enforcement officers per capita	.002 (.0005)	.001 (.001)	.002 (.0005)	.002 (.0005)	.002 (.0006)				
					.00001	.001	.002	.002	.003
Population living in urban areas (%)	79.5 (10.6)	77.1 (13.9)	76.8 (14.2)	74.8 (14.2)	76.9 (13.4)				
					38.9	70.4	77.9	87.9	94.9
Catholic adherents per 1,000 population	192.0 (101.7)	204.6 (111.0)	193.6 (114.8)	169.4 (105.1)	189.3 (107.8)				
					35.1	115.3	172.7	264.9	449.0
<b>Census Region</b>	<b>n (%)</b>	<b>n (%)</b>	<b>% (n)</b>	<b>n (%)</b>	<b>n (%)</b>				
Northeast	4 (19.0%)	6 (24.0%)	6 (22.2%)	5 (17.9%)	6 (17.1%)				
Midwest	7 (33.3%)	7 (28.0%)	6 (22.2 %)	6 (21.4%)	8 (22.9%)				
South	6 (28.6%)	7 (28.0%)	10 (37.0%)	12 (42.9%)	14 (40.0%)				
West	4 (19.0%)	5 (20.0%)	5 (18.5%)	5 (17.9%)	7 (20.0%)				

States included in 2015: CO, CT, DE, GA, HI, ID, IL, IN, KS, MD, MA, MN, MO, NV, NY, OH, PA, TX, VA, WV, WI

States included in 2016: CA, CT, DE, GA, HI, ID, IL, IN, IA, KY, LA, MA, MN, MS, MO, NV, NY, OH, PA, RI, TX, VT, VA, WA, WI

States included in 2017: CA, CT, DE, FL, GA, HI, IL, IN, IA, LA, MA, MN, MS, MT, NV, NY, NC, OH, OK, PA, RI, SC, TX, VT, VA, WA, WI

States included in 2018: CT, DE, FL, HI, ID, IL, KS, LA, MD, MN, MS, MO, MT, NV, NY, NC, OH, OK, PA, RI, SC, TN, TX, VT, VA, WA, WV, WI



**Table 3.7: Supplementary Table S2 - Association between alcohol policy score, sexual identity, and individual-level binge drinking among women showing 99% confidence intervals, 2015-2018**

	<b>MODEL 1</b>		<b>MODEL 2</b>		<b>MODEL 3</b>		<b>MODEL 4</b>	
	<b>OR<sup>a</sup> (99% CI)</b>	<b>p</b>	<b>OR<sup>a</sup> (99% CI)</b>	<b>p</b>	<b>OR<sup>a</sup> (99% CI)</b>	<b>p</b>	<b>OR<sup>a</sup> (99% CI)</b>	<b>p</b>
Lesbian	2.05 (1.63 – 2.58)	<0.001 <sup>c,d</sup>	2.06 (1.63 – 2.59)	<0.001 <sup>c,d</sup>	1.42 (1.09 – 1.86)	<0.001 <sup>c,d</sup>	1.43 (1.10 – 1.87)	<0.001 <sup>c,d</sup>
Bisexual	2.05 (1.63 – 2.58)	<0.001 <sup>c,d</sup>	2.60 (2.26 – 2.98)	<0.001 <sup>c,d</sup>	1.59 (1.35 – 1.86)	<0.001 <sup>c,d</sup>	1.58 (1.35 – 1.86)	<0.001 <sup>c,d</sup>
Heterosexual	Reference							
APS Score <sup>b</sup> (10 percentage points)	0.98 (0.95 – 1.01)	0.051	0.97 (0.94 – 1.00)	0.012 <sup>c</sup>	0.93 (0.90 – 0.96)	<0.001 <sup>c,d</sup>	0.96 (0.93 – 0.99)	0.003 <sup>c,d</sup>

States included in the models: CA, CO, CT, DE, FL, GA, HI, ID, IL, IN, IA, KS, KY, LA, MD, MA, MN, MS, MO, MT, NV, NY, NC, OH, OK, PA, RI, SC, TN, TX, VT, VA, WA, WI, WV

<sup>a</sup> Odds ratio

<sup>b</sup> Alcohol Policy Scale Score

<sup>c</sup> Significant at alpha=0.05

<sup>d</sup> Significant at alpha = 0.00625 (Bonferroni correction where alpha = 0.05/n where n=8, the total number of models)

Model 1: Adjusted for survey year

Model 2: Adjusted for survey year, population age 21+, male population 18+, proportion of population white, percent population LGB, median household income, officers per capita, catholic adherents per 1,000 population, percent population living in urban areas, state region

Model 3: Adjusted for survey year, age, race, income, education, relationship status

Model 4: Adjusted for survey year, population age 21+, male population 18+, proportion of population white, percent population LGB, median household income, officers per capita, catholic adherents per 1,000 population, percent population living in urban areas, state region, age, race, income, education, relationship status

**Table 3.8: Supplementary Table S3 - Association between alcohol policy score, sexual identity, and individual-level binge drinking among men showing 99% confidence intervals, 2015-2018**

	MODEL 1		MODEL 2		MODEL 3		MODEL 4	
	OR <sup>a</sup> (99% CI)	p	OR <sup>a</sup> (99% CI)	p	OR <sup>a</sup> (99% CI)	p	OR <sup>a</sup> (99% CI)	p
Gay	1.25 (1.08 – 1.46)	<0.001 <sup>c,d</sup>	1.26 (1.09 – 1.47)	<0.001 <sup>c,d</sup>	1.02 (0.87 – 1.20)	0.737	1.03 (0.88 – 1.21)	0.627
Bisexual	1.26 (1.05 – 1.50)	0.01 <sup>c</sup>	1.25 (1.05 – 1.50)	0.001 <sup>c,d</sup>	1.03 (0.83 – 1.27)	0.706	1.03 (0.84 – 1.23)	0.681
Heterosexual								
APS Score <sup>b</sup> (10 percentage points)	0.98 (0.96 – 1.01)	0.115	0.99 (0.96 – 1.02)	0.311	0.98 (0.95 – 1.01)	0.078	1.00 (0.97 – 1.03)	0.706

States included in the models: CA, CO, CT, DE, FL, GA, HI, ID, IL, IN, IA, KS, KY, LA, MD, MA, MN, MS, MO, MT, NV, NY, NC, OH, OK, PA, RI, SC, TN, TX, VT, VA, WA, WI, WV

<sup>a</sup> Odds ratio

<sup>b</sup> Alcohol Policy Scale Score

<sup>c</sup> Significant at alpha=0.05

<sup>d</sup> Significant at alpha = 0.00625 (Bonferroni correction where alpha = 0.05/n where n=8, the total number of models)

Model 1: Adjusted for survey year

Model 2: Adjusted for survey year, population age 21+, male population 18+, proportion of population white, percent population LGB, median household income, officers per capita, catholic adherents per 1,000 population, state region

Model 3: Adjusted for survey year, age, race, income, education, relationship status

Model 4: Adjusted for survey year, population age 21+, male population 18+, proportion of population white, percent population LGB, median household income, officers per capita, catholic adherents per 1,000 population, state region, age, race, income, education, relationship status

**Table 3.9: Supplementary Table S4 - Tests of mean differences in binge drinking prevalence by use of Sexual and Gender Identity module, 2015-2018**

	States not using module	States using module		
Year	Mean (Std)	Mean (Std)	t-statistic	p-value
2015	61.8 (13.4)	58.5 (7.96)	1.0882	0.282
2016	62.8 (13.3)	58.6 (7.89)	1.3829	0.1742
2017	62.0 (12.7)	59.3 (9.50)	0.86812	0.3902
2018	60.6 (12.8)	60.8 (9.78)	-0.04576	0.9637
2015-2018	61.8 (12.9)	59.4 (8.82)	1.6042	0.1104

**Table 3.10: Supplementary Table 5 - Tests of mean difference in proportion of state population identifying as lesbian, gay, or bisexual by use of the Sexual and Gender Identity module, 2015-2018**

	States not using module	States using module		
Year	Mean (SD)	Mean (SD)	t-statistic	p-value
2015	3.77 (1.07)	3.88 (0.604)	-0.47651	0.6359
2016	3.71 (1.08)	3.93 (0.662)	-0.90217	0.3721
2017	3.68 (1.13)	3.94 (0.624)	-0.97313	0.3372
2018	3.92 (1.15)	3.73 (0.633)	0.71218	0.4814
2015-2018	3.77 (1.09)	3.87 (0.628)	-0.79843	0.4258

**Table 3.11: Supplementary Table S6 - Tests of mean difference in state's crude binge drinking prevalence by use of Sexual and Gender identity module, 2015-2018**

	States not using module	States using module		
Year	Mean (SD)	Mean (SD)	t-statistic	p-value
2015	16.4 (3.62)	16.6 (2.57)	-0.27365	0.7855
2016	16.8 (3.45)	17.5 (2.56)	-0.80742	0.4236
2017	16.9 (3.39)	17.3 (2.49)	-0.41279	0.6819
2018	17.1 (3.46)	16.3 (2.45)	0.99256	0.3271
2015-2018	16.8 (3.45)	16.9 (2.52)	-0.31607	0.7523

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**CHAPTER 4 – ARE BINGE DRINKING DISPARITIES BY SEXUAL  
IDENTITY LOWER IN U.S. STATES WITH NONDISCRIMINATION  
STATUTES THAT INCLUDE SEXUAL ORIENTATION?<sup>2</sup>**

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<sup>2</sup> Manuscript has been submitted to *Journal of Health Disparities Research and Practice* and is formatted for that journal.

## Abstract

### *Purpose*

Studies examining binge drinking disparities by sexual identity focus on intra- and inter-personal minority stressors experienced by lesbian, gay, and bisexual (LGB) populations. State-level statutes are powerful tools that can reduce health disparities. Therefore, we examined how state-level nondiscrimination statutes that include sexual orientation as a protected ground (i.e., inclusive statutes) are associated with binge drinking disparities between LGB and straight adults.

### *Methods*

We combined data from the 2015-2018 Behavioral Risk Factor Surveillance System (BRFSS), the Movement Advancement Project (MAP), and administrative data sources for information on binge drinking, sexual identity, state nondiscrimination statutes, and individual and state-level factors. We included an interaction term in the logistic regression models to test whether inclusive nondiscrimination statutes modify the association between sexual identity and binge drinking.

### *Results*

Inclusive statutes modified the association between sexual identity and binge drinking among women, but not men. In states without inclusive statutes: (1) the odds of binge drinking among lesbian [1.71 (95%CI: 1.27–2.31)] and bisexual [1.83 (95% CI: 1.54–2.17)] women were significantly higher compared with straight women; (2) the odds ratio of binge drinking comparing bisexual to straight women was 26.8% lower than the odds ratio for states without inclusive statutes [1.34 (95% CI: 1.13–1.60)]; and, (3) the odds of binge drinking comparing lesbian to straight women were not significantly different [1.19 (95% CI: 0.92–1.53)].

### *Conclusions*

The enactment of nondiscrimination statutes inclusive of sexual orientation at the state-level are associated with narrower binge drinking disparities between lesbian, bisexual, and straight women.

**Keywords:** Behavioral Risk Factor Surveillance System (BRFSS), Binge Drinking, Bisexual, Legal Epidemiology, Lesbian, Structural Stigma

## Introduction

Sexual identity disparities in binge drinking are well-documented and show important sex differences (Drabble, Midanik, & Trocki, 2005; Gonzales, Przedworski, & Henning-Smith, 2016; Medley et al., 2016). The literature consistently shows that sexual minority women, including those who identify as lesbian or bisexual and those who identify as heterosexual with female partners, are more likely to binge drink (Gonzales & Henning-Smith, 2017; Gonzales et al., 2016; Medley et al., 2016) and drink more per binge compared with heterosexual women (Fish, 2019; Fish, Hughes, & Russell, 2018). Studies comparing gay and bisexual men to heterosexual men have been more varied. Some show that gay and bisexual men are more likely to binge drink (Gonzales et al., 2016) while others show gay and bisexual men have the same or lower odds of binge drinking (Caceres et al., 2018; Gonzales & Henning-Smith, 2017).

Previous studies posit that the higher binge drinking prevalence and alcohol-related harms among lesbian, gay, and bisexual (LGB) populations is due to minority stress (Bryan, Kim, & Fredriksen-Goldsen, 2017; English, Rendina, & Parsons, 2018; Wilson, Gilmore, Rhew, Hodge, & Kaysen, 2016; Wray, Pantalone, Kahler, Monti, & Mayer, 2016) – the excess stress experienced by LGB individuals as a result of discrimination, prejudice, and homophobia (Meyer, 2003). Qualitative studies reveal that lesbian and bisexual women may self-medicate with alcohol to cope with negative life stressors including homophobia and other traumatic experiences (Drabble & Trocki, 2014). Quantitative studies have found cross-sectional associations between minority stress and alcohol use among gay and bisexual men (Stall et al., 2001), and longitudinal associations between minority stress and alcohol-related consequences among lesbian and bisexual women (Wilson et al., 2016). The minority stress model posits how the internalization of homophobic attitudes and interpersonal experiences of prejudice and discrimination increase stress which results in health disparities among LGB populations. However, the model is limited in theorizing about larger policy and structural issues facing LGB populations. Few studies have examined how macro-level factors, such as public policy, reinforce structural stigma which can increase minority stress and how this may be associated with binge drinking disparities.

Posited by Link and Phelan, structural stigma is a phenomenon whereby powerful actors use social structures, including laws, to persecute a less powerful group (Link & Phelan, 2001). This

process involves labeling, stereotyping, separating, and employing discrimination to inflict social status loss and reinforce power differentials between majority and minority groups (Link & Phelan, 2001). Because structural stigma is all-encompassing and affects multiple health outcomes among LGB populations, Hatzenbuehler, Link and Phelan have argued that it is a fundamental cause of disease and health disparities alongside socioeconomic position (Hatzenbuehler, Phelan, & Link, 2013).

Public policies are powerful tools that can influence stigma against LGB populations and subsequent minority stress. Some evidence exists showing that discriminatory state policies on the basis of sexual orientation, such as state-bans on same sex marriage, are associated with worse health outcomes among LGB populations (Hatzenbuehler, Keyes, & Hasin, 2009; Hatzenbuehler, McLaughlin, Keyes, & Hasin, 2010; Raifman, Moscoe, Austin, Hatzenbuehler, & Galea, 2018), whereas protective policies, such as nondiscrimination protections that include sexual orientation, improve health among this population (Everett, Hatzenbuehler, & Hughes, 2016; Hatzenbuehler et al., 2012; Raifman, Moscoe, Austin, & McConnell, 2017).

Hatzenbuehler and colleagues found that the odds of mood and substance use disorders was significantly higher among LGB adults living in states without protections for employment discrimination or hate crimes (Hatzenbuehler et al., 2009). An early study on marriage equality bans shows that LGB adults who lived in states with the bans had a significantly higher prevalence of generalized anxiety disorders and alcohol use disorders (Hatzenbuehler et al., 2010). A more recent study shows that LGB adults living in states without protections for discrimination in public accommodations have a significantly higher prevalence of mental distress compared with LGB adults in states with these protections (Raifman et al., 2018). By contrast, when Massachusetts enacted marriage equality in 2003, the state saw significant decreases in average mental health expenditures of \$305 among gay and bisexual men regardless of whether men had partners, an indication that policies destigmatizing same-sex relationships were protective for mental health (Hatzenbuehler et al., 2012).

Although the evidence linking state laws with LGB health outcomes is compelling, it is primarily focused on mental health, including alcohol use disorder. While almost all individuals with an alcohol use disorder engage in binge drinking, an estimated 90% of binge drinkers do not meet criteria for this diagnosis (Esser et al., 2014). As evidenced above, state-level policies, such as nondiscrimination laws that include sexual orientation, have the power to improve health

outcomes among LGB populations by reducing structural stigma and minority stressors. The presence of nondiscrimination legislation inclusive of sexual orientation may be a signal of less structural stigma and more acceptance of LGBT identities. More accepting environments, in turn, may prevent individuals from engaging in maladaptive coping behaviors such as binge drinking, to cope with these excess stressors. Therefore, understanding how nondiscrimination state laws inclusive of sexual orientation influence binge drinking disparities among LGB adults is important in developing primary prevention efforts.

We examined the association between sexual identity, state-level nondiscrimination statutes, and binge drinking among US adults. This study builds on a growing body of research demonstrating associations between policy and disparities in mental health and alcohol use disorders among LGB populations. We hypothesized that the presence of state statutes that include protections on the basis of sexual orientation in employment, housing, and public accommodations (i.e., inclusive state statutes) modifies the positive association between sexual identity and binge drinking, resulting in lower binge drinking disparities between LGB adults and heterosexual adults in states with inclusive statutes.

## **Methods**

### *Data*

We used the 2015-2018 Behavioral Risk Factor Surveillance System (BRFSS), a repeated cross-sectional survey overseen by the Centers for Disease Control and Prevention (CDC). Each US state collects information from state residents about health behaviors via telephone including landlines and cellphones. Multistage sampling and random digit dialing are used to produce representative samples of state residents age 18+ years (“BRFSS Data User Guide,” 2013).

### *Sample*

From 2015-2018, 35 states used the optional Sexual Orientation and Gender Identity (SOGI) module in at least one year. Three states used the module in only one year (Colorado, Kentucky, Tennessee). Ten states used the module in two years (California, Florida, Iowa, Kansas, Maryland, Montana, North Carolina, Oklahoma, South Carolina, West Virginia). Ten states used the module in three years (Georgia, Idaho, Indiana, Louisiana, Massachusetts, Mississippi,

Missouri, Rhode Island, Vermont, Washington). Twelve states used the module in all four years (Connecticut, Delaware, Hawaii, Illinois, Minnesota, Nevada, New York, Ohio, Pennsylvania, Texas, Virginia, Wisconsin). The unweighted sample size from 35 states in the analysis was 484,966 women and 378,291 men and covers all four regions of the nation.

### *Measures*

*Sexual Identity:* Participants were asked “Do you consider yourself to be?” with the following response options: Straight, Lesbian or Gay, Bisexual, or Something Else. Individuals who identified as ‘something else’, ‘don’t know’, or ‘refused’ or who were missing information were excluded from the analysis (women: 15.4%; men: 16.3%).

*Binge Drinking:* Participants were asked: “Considering all types of alcoholic beverages, how many times during the past 30 days did you have X [X = 5 for men, X = 4 for women] or more drinks on an occasion.” Participants who answered that they engaged in this behavior one or more times were classified as binge drinkers. This is the definition of binge drinking according to the National Institute on Alcohol Abuse and Alcoholism. (National Institute on Alcohol Abuse and Alcoholism, n.d.).

*Inclusive nondiscrimination state statutes:* The effect measure modifier for this analysis was whether a state included sexual orientation in their nondiscrimination laws for employment, housing, and public accommodations. We compared information extracted from the Human Rights Campaign’s (HRC) State Equality Index reports with information extracted from the Movement Advancement Project (MAP) online reports. Both organizations track state policies over time to assess whether they are inclusive of sexual and gender minority populations. MAP’s reports on the presence of inclusive nondiscrimination laws in states were downloaded and data extracted in September 2019 (Movement Advancement Project, 2019a, 2019b, 2019c). The information in these reports was current as of January 2019. HRC’s State Equality Index reports for laws enacted between 2015 and 2018 were downloaded and data extracted in October 2019 (Sarah Warbelow & Diaz, n.d.; Sarah Warbelow, Oakley, & Kutney, n.d.; Sarah Warbelow & Persad, 2016; Sarah Warbelow & Diaz, 2017). MAP and HRC provide the most comprehensive legal surveillance on policies impacting LGB communities. Reports from the Williams Institute



at the UCLA School of Law rely on data provided from the Movement Advancement Project to estimate the number of LGBT people living in states without nondiscrimination protections (Conron & Goldberg, 2020). A peer-reviewed study examining the association between nondiscrimination statutes and general health used legal research from HRC (Gonzales & Ehrenfeld, 2018).

Our exploratory analyses show that there was complete agreement between HRC and MAP on whether a state had inclusive nondiscrimination laws in employment, housing, and public accommodations. Additionally, states that had inclusive nondiscrimination laws in employment also had inclusive nondiscrimination laws in housing and public accommodations. Therefore, we treated this as a binary variable coded 1 for the presence of inclusive laws and coded 0 for the absence of inclusive laws.

*LGB Adults per State:* Data from the Williams Institute, a research institute examining how law and public policy impact LGBT equity, provided the estimated number of LGB adults (18+ years) for each state using the 2017 Gallup Tracking poll (Conron & Goldberg, 2019). We divided the estimated number of LGB adults by the 2017 state population 5-year estimates to get the percentage of LGB adults in each state. We hypothesized that a larger proportion of LGB adults living in a state may provide greater access to LGB community spaces for LGB individuals in those states.

*State-level variables:* Covariates were chosen *a priori* for their potential association with both binge drinking and the state policy environment. Information about state composition came from the American Community Survey (U.S. Census Bureau, 2019a, 2019b, 2019c). For 2015, 2016, and 2017, we used 5-year estimates. The latest data for 2018 were 1-year estimates. State composition variables included the percentage of the population age 21 years and older (i.e., adults who are legally permitted to drink), that are adult males, and that are Non-Hispanic White, as well as median household income. The percentage of a state's population living in urban areas was extracted from the 2010 Census summary file (U.S. Census Bureau, 2011, 2012). We included a measure of Catholic adherents per 1,000 population, from the U.S. Religion Census Religious Congregations and Membership Study (Grammich et al., 2018). This measure has been used in previous studies because states with a higher prevalence of Catholics have higher binge

drinking prevalence compared to states with fewer Catholics (Holt, Miller, Naimi, & Sui, 2006). State region (i.e., Northeast, Midwest, South, and West) was determined by the US Census Bureau (U.S. Census Bureau, n.d.).

*Individual-level variables:* Individual demographic characteristics came from the BRFSS. All variables were categorical. These included age (18–24, 25–34, 35–44, 45–54, 55–64, 65+ years); sex (female, male); race-ethnicity (i.e., Hispanic/Latino, any race and Non-Hispanic White, Black,, Multi-racial, and Other); education level (less than high school, high school graduate, some college, college graduate); household income (<\$15K; \$15–24,999; \$25–34,999; \$35–49,000; \$50K plus); and “marital status” (married, divorced, widowed, separated, never married, member of unmarried couple).

### *Statistical Analyses*

Data from all sources were combined in R Version 3.6.1 (2019-07-05). Final survey weights were divided by the number of years a state contributed data as the purpose of combining years was to increase sample size rather than conduct trend analysis. We modeled the association between presence of inclusive nondiscrimination state statutes and binge drinking separately for women and men. We tested for differences in the association between sexual identity (i.e., lesbian/gay, bisexual, straight) and binge drinking by presence of inclusive state statutes with an interaction term between sexual identity and a binary indicator of inclusive state-level statutes. All statistical models were built in SAS 9.4 using PROC SURVEYLOGISTIC to account for the complex sampling design.

## **Results**

### *Prevalence of Binge Drinking in States based on Statutes*

Overall, the prevalence of binge drinking among women was higher in states with inclusive nondiscrimination statutes than in states without these statutes (12.8% vs 11.0%;  $p < 0.01$ , Table 1). There was no statistically significant difference in the prevalence of binge drinking in states with versus without inclusive statutes among lesbian women (18.1% vs 22.0%;  $p = 0.16$ ) and

bisexual women (23.8% vs 24.4%;  $p=0.74$ ). The prevalence of binge drinking among straight women was significantly higher in states with vs without inclusive statutes (11.9% vs 10.0%;  $p<0.001$ ). Differences in binge drinking prevalence among women varied widely across states and by sexual identity (Supplemental Table A.1). Binge drinking prevalence was highest among bisexual women in Missouri (39.1%) and lesbian women in Oklahoma (33.7%). Among straight women, the highest binge drinking prevalence was in Wisconsin (17.2%), but still lower than binge drinking prevalence among bisexual and lesbian women in many states.

Overall, the prevalence of binge drinking among men was significantly higher in states with inclusive statutes compared with states without inclusive statutes (22.9% vs 21.4%;  $p<0.01$ ; Table 1). This pattern was seen for straight, gay, and bisexual men. However, among gay and bisexual men, the difference in binge drinking prevalence between states with and without inclusive statutes was not statistically significant. Among men, differences in binge drinking prevalence did not vary widely across states or by sexual identity (Supplemental Table A.2).

#### *Risk for Binge Drinking Based on Statutes*

The composition of states differed by whether the state did or did not have inclusive nondiscrimination statutes (Table 2). On average, the proportion of the population living in urban areas was significantly higher in states with inclusive statutes compared to states without inclusive statutes (82.4% vs 71.2%;  $p<0.01$ ). A significantly higher proportion of individuals identifying as lesbian, gay, or bisexual lived in states with inclusive statutes compared with states without inclusive statutes (4.2% vs 3.5%;  $p<0.01$ ). States with inclusive statutes had significantly higher median income, proportion of the population of legal drinking age, and Catholic adherents per 1,000 population compared to states without inclusive statutes. States without inclusive nondiscrimination statutes were more likely to be in the South compared to states with inclusive statutes (63.2% vs 12.5%;  $p<0.01$ ).

There was a statistically significant interaction between the presence of inclusive statutes and sexual identity for lesbian women ( $p=0.01$ ; data not shown) and bisexual women ( $p=0.03$ ; data not shown). Among women, the association between binge drinking and sexual identity differed between states with inclusive nondiscrimination statutes and those without (Table 3). After controlling for individual demographic characteristics and state-level factors, the odds of binge drinking among lesbian women were 1.71 [95% CI: 1.27–2.30] times higher compared with

straight women in states without inclusive statutes. However, in states with inclusive statutes, the odds of binge drinking comparing lesbian and straight women was not significantly different (1.19 [95% CI: 0.92–1.53]). After controlling for individual demographic characteristics and state-level factors, the odds of binge drinking among bisexual women were 1.83 [95% CI: 1.55–2.17] times higher compared to straight women in states without inclusive statutes. However, in states with inclusive statutes, the odds of binge drinking among bisexual women were 1.35 [95% CI: 1.13–1.60] times that of straight women. Thus, the odds ratio comparing bisexual to straight women was 26.8% lower in states with vs without inclusive statutes.

There was not a statistically significant interaction between the presence of inclusive statutes and sexual identity for gay men ( $p=0.3337$ ; data not shown) and bisexual men ( $p=0.7881$ ; data not shown). Controlling for the presence of nondiscrimination statutes, gay men had 1.25 [95% CI: 1.12–1.40] times the odds and bisexual men had 1.25 [95% CI: 1.09–1.43] times the odds of binge drinking compared with straight men (Table 4). After controlling for individual characteristics and state-level factors, there was no association between the presence of nondiscrimination statutes and binge drinking among straight men (1.00 [95% CI: 0.94–1.07]). Moreover, the odds of binge drinking were not significantly different comparing gay and bisexual men to straight men.

## Discussion

In this study, we examined the association between the presence of state-level nondiscrimination statutes for employment, housing, and public accommodations that include sexual orientation (i.e., inclusive state statutes) and differences in binge drinking across sex and sexual identity among US adults in 35 states. We found that the presence of inclusive state statutes modifies the association between sexual identity and binge drinking among women, but not among men. The binge drinking disparity between bisexual and straight women was 26.8% lower in states with versus without inclusive statutes. There was no significant difference in binge drinking between lesbian and straight women in states with inclusive statutes. These findings suggest that the presence of inclusive state statutes may reduce binge drinking disparities among women.

Associations between nondiscrimination law, sexual identity and binge drinking were more complex among women than among men. This complexity may be due to differences in

historical gender norms related to excessive alcohol consumption and the ways in which sexual minorities subvert these norms. A recent review of the global literature on drinking patterns finds consistent evidence that straight men are more likely to drink than straight women, have more heavy drinking episodes, and consume more drinks per episode (Hughes, Wilsnack, & Kantor, 2016). It is assumed that women, as a result of their expected responsibilities to be mothers and caretakers, will drink less than men while men may drink more to prove masculine stereotypes (Hughes et al., 2016). The authors suggest that sexual minority women and men subvert these traditional gender norms such that sexual minority women drink more than straight women and sexual minority men do not feel the need to prove masculine stereotypes and thus may drink less than straight men (Hughes et al., 2016). Thus, while both sexual minority women and men face minority stress and structural stigma, the ways in which each group subverts these drinking-related gender norms has a different impact on their drinking patterns and thus disparities when compared with their heterosexual peers. Although nondiscrimination statutes can have a protective effect on binge drinking by buffering LGB populations from structural stigma, multi-level targeted interventions may be needed with a focus on structural, community, and interpersonal levels to fully reduce binge drinking disparities.

### *Limitations*

This study has several limitations. First, most large surveys provide a conservative estimate of binge drinking prevalence in US states. A 2010 study showed that binge drinking prevalence estimates from the 1993-2006 BRFSS accounted for 22-32% of alcohol consumption as measured by alcohol sales data though the two measures were highly correlated (Nelson, Naimi, Brewer, & Roeder, 2010). Some of this underestimation was due to the exclusion of populations without landline telephones, many of whom, including college students, are more likely to engage in binge drinking (Nelson et al., 2010). Since 2011, the BRFSS has included both landline and cellphone numbers and improved weighting measures so that the sample is more representative of US residents age 18 years and older (Pierannunzi, Town, Garvin, Shaw, & Balluz, 2012). Nonetheless, underestimation of binge drinking may bias our results towards the null as individuals who engage in binge drinking may be misclassified as non-binge drinkers.

Second, sexual identity is not collected in all 50 US states across the four years of data included in this analysis. We explored compositional differences between states that did and did

not use the Sexual Orientation and Gender Identity module in 2015-2018 and did not find significant differences. Moreover, by applying sample weights, we can make inferences from the sample to each state's population. Therefore, our estimates of the differential association between sexual identity and binge drinking by the presence of nondiscrimination statutes are valid for the target populations of the states included.

Finally, the BRFSS may undercount sexual minority populations, particularly in states without inclusive statutes. A 2017 study found that approximately 30% of gay and bisexual men in a community sample would not reveal their sexual identity, if asked, on a government survey (Ferlatte, Hottes, Trussler, & Marchand, 2017). Intent not to disclose was particularly high for bisexual men and sexual minority men with female partners (Ferlatte et al., 2017). Although BRFSS does not collect personally identifiable information, the intent to not disclose sexual identity means that individuals might be misclassified or simply refuse to answer questions about sexual identity. This misclassification might mean that the true difference in binge drinking prevalence between sexual minorities and heterosexual populations, particularly among bisexual men, are wider than our estimates.

## **Conclusions**

Despite these limitations, we found that the binge drinking disparity between lesbian and bisexual women and straight women was narrower in states with inclusive nondiscrimination statutes. Enacting nondiscrimination statutes that are inclusive of sexual orientation at the state-level can narrow the disparity in binge drinking between sexual minority women and heterosexual women. Alcohol policy environments have been shown to reduce binge drinking in the general population (Xuan et al., 2015). Future research examining binge drinking disparities among lesbian, gay, and bisexual adults should consider incorporating measures of the alcohol policy environment or individual alcohol policies to see if there is a synergistic relationship between nondiscrimination laws and alcohol policies and seek to better understand the pathways and mechanisms underlying these associations. It is possible that these two structural factors may work in tandem.

While our study focused on state-level binge drinking disparities and nondiscrimination laws, it is critical to acknowledge that individual alcohol consumption can be impacted by policy at various political levels. Sub-state entities, such as cities, may also pass nondiscrimination

ordinances that include sexual orientation. Therefore, even in a state without state-level statutes, people living in these municipalities may still have legal protections on the basis of sexual orientation, though they are often more limited (Mallory, Sears, Mallory, & Sears, 2020). For example, Kansas does not have state-level nondiscrimination protections inclusive of sexual orientation; however, 16 cities covering approximately 33% of the LGBT population in Kansas do have local ordinances (Movement Advancement Project, 2020). Future research may consider estimating the sub-state prevalence of binge drinking to understand how local protective policies are associated with excessive alcohol use and how effective they are in reducing binge drinking disparities when state-level protections do not exist. Moreover, examining the difficulty of passing state-level nondiscrimination statutes and the duration that states have had statutes may be an additional indicator of structural stigma that future studies may examine. It will be important to separate the effects of the presence of the law from duration that the law has been present.

Finally, our study took a resiliency approach by examining whether nondiscrimination statutes can be protective. However, many states not only lack basic protections for LGBT people, but also enact laws that allow religious organizations the right to deny services to sexual and gender minorities on the basis of religious beliefs. The lack of legal protections and the institutionalization of discrimination may work synergistically to produce wider health disparities among LGBT populations in these states. Understanding these mechanisms can drive advocacy efforts to create more equitable environments for LGBT people.

**Table 4.1: Prevalence of binge drinking among women and men by sexual identity comparing states with inclusive nondiscrimination statutes for sexual orientation to states without inclusive statutes, BRFSS, 2015-2018**

		States with inclusive statutes <sup>1</sup>		States without inclusive statutes <sup>2</sup>		
	Unweighted sample size	Weighted %	95% CI	Weighted %	95% CI	p-value
<b>All women</b>	484,966	12.8	12.5 – 13.1	11.0	10.7 – 11.3	< 0.01
<b>Straight women</b>	413,205	11.9	11.6 – 12.3	10.0	9.7 – 10.3	< 0.01
<b>Lesbian women</b>	4,951	18.1	15.0 – 21.7	22.0	17.9 – 26.6	0.16
<b>Bisexual women</b>	8,875	23.8	21.5 – 26.3	24.4	21.8 – 27.3	0.74
<b>All men</b>	378,291	22.9	22.5 – 23.3	21.4	21.0 – 21.8	< 0.01
<b>Straight men</b>	318,494	22.3	21.8 – 22.8	20.7	20.3 – 21.1	< 0.01
<b>Gay men</b>	6,952	27.3	24.4 – 30.4	23.4	20.6 – 26.4	0.07
<b>Bisexual men</b>	4,814	26.0	22.7 – 29.7	24.9	21.3 – 28.8	0.67

<sup>1</sup>: California, Colorado, Connecticut, Delaware, Hawaii, Illinois, Iowa, Maryland, Massachusetts, Minnesota, Nevada, New York, Rhode Island, Vermont, Washington, Wisconsin

<sup>2</sup>: Florida, Georgia, Idaho, Indiana, Kansas, Kentucky, Louisiana, Mississippi, Missouri, Montana, North Carolina, Ohio, Oklahoma, Pennsylvania, South Carolina, Tennessee, Texas, Virginia, West Virginia



**Table 4.2: State-level covariates by presence of inclusive statutes**

	<b>States with inclusive statutes<sup>1</sup> (N=16)</b>	<b>States without inclusive statutes<sup>2</sup> (N=19)</b>	
	<b>Mean (SD)</b>	<b>Mean (SD)</b>	<b>Two-sample t-test p-value</b>
Population 21+ years	73.8 (1.11)	72.5 (1.89)	<0.01
Population adult male	48.8 (0.83)	48.6 (0.61)	0.18
Population Non-Hispanic White	52.6 (14.2)	55.0 (10.5)	0.34
Population lesbian, gay, or bisexual	4.2 (0.56)	3.5 (0.46)	<0.01
Median household income (\$)	64,174 (7,388)	52,472 (6,502)	<0.01
Population living in urban area	82.4 (13.8)	71.2 (10.4)	<0.01
Population living in rural area	17.6 (13.8)	28.8 (10.4)	<0.01
Catholic adherents per 1,000 population	253 (96.1)	124 (76.0)	<0.01
<b>Census region</b>	<b>Percent (n)</b>	<b>Percent (n)</b>	<b>Fisher's exact p-value</b>
Northeast	31.2 (5)	5.3 (1)	<0.01
Midwest	25.0 (4)	21.1 (4)	
South	12.5 (2)	63.2 (12)	
West	31.2 (5)	10.5 (2)	

<sup>1</sup>: California, Colorado, Connecticut, Delaware, Hawaii, Illinois, Iowa, Maryland, Massachusetts, Minnesota, Nevada, New York, Rhode Island, Vermont, Washington, Wisconsin

<sup>2</sup>: Florida, Georgia, Idaho, Indiana, Kansas, Kentucky, Louisiana, Mississippi, Missouri, Montana, North Carolina, Ohio, Oklahoma, Pennsylvania, South Carolina, Tennessee, Texas, Virginia, West Virginia

**Table 4.3: Association between sexual minority identity and binge drinking stratified by presence of inclusive statutes among women in BRFSS, 2015-2018**

	States with inclusive statutes				States without inclusive statutes			
	Lesbian vs Straight		Bisexual vs Straight		Lesbian vs Straight		Bisexual vs Straight	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
<b>MODEL 1</b>	1.63	1.30 – 2.05	2.31	2.01 – 2.65	2.53	1.96 – 3.26	2.91	2.50 – 3.40
<b>MODEL 2</b>	1.18	0.92 – 1.52	1.33	1.12 – 1.58	1.71	1.27 – 2.31	1.84	1.56 – 2.19
<b>MODEL 3</b>	1.66	1.32 – 2.08	2.30	2.00 – 2.63	2.54	1.97 – 3.27	2.91	2.49 – 3.39
<b>MODEL 4</b>	1.19	0.92 – 1.53	1.35	1.13 – 1.60	1.71	1.27 – 2.30	1.83	1.55 – 2.17

Model 1: Unadjusted association between sexual identity and binge drinking

Model 2: Model 1 adjusted for age, race, education, income, marital status

Model 3: Model 1 adjusted for pop 21+ years, pop adult male, pop white, percent LGB, median household income, urban pop, catholic rate, region

Model 4: Model 2 adjusted for covariates in Model 3

**Table 4.4: Association between presence of nondiscrimination statutes inclusive of sexual orientation and binge drinking among men in BRFSS, 2015-2018**

	MODEL 1		MODEL 2		MODEL 3		MODEL 4	
	OR [95% CI]	<i>p</i>	OR [95% CI]	<i>p</i>	OR [95% CI]	<i>p</i>	OR [95% CI]	<i>p</i>
Inclusive statutes	1.10 [1.06–1.14]	<0.01	1.08 [1.03 – 1.12]	0.01	1.02 [0.96 – 1.08]	0.57	1.00 [0.94 – 1.07]	0.99
Gay	1.25 [1.12–1.40]	0.01	1.02 [0.90 – 1.15]	0.75	1.26 [1.13 – 1.41]	<0.01	1.03 [0.91 – 1.16]	0.64
Bisexual	1.25 [1.09–1.43]	0.01	1.03 [0.88 – 1.21]	0.73	1.25 [1.09 – 1.44]	0.01	1.03 [0.88 – 1.21]	0.70
Straight	Ref		Ref		Ref		Ref	

Model 1: Unadjusted model

Model 2: Model 1 adjusted for age, race-ethnicity, education, income, marital status

Model 3: Model 1 adjusted for pop 21+, pop adult male, pop white, pop LGB, median household income, officers per capita, urban pop, catholic rate, region, survey year

Model 4: Model 2 adjusted for all factors in Model 3

**Table 4.5: Supplemental Table A1 - Prevalence of binge drinking and presence of inclusive nondiscrimination statutes among women in states using the SOGI module, BRFSS, 2015-2018**

State	All Women	Straight	Lesbian	Bisexual	Inclusive Nondiscrimination Statutes	Diff Lesbian vs Straight <sup>1</sup>	Diff Bisexual v Straight <sup>2</sup>	Diff Bisexual v Lesbian <sup>3</sup>	Ratio Lesbian v Straight <sup>4</sup>	Ratio Bisexual v Straight <sup>5</sup>	Ratio Bisexual v Lesbian <sup>6</sup>
<b>All States</b>	<b>11.4</b>	<b>10.9</b>	<b>20.1</b>	<b>24.1</b>	<b>NA</b>	<b>9.2</b>	<b>13.2</b>	<b>4.0</b>	<b>1.8</b>	<b>2.2</b>	<b>1.2</b>
California	11.8	10.9	16.1	19.4	Yes	5.2	8.5	3.3	1.5	1.8	1.2
Colorado	12.4	11.6	30.4	23.9	Yes	18.8	12.3	-6.5	2.6	2.1	0.8
Connecticut	12.0	11.2	20.8	28.2	Yes	9.6	17.0	7.4	1.9	2.5	1.4
Delaware	12.5	12.0	15.7	22.8	Yes	3.7	10.8	7.1	1.3	1.9	1.5
Florida	10.4	10.0	22.5	24.0	No	12.5	14.0	1.5	2.3	2.4	1.1
Georgia	9.6	8.8	15.1	11.4	No	6.3	2.6	-3.7	1.7	1.3	0.8
Hawaii	12.6	11.8	30.4	29.6	Yes	18.6	17.8	-0.8	2.6	2.5	1.0
Idaho	10.4	9.3	15.3	19.9	No	6.0	10.6	4.6	1.6	2.1	1.3
Illinois	14.0	13.2	16.3	24.2	Yes	3.1	11.0	7.9	1.2	1.8	1.5
Indiana	11.0	10.4	15.7	16.3	No	5.3	5.9	0.6	1.5	1.6	1.0
Iowa	15.1	14.6	27.7	33.9	Yes	13.1	19.3	6.2	1.9	2.3	1.2
Kansas	10.4	9.6	25.3	24.3	No	15.7	14.7	-1.0	2.6	2.5	1.0
Kentucky	9.2	8.4	32.4	18.4	No	24.0	10.0	-14.0	3.9	2.2	0.6
Louisiana	12.5	10.9	26.8	24.2	No	15.9	13.3	-2.6	2.5	2.2	0.9
Maryland	11.0	9.9	26.4	18.1	Yes	16.5	8.2	-8.3	2.7	1.8	0.7
Massachusetts	14.1	12.8	8.4	31.3	Yes	-4.4	18.5	22.9	0.7	2.4	3.7
Minnesota	15.0	14.7	22.0	24.5	Yes	7.3	9.8	2.5	1.5	1.7	1.1
Mississippi	7.3	6.8	25.6	15.2	No	18.8	8.4	-10.4	3.8	2.2	0.6
Missouri	13.1	11.3	12.4	39.1	No	1.1	27.8	25.7	1.2	3.5	2.9
Montana	13.3	12.8	24.2	28.1	No	11.4	15.3	3.9	1.9	2.2	1.2
Nevada	10.4	9.5	19.2	22.9	Yes	9.7	13.4	3.8	2.0	2.4	1.2
New York	12.6	11.8	17.8	23.5	Yes	6.0	11.7	5.7	1.5	2.0	1.3
North Carolina	10.2	9.0	9.5	18.0	No	0.5	9.0	8.5	1.1	2.0	1.9
Ohio	12.3	11.4	16.4	25.7	No	5.0	14.3	9.3	1.4	2.3	1.6
Oklahoma	8.7	7.4	33.7	17.6	No	26.3	10.2	-16.1	4.6	2.4	0.5
Pennsylvania	12.8	11.6	18.1	25.5	No	6.5	13.9	7.4	1.6	2.2	1.4

Rhode Island	12.1	11.3	20.6	20.4	Yes	9.3	9.1	-0.2	1.8	1.8	1.0
South Carolina	9.9	9.0	29.6	16.3	No	20.6	7.3	-13.3	3.3	1.8	0.6
Tennessee	9.9	8.2	25.1	37.0	No	16.9	28.8	11.9	3.1	4.5	1.5
Texas	11.7	10.9	31.5	28.9	No	20.6	18.0	-2.6	2.9	2.7	0.9
Vermont	13.2	12.6	10.3	23.7	Yes	-2.3	11.1	13.4	0.8	1.9	2.3
Virginia	11.9	10.5	25.6	27.1	No	15.1	16.6	1.5	2.4	2.6	1.1
Washington	11.7	10.9	17.7	26.8	Yes	6.8	15.9	9.1	1.6	2.5	1.5
West Virginia	5.4	5.0	14.8	19.3	No	9.8	14.3	4.5	3.0	3.9	1.3
Wisconsin	18.0	17.2	21.7	25.5	Yes	4.5	8.3	3.8	1.3	1.5	1.2

<sup>1</sup> Difference in binge drinking prevalence between lesbian and straight women

<sup>2</sup> Difference in binge drinking prevalence between bisexual and straight women

<sup>3</sup> Difference in binge drinking prevalence between bisexual and lesbian women

<sup>4</sup> Ratio of the prevalence in binge drinking comparing lesbian to straight women

<sup>5</sup> Ratio of the prevalence in binge drinking comparing bisexual to straight women

<sup>6</sup> Ratio of the prevalence in binge drinking comparing bisexual to lesbian women

**Table 4.6: Supplemental Table A2 - Prevalence of binge drinking and presence of inclusive nondiscrimination statutes among men in states using the SOGI module, BRFSS, 2015-2018**

State	All Men	Straight	Gay	Bisexual	Inclusive Nondiscrimination Statutes	Diff Gay <sup>1</sup>	Diff Bisexual <sup>2</sup>	Diff Bisexual vs Gay <sup>3</sup>	Ratio Gay <sup>4</sup>	Ratio Bisexual <sup>5</sup>	Ratio Bisexual v Gay <sup>6</sup>
<b>All States</b>	<b>21.6</b>	<b>21.4</b>	<b>25.5</b>	<b>25.4</b>	<b>NA</b>	<b>4.1</b>	<b>4.0</b>	<b>-0.1</b>	<b>1.2</b>	<b>1.2</b>	<b>1.0</b>
California	18.4	21.8	28.4	28.6	Yes	6.6	6.8	0.2	1.2	0.4	1.0
Colorado	21.1	21.4	38.4	25.2	Yes	17.0	3.8	-13.2	1.1	0.9	0.7
Connecticut	19.0	20.9	19.5	32.7	Yes	-1.4	11.8	13.2	0.9	0.9	1.7
Delaware	21.2	19.4	18.4	23.5	Yes	-1.0	4.1	5.1	1.4	1.0	1.3
Florida	22.1	20.2	17.2	20.7	No	-3.0	0.5	3.5	1.4	1.0	1.2
Georgia	23.3	17.1	23.7	20.3	No	6.6	3.2	-3.4	1.5	1.0	0.9
Hawaii	20.9	25.3	23.4	31.2	Yes	-1.9	5.9	7.8	0.9	1.0	1.3
Idaho	26.3	19.4	27.0	34.1	No	7.6	14.7	7.1	1.1	1.0	1.3
Illinois	19.5	25.9	28.3	26.6	Yes	2.4	0.7	-1.7	1.0	1.1	0.9
Indiana	20.2	21.9	21.8	33.7	No	-0.1	11.8	11.9	1.1	1.1	1.5
Iowa	20.5	27.6	29.4	29.9	Yes	1.8	2.3	0.5	0.8	1.1	1.0
Kansas	27.3	20.6	28.1	20.8	No	7.5	0.2	-7.3	1.1	1.1	0.7
Kentucky	17.6	20.1	16.8	22.4	No	-3.3	2.3	5.6	2.7	1.1	1.3
Louisiana	20.4	22.1	11.4	25.2	No	-10.7	3.1	13.8	1.7	1.1	2.2
Maryland	22.6	16.3	20.1	25.7	Yes	3.8	9.4	5.6	0.5	1.1	1.3
Massachusetts	29.2	21.4	22.7	25.4	Yes	1.3	4.0	2.7	1.3	1.1	1.1
Minnesota	18.5	25.6	29.2	29.7	Yes	3.6	4.1	0.5	1.4	1.2	1.0
Mississippi	23.0	18.7	23.3	8.1	No	4.6	-10.6	-15.2	1.8	1.2	0.3
Missouri	22.6	21.6	26.6	29.3	No	5.0	7.7	2.7	1.1	1.2	1.1
Montana	25.7	23.7	21.4	36.7	No	-2.3	13.0	15.3	1.1	1.2	1.7
Nevada	19.4	21.2	22.6	18.4	Yes	1.4	-2.8	-4.2	0.9	1.2	0.8
New York	23.1	21.1	28.5	21.5	Yes	7.4	0.4	-7.0	1.0	1.2	0.8
North Carolina	21.9	19.1	32.8	21.9	No	13.7	2.8	-10.9	1.2	1.3	0.7
Ohio	25.5	23.0	28.7	34.1	No	5.7	11.1	5.4	0.9	1.2	1.2
Oklahoma	22.3	17.1	17.6	25.7	No	0.5	8.6	8.1	1.3	1.3	1.5
Pennsylvania	22.3	22.9	35.2	23.3	No	12.3	0.4	-11.9	1.2	1.4	0.7
Rhode Island	21.2	21.4	12.2	33.6	Yes	-9.2	12.2	21.4	1.2	1.4	2.8

South Carolina	17.9	20.1	24.8	28.6	No	4.7	8.5	3.8	1.0	1.5	1.2
Tennessee	17.1	17.9	15.5	15.8	No	-2.4	-2.1	0.3	1.2	1.6	1.0
Texas	23.6	22.3	22.8	27.1	No	0.5	4.8	4.3	1.2	1.5	1.2
Vermont	21.5	20.9	26.0	26.4	Yes	5.1	5.5	0.4	0.9	1.6	1.0
Virginia	22.5	19.7	21.6	21.8	No	1.9	2.1	0.2	1.0	1.5	1.0
Washington	21.9	18.7	19.1	19.9	Yes	0.4	1.2	0.8	0.6	1.6	1.0
West Virginia	24.1	16.7	44.3	19.0	No	27.6	2.3	-25.3	0.9	1.5	0.4
Wisconsin	19.8	29.2	37.2	32.3	Yes	8.0	3.1	-4.9	1.4	1.8	0.9

<sup>1</sup> Difference in binge drinking prevalence between gay and straight men

<sup>2</sup> Difference in binge drinking prevalence between bisexual and straight men

<sup>3</sup> Difference in binge drinking prevalence between bisexual and gay men

<sup>4</sup> Ratio of the prevalence in binge drinking comparing gay to straight men

<sup>5</sup> Ratio of the prevalence in binge drinking comparing bisexual to straight men

<sup>6</sup> Ratio of the prevalence in binge drinking comparing bisexual to gay men

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**CHAPTER 5 – EXPLORING THE RELATIONSHIP BETWEEN THE  
ALCOHOL POLICY ENVIRONMENT AND NONDISCRIMINATION  
LAWS: IMPLICATIONS FOR BINGE DRINKING DISPARITIES  
AMONG LGB ADULTS IN THE UNITED STATES<sup>3</sup>**

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<sup>3</sup> Manuscript is formatted for submission to *Drug and Alcohol Dependence*.

## Abstract

### *Background*

Alcohol policies reduce population-level binge drinking; however, they may not reduce binge drinking disparities between different populations. We examined the impact of the alcohol policy environment on binge drinking among Lesbian, Gay and Bisexual (LGB) and heterosexual adults in the presence and absence of state laws that protect LGB people from discrimination.

### *Methods*

The 2015-2018 Behavioral Risk Factor Surveillance System (BRFSS) provided information about individual-level binge drinking, sexual identity, and individual-level covariates. Strictness of state-level alcohol policy environments was measured using the Alcohol Policy Scale. Presence of state-level nondiscrimination protections based on sexual orientation came from the Movement Advancement Project. We built logistic regression models to test whether nondiscrimination statutes modified the association between the alcohol policy environment and binge drinking and whether this interaction was different for LGB and heterosexual adults.

### *Results*

The association between the alcohol policy scale score and binge drinking was lower in states with inclusive nondiscrimination laws (aOR: 0.93 [95% CI: 0.89–0.97;  $p=0.0003$ ]) than in states without inclusive nondiscrimination laws (aOR: 0.98 [95% CI: 0.93–1.03]  $p=0.4781$ ). Moreover, binge drinking disparities between lesbian and bisexual women compared with heterosexual women were narrower in states with inclusive nondiscrimination statutes. We did not find significant associations among heterosexual, gay, or bisexual men.

### *Conclusions*

The presence of inclusive nondiscrimination laws increases the effectiveness of stricter alcohol policy environments in narrowing binge drinking disparities between sexual minority and heterosexual women in the US possibly because these laws reduce structural stigma against sexual minority groups.

*Keywords:* alcohol policy environment, Behavioral Risk Factor Surveillance System, binge drinking, bisexual, legal epidemiology, lesbian, structural stigma

## Introduction

Binge drinking is a major public health issue that results in individual and societal costs to health and well-being in the United States (Bouchery et al., 2011; Mokdad et al., 2004; Stahre et al., 2014). A substantial literature documents the higher prevalence of binge drinking and alcohol-related harms among lesbian, gay, and bisexual (LGB) populations, particularly among LGB women (Drabble et al., 2005; Fish et al., 2018; Medley et al., 2016). These longstanding disparities among LGB adults are posited to result from sexual minority stress in the form of identity concealment, prejudice, discrimination, and violence (Meyer, 2003). Reducing binge drinking disparities among LGB populations is important for reducing binge drinking and alcohol-related harms at the population level and for achieving health equity.

The current approach to reducing population-level binge drinking and alcohol-related harms is through the use of alcohol control policies; that is, laws and regulations that directly determine the sale and distribution of alcohol products as well as control when, where, and by whom alcohol can be consumed (T. F. Nelson et al., 2013). Several systematic reviews provide evidence that individual alcohol control policies (e.g., increasing alcohol taxes, reducing the density of alcohol outlets, limiting the days and hours of sale for alcohol, and holding alcohol outlets liable for overserving intoxicated customers) can reduce binge drinking, and also have the potential to reduce rates of alcohol-impaired motor vehicle crashes, interpersonal violence, and liver cirrhosis (Campbell et al., 2009; Elder et al., 2010; Hahn et al., 2010; Middleton et al., 2010; Rammohan et al., 2011). Moreover, there is evidence that the alcohol policy environment (i.e., the combined impact of individual alcohol policies enacted in a jurisdiction ) reduces individual-level binge drinking among adults and youth (Xuan, Blanchette, Nelson, Heeren, et al., 2015; Xuan, Blanchette, Nelson, Nguyen, et al., 2015). While these universal approaches have the same effect on binge drinking for LGB and heterosexual populations, they do not appear to decrease binge drinking disparities between these groups (Greene Dissertation Paper 1). Lesbian and bisexual women have significantly higher odds of binge drinking compared with heterosexual women even in the presence of stronger alcohol policy environments (Greene Dissertation Paper 1). One possible explanation for this phenomenon is that alcohol policy environments influence the economic reasons that people drink, but not the structural factors that underlie binge drinking disparities between LGB and heterosexual populations.

Disparities in the prevalence and severity of mental health and substance use problems among LGB populations are driven by fundamental differences in the way LGB people are treated in society. Previous studies show that the lack of legal protections on the basis of sexual orientation increases psychiatric disorders, mental distress, and alcohol use disorders among LGB people (Hatzenbuehler et al., 2009, 2010; Raifman et al., 2018). Structural stigma is the theoretical framework that describes the mechanisms whereby these fundamental societal differences manifest as differences in health and well-being for the stigmatized group (Hatzenbuehler et al., 2013). Lesbian, gay, bisexual and other sexual minority people become stigmatized through processes that label these groups as ‘other,’ produce negative and harmful stereotypes, and separate these groups from the rest of society (Link & Phelan, 2001). This stigmatization is embedded in laws and policies (i.e., structural discrimination) that perpetuate the labelling, stereotyping, and separation and thus continue the stigmatization of these groups (Link & Phelan, 2001). While the lack of legal protections is associated with worse mental health and substance use outcomes among LGB people, the presence of protections on the basis of sexual orientation is associated with reductions in disparities and improved health outcomes among LGB people (Everett et al., 2016; Hatzenbuehler et al., 2012; Raifman et al., 2017).

Given what is known about the protective effects of the alcohol policy environment on binge drinking among the general population and the ameliorative effects of legal protections on the basis of sexual orientation, we sought to explore how state-level alcohol policy environments interact with state-level nondiscrimination statutes that include protections on the basis of sexual orientation (i.e., inclusive nondiscrimination statutes) to contribute to disparities in binge drinking between LGB and heterosexual adults in the US. Stronger alcohol policy environments reduce binge drinking by decreasing the availability, affordability, and accessibility of alcohol products. Inclusive nondiscrimination statutes reduce substance use problems among LGB populations by reducing structural stigma. For LGB populations, living in states with stronger alcohol policy environments and inclusive nondiscrimination statutes may be associated with lower binge drinking prevalence. Therefore, we hypothesized that inclusive nondiscrimination statutes strengthen the negative association between state-level alcohol policy environments and binge drinking among LGB adults and reduce binge drinking disparities because the combination of these policies address both the economic and social roots of binge drinking and binge drinking disparities. We conducted separate analyses for men and women (based on sex at birth) because

of well-documented sex differences in the epidemiology of alcohol use; these differences are particularly salient at the intersection of sex and sexual orientation (Hughes et al., 2016).

## **Methods**

### *Data source and sample*

#### *Study sample*

We pooled data from the 2015-2018 Behavioral Risk Factor Surveillance System (BRFSS). The BRFSS is a repeated cross-sectional survey conducted by the Centers for Disease Control and Prevention used to estimate national and state-level prevalence of health outcomes and behaviors. Eligible individuals include adults 18+ years in the noninstitutionalized civilian population. BRFSS samples both landline and mobile telephone numbers. Through multistage sampling, the BRFSS produces a representative sample of the target population (*BRFSS Data User Guide*, 2013). Our sample includes the 35 states that used the Sexual Orientation and Gender Identity (SOGI) module between 2015 and 2018, which includes an unweighted sample of 484,966 women and 378,291 men.

### *Measures*

#### *Primary exposures*

This analysis has two primary exposures: the strictness of the alcohol policy environment and whether a state's nondiscrimination laws in employment, housing, and public accommodations include sexual orientation.

The strictness of the alcohol policy environment was measured using the Alcohol Policy Scale (APS) score. This measure captures both the presence of individual alcohol policies enacted within a state as well as the degree to which these policies have been implemented. Development of the APS score has been fully explained elsewhere (Naimi et al., 2014; T. F. Nelson et al., 2013). Briefly, the scale developers convened a Delphi panel of alcohol policy experts who created a list of individual alcohol policies (e.g., excise taxes on alcohol) shown to reduce population-level binge drinking. The Delphi panel rated the efficacy of each policy in reducing binge drinking on a scale of 1 (low efficacy) to 5 (high efficacy). Separately, the scale developers created an implementation rating for each policy to represent the degree to which a state fully implemented each alcohol policy. The APS score is created by summing the products



of the efficacy rating and implementation rating for all individual alcohol policies enacted in a state within a given year. Higher APS scores reflect stricter alcohol policy environments in which alcohol products may be more difficult to acquire and alcohol-related harms (e.g., drinking and driving) have more severe civil or criminal sanctions. We used APS scores calculated for 2014-2017 so that scores could be lagged by one year in the statistical models.

We extracted data from reports produced by the Movement Advancement Project on the current state of inclusive legislation in employment, housing, and public accommodations in US states between 2015-2018 (Movement Advancement Project, 2019). We used a binary indicator of whether a state's nondiscrimination laws explicitly include sexual orientation (i.e., inclusive nondiscrimination statutes). During this time period, states included in this analysis that had inclusive employment nondiscrimination laws also had inclusive housing and public accommodations laws. The Movement Advancement Project's legal surveillance on inclusive state laws has also been used by the Williams Institute at UCLA School of Law, a research center that examines the role of public policy on the wellbeing of LGBT populations (Conron & Goldberg, 2020).

#### *Primary outcome measure*

The primary outcome for this analysis was binge drinking. The National Institute on Alcohol Abuse and Alcoholism (NIAAA) defines binge drinking as 4+/5+ alcoholic beverages on a single occasion (about 2 hours) for women/men (National Institute on Alcohol Abuse and Alcoholism, n.d.). This amount of alcohol in this amount of time causes substantial impairment and, on average, raises a person's blood alcohol level to 0.08 mg/dL, the legal limit in most US states.

#### *Moderator*

The moderator is an indicator for sexual identity. This information is captured in the BRFSS through the optional Sexual Orientation and Gender Identity module. The module asks the question: "Do you consider yourself to be?" with response options: Straight (i.e., heterosexual), Lesbian or Gay, Bisexual, or Something Else. We restricted this analysis to individuals who identified as heterosexual, lesbian or gay, or bisexual.

### *Covariates*

Binge drinking prevalence can be affected by both individual and state-level factors. Therefore, we adjusted for several individual-level and state-level covariates in this analysis. Individual covariates come from the BRFSS and include: age category (i.e., 18–24, 25–34, 35–44, 45–54, 55–64, 65+ years), race-ethnicity (categories included Hispanic/Latino, any race; and Non-Hispanic White, Black, Multi-racial, and Other race), educational attainment (less than high school, high school graduate, some college, college graduate), annual household income (<\$15K; \$15–24,999; \$25–34,999; \$35–49,000; \$50K plus), and relationship status (married, divorced, widowed, separated, never married, member of unmarried couple). State-level covariates came from the 2010 US Census, the American Community Survey, the U.S. Religion Census Religious Congregations and Membership Study, and the Federal Bureau of Investigation Uniform Crime Reporting Statistics (Federal Bureau of Investigation, n.d.; Grammich et al., 2018; U.S. Census Bureau, 2012, 2019). State-level covariates were the population composition (e.g., proportion in the state who are 21+ years, adult males, Non-Hispanic White adults, and LGB adults), number of law enforcement officers per capita, the number of Catholics per 1,000 population, median household income, proportion of the population living in urban areas, and the state's Census region (i.e., Northeast, South, Midwest, West). State-level covariates were chosen *a priori* based on studies of the association between the alcohol policy environment and binge drinking (Xuan, Blanchette, Nelson, Heeren, et al., 2015; Xuan, Blanchette, Nelson, Nguyen, et al., 2015). The number of Catholics in the population has been included in other studies because a higher proportion of Catholics in a state is associated with higher binge drinking prevalence (Holt et al., 2006).

### *Statistical analysis*

Our goal for this analysis was to examine whether the way in which inclusive nondiscrimination laws interact with the alcohol policy environment (as measured by the APS score) differs for LGB compared with heterosexual adults. Therefore, we built nested models that included a 2-way interaction between APS score and the binary indicator for the presence of inclusive nondiscrimination laws; 3-way interaction terms between APS score, inclusive nondiscrimination law, and sexual identity; and all other 2-way interactions between these three variables (Jaccard & Turrisi, 2011). We built separate models for women and men given

documented differences in binge drinking between these populations (Dawson et al., 2015). We used backward step-wise logistic regression to find the most parsimonious model for the association between alcohol policy score, binge drinking, sexual identity, and nondiscrimination law. Interaction terms with  $\alpha > 0.05$  were removed and the models re-run with a smaller number of interactions and main effects. In the final step, we removed nonsignificant covariates. For ease of interpretation, we stratified the final models on the variables in these significant interactions. All models were built in SAS 9.4 using PROC SURVEYLOGISTIC to account for the BRFSS complex survey design.

## Results

### *Alcohol policy scores and inclusive nondiscrimination statutes*

Among the 35 states included in the sample, 16 states had nondiscrimination statutes that included sexual orientation and 19 states had nondiscrimination statutes that did not include sexual orientation. We present the distribution of the alcohol policy scale (APS) scores between states with and without inclusive nondiscrimination statutes across 2014-2017 (Figure 1). Among states with inclusive nondiscrimination statutes, APS scores ranged from 43.1 to 69.5, with a mean of 56.7 ( $\pm 8.18$ ). Among states without inclusive nondiscrimination laws, APS scores ranged from 44.8 to 83.8, with a mean of 61.8 ( $\pm 10.3$ ) (Table 1); moreover, Oklahoma, Tennessee, Pennsylvania, and Florida were outliers in these states. There was not a statistically significant difference in mean APS score between states with and without inclusive nondiscrimination statutes ( $p=0.11$ ).

### *Interactions between sexual identity, alcohol policy scores, and presence of inclusive nondiscrimination statutes among women*

In the nested model with main effects, two-way and three-way interactions, and covariates (Supplemental Table C: Model 1), the three-way interaction term was not statistically significant – APS score x presence of inclusive nondiscrimination statutes x sexual minority (i.e., lesbian, bisexual) identity. This means that the association between APS score and binge drinking does not differ between states with and states without inclusive nondiscrimination statutes among sexual minority women compared with heterosexual women.

In the model that included main effects, 2-way interactions (i.e., product terms for APS score and nondiscrimination status, APS score with sexual orientation, and nondiscrimination statutes with sexual identity), and covariates, there was not a statistically significant interaction between APS score and presence of inclusive nondiscrimination statutes (Supplemental Table C: Model 2). We interpret this result to indicate that the presence of inclusive nondiscrimination statutes does not modify the association between APS score and individual-level binge drinking among women generally. Additionally, we did not find a statistically significant interaction between APS score and sexual identity. This indicates that the association between the alcohol policy environment and binge drinking does not differ for lesbian and bisexual women compared with heterosexual women. The interaction between presence of inclusive nondiscrimination statutes and bisexual identity was statistically significant ( $\beta=-0.074$ ,  $p=0.02$ ). This suggests that the odds of binge drinking comparing bisexual women with heterosexual women differs between states with and those without inclusive nondiscrimination statutes. The negative coefficient for the interaction term suggests that the odds ratio will be smaller in states with inclusive nondiscrimination statutes compared with states without nondiscrimination statutes.

After retaining only the statistically significant main terms and the interactions including these terms (Supplemental Table C: Model 3.1), the APS score, inclusive nondiscrimination statutes, sexual identity, and the interaction term between sexual identity and presence of nondiscrimination statutes were significantly associated with binge drinking. There is a significant negative association between the alcohol policy environment and individual-level binge drinking controlling for the presence of nondiscrimination statutes, sexual identity, individual factors, and state-level factors. There is a significant negative association between the presence of nondiscrimination statutes and individual-level binge drinking controlling for the alcohol policy environment. There is a significant positive association between individual binge drinking and lesbian/bisexual sexual identity suggesting that the odds of binge drinking are higher among these groups compared with heterosexual women. Additionally, the association between inclusive nondiscrimination statutes and individual-level binge drinking differs between lesbian and bisexual women compared to heterosexual women.

The final model (Supplemental Table C: Model 3.2) removes the covariates that were not statistically significant including officers per capita, median household income, and percentage of the population living in urban areas. Removal of these state-level covariates did not change

the findings regarding the main terms or interaction terms and creates a more parsimonious model. We stratified our final model by the presence of inclusive nondiscrimination statutes and interpret the results below.

*Association between alcohol policy score and binge drinking among women stratified by presence of inclusive nondiscrimination statutes*

In states with inclusive nondiscrimination statutes, a 10-percentage point increase in APS score was associated with a 7% lower odds of individual-level binge drinking (OR: 0.93 [95% CI: 0.89–0.97;  $p=0.0003$ ]) among women controlling for sexual identity, individual demographic characteristics, and state-level factors. The odds of binge drinking were not significantly different comparing lesbian and heterosexual women (OR: 1.19 [95% CI: 0.92–1.54;  $p=0.1777$ ]). The odds of binge drinking among bisexual women were 1.34 [95% CI: 1.13–1.60;  $p=0.0008$ ] times that of heterosexual women (Table 2).

In states without inclusive nondiscrimination statutes, there was not a significant association (OR: 0.98 [95% CI: 0.93–1.03]  $p=0.4781$ ) between APS score and individual-level binge drinking adjusted for age, race, education, income, relationship status, proportion of legal drinkers, proportion of the population that is male, proportion of the population that is Non-Hispanic White, proportion of the population identifying as lesbian, gay, or bisexual, the number of Catholics per 1,000 population, and Census region. In these states, lesbian and bisexual women were more likely to engage in binge drinking. Lesbian women had 1.71 [95% CI: 1.27–2.31;  $p=0.0004$ ] times the odds of binge drinking compared to heterosexual women. Bisexual women had 1.84 [95% CI: 1.55–2.18;  $p<.0001$ ] times the odds of binge drinking compared to heterosexual women.

*Interactions between sexual identity, alcohol policy scores, and presence of inclusive nondiscrimination statutes among men*

In the largest nested model among men, the 3-way interaction term between APS score, presence of inclusive nondiscrimination statutes, and sexual identity for gay men was statistically significant, suggesting that the interaction between APS score and presence of inclusive nondiscrimination statutes differs for gay men compared with heterosexual men (Supplemental Table D: Model 1). We interpret this significant interaction to suggest that the association

between APS score and binge drinking in the presence of nondiscrimination laws is different for gay men compared with heterosexual men. Moreover, we found a statistically significant 2-way interaction term between presence of inclusive nondiscrimination statutes and sexual identity for gay men. This suggests that the association between inclusive nondiscrimination statutes and binge drinking differs between gay and heterosexual men. Therefore, we stratified this model on both sexual identity and presence of inclusive nondiscrimination statutes.

*Association between alcohol policy score and binge drinking among men stratified by presence of inclusive nondiscrimination statutes and sexual identity*

After stratifying on the presence of inclusive nondiscrimination statutes and sexual identity, we did not find a significant association between APS score and individual-level binge drinking for heterosexual, gay, or bisexual men living in states with or without inclusive nondiscrimination statutes (Table 3). Among heterosexual men, the association between APS score and binge drinking was similar in states with vs without inclusive nondiscrimination statutes (OR: 1.00 [95% CI: 0.97–1.05] vs OR: 0.99 [95% CI: 0.95–1.03]) controlling for all individual and state-level factors. Among gay men, the association between APS score and binge drinking was also similar in states with vs without inclusive nondiscrimination statutes (OR: 0.92 [95% CI: 0.71–1.12] vs OR: 0.85 [95% CI: 0.64–1.12]). However, among bisexual men, the association between APS score and binge drinking was in opposite directions, but not statistically significant. In states with inclusive nondiscrimination statutes, the association between APS score and binge drinking was negative (OR: 0.95 [95% CI: 0.68–1.32]) among bisexual men; in states without inclusive nondiscrimination statutes, the association between APS score and binge drinking was positive (OR: 1.08 [95% CI: 0.76–1.53]) among bisexual men.

## **Discussion**

Our study examined how the interaction between the strictness of alcohol policy environments and state-level nondiscrimination statutes inclusive of sexual orientation impacts binge drinking disparities between lesbian, gay, and bisexual adults compared with heterosexual adults in 35 US states. Overall, while the alcohol policy environment and inclusive nondiscrimination statutes have a strong association with binge drinking among women,

particularly lesbian women, they have a trivial association for men. We found that stricter alcohol policy environments were significantly associated with lower odds of binge drinking among all women in states with inclusive nondiscrimination statutes. Binge drinking disparities between bisexual women and heterosexual women were narrower in these states and there was not a significant difference in the odds of binge drinking between lesbian and heterosexual women in states with inclusive nondiscrimination statutes. In states without inclusive nondiscrimination statutes, stricter alcohol policy environments were not significantly associated with lower odds of binge drinking among women. Moreover, disparities between lesbian/bisexual women and heterosexual women were much wider in these states.

There was no association between the alcohol policy environment and binge drinking among heterosexual men regardless of whether they lived in states with or without inclusive nondiscrimination statutes. For gay men, there was a significant interaction between the alcohol policy environment and presence of inclusive nondiscrimination statutes; however, upon stratifying this model on sexual identity and presence of inclusive nondiscrimination statutes, we did not find a significant association between the strictness of the alcohol policy environment and binge drinking among gay men in either type of state. Among bisexual men, the direction of the association between the alcohol policy environment was positive in states without inclusive nondiscrimination statutes while it was negative in states with inclusive nondiscrimination statutes. However, neither of these associations was significant.

We conducted an additional analysis that defined binge drinking at 4+/5+ drinks for women/men on 5 or more occasions (i.e., high-frequency binge drinking) to see if the exposures had a stronger association for individuals with more problematic drinking. Among women, there was a weaker association between the alcohol policy environment and high-frequency binge drinking stratified by whether a state had inclusive nondiscrimination statutes. Among men, the analysis of high-frequency binge drinking was similar to that for binge drinking.

Previous studies have shown that stricter alcohol policy environments are associated with reduced odds of binge drinking among women, men, and the general population (Xuan, Blanchette, Nelson, Heeren, et al., 2015); however, they were unclear as to whether stricter alcohol policy environments had the same effect for LGB subgroups or whether they could reduce binge drinking disparities. Our study expands what is known by exploring how the strength of the alcohol policy environment is associated with binge drinking disparities in the

presence of other public policies. Our findings suggest that stricter alcohol policy environments may reduce binge drinking among LGB women to the same degree as heterosexual women. Moreover, stricter alcohol policy environments appear to have greater effectiveness in states with nondiscrimination protections for LGB groups, a signal that these states may have less structural stigma directed at sexual minorities.

Furthermore, our study contributes to the growing literature on the impact of public policy on the health and well-being of LGB people in two important ways (Everett et al., 2016; Hatzenbuehler et al., 2009, 2010; Raifman et al., 2018). First, our study brings a structural perspective to the examination of binge drinking disparities. As previously discussed, the epidemiology of binge drinking by sexual identity has revealed stark differences between LGB and heterosexual people, particularly among women (Drabble et al., 2005; Drabble & Trocki, 2005; Fish, 2019; Fish et al., 2018; Gonzales et al., 2016; Gonzales & Henning-Smith, 2017; Hughes et al., 2016). In general, women are less likely to binge drink than men. However, lesbian, bisexual, and other sexual minority women are more likely to binge drink than heterosexual women whereas gay, bisexual, and other sexual minority men binge drink at the same rate or only slightly more than heterosexual men. Studies examining the underlying causes for these differences have relied on measuring interpersonal experiences of discrimination, homophobia, and other minority stressors (Gilbert & Zembre, 2016; Wilson et al., 2016; Wray et al., 2016). However, structural stigma pervades every part of society and it can have negative effects on health outcomes even if individuals do not experience personally-mediated discrimination or homophobia (Hatzenbuehler et al., 2013). Our study reveals how public policy contributes to these documented disparities even in places where the availability, accessibility, and affordability of alcohol is low. Therefore, it is not only important to understand the role of individual, interpersonal, and community-level exposures on binge drinking disparities, but also policy-level exposures. As more US states continue to collect information about sexual orientation and gender identity, future research should continue to examine how structural factors contribute to health disparities for sexual and gender minority populations.

Our study also reveals the importance of taking a health equity approach when examining how public policies impact population-level binge drinking and binge drinking disparities. Few studies examining the effect of alcohol policy on binge drinking and alcohol-related harms include a health equity approach (Roche et al., 2015). Yet, crafting public policy with health



equity in mind is critical for improving population health (Pollack Porter et al., 2018). While alcohol policies included in the APS score address the economic forces that underscore excessive alcohol consumption, they may not account for other reasons (e.g., cultural) that people drink.

Social and cultural differences for the reasons people drink may also underscore why we found significant associations for women but not men. While an analysis of the factors that may contribute to this finding is beyond the scope of this paper, previous work has hypothesized that significant differences between sexual minority women and heterosexual women (but not sexual minority and heterosexual men) are due to the eschewing of traditional gender norms (Hughes et al., 2016). Sexual minority women are more likely than heterosexual women to take on masculine behaviors including increased alcohol consumption (Hughes et al., 2016). Conversely, sexual minority men may be less likely to conform to masculine stereotypes and drinking behaviors (Hughes et al., 2016).

Another hypothesis is that heterosexual and sexual minority women make different choices regarding the creation of families. Alcohol use changes over the life course. Individuals tend to drink heavily during emerging adulthood (18-25 years) with drinking tapering off in middle adulthood due to increased responsibilities, such as caring for children (O'Malley, 2004). Given that sexual minority women are more likely than heterosexual women to be nulliparous (Case et al., 2004), these external changes to drinking patterns may not occur for sexual minority women to the same degree as they do for heterosexual women.

Additionally, in the past twenty years, there are important demographic shifts that have occurred alcohol consumption, particular hazardous alcohol use. Overall, US adults are more likely to consume alcohol and to engage in patterns of hazardous alcohol use including binge drinking (Dawson et al., 2015). These changes have been driven by increases in alcohol consumption among women, racial-ethnic minority populations, and those with less education and income (Dawson et al., 2015).

Similar to previous studies, this study found a significantly higher odds of binge drinking for bisexual women compared with heterosexual women even in states with inclusive nondiscrimination statutes. Negative attitudes towards bisexual people are held by both lesbian/gay and heterosexual people, though these attitudes are less prevalent among lesbian and gay individuals (Friedman et al., 2014). In a qualitative study, young bisexual women reported challenges at the macro, meso, and micro-levels (Flanders et al., 2015). These challenges

included finding inclusive community, individuals denying the reality of their sexual orientation, and internalizing stereotypes about bisexual people (Flanders et al., 2015). At least one study has shown that greater involvement in LGBT community is associated with increased problematic alcohol use among bisexual women, but not lesbian women and this association is mediated by experiences of discrimination (Feinstein et al., 2017). Thus, it is important to look to other public policies at the macro and meso levels as additional levers for reducing population-level binge drinking.

### *Strengths and limitations*

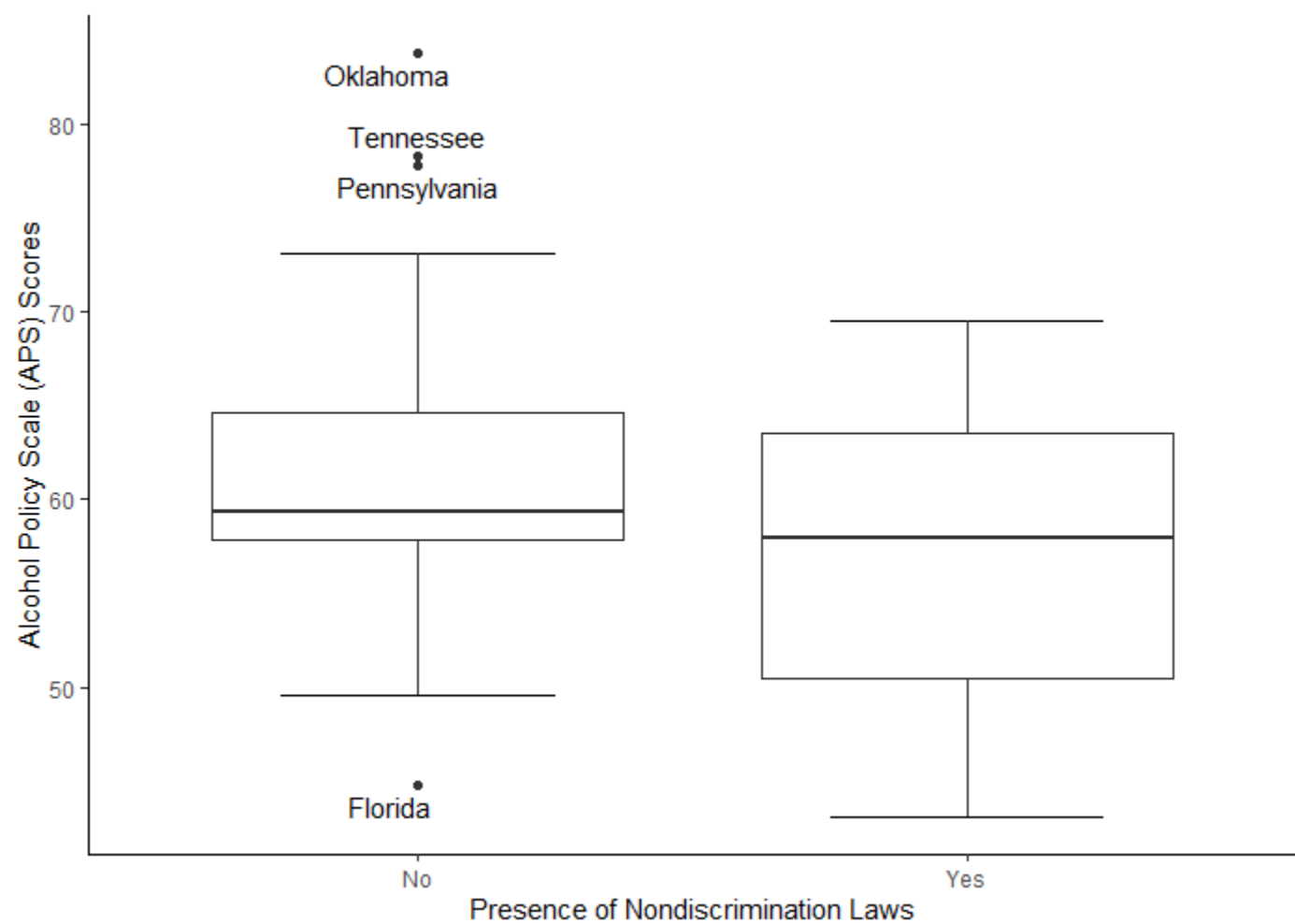
Our study has several strengths and limitations to consider. First, the study was guided by a structural stigma theoretical framework to place binge drinking in a larger population-level context rather than an individual context. Second, the measure used to capture the alcohol policy environment accounts for all the alcohol laws enacted at the state level as well as the degree of implementation of these laws. Moreover, lagging the alcohol policy scale score reduces the possibility of reverse causation in which stricter policies are enacted in states with lower binge drinking prevalence because they face fewer political challenges. Finally, our models adjust for several individual and state-level factors to rule out alternative explanations for the association between the alcohol policy environment, nondiscrimination statutes, and binge drinking disparities.

However, the findings must be carefully considered in the context of the following limitations. The Sexual Orientation and Gender Identity module was used only in 35 of the 50 US states during the period and some states used the module in more years than others. However, while our results are not representative of the US population, they are representative of the target populations of the included states. Moreover, we stratify our analysis on sex at birth which limits the generalizability of these findings to transgender and gender diverse populations whose sex at birth may not align with their gender identity. In some cases, individuals may be misclassified as binge drinkers or non-binge drinkers given that sex is included in the definition of binge drinking. Finally, government surveys provide conservative estimates of binge drinking prevalence which may bias our results towards the null (D. E. Nelson et al., 2010).

## **Conclusions**

The presence of inclusive nondiscrimination laws strengthens the association between stricter alcohol policy environments and individual level-binge drinking among US women, likely because these laws reduce structural stigma against this group. Future studies should continue to interrogate which laws might be helpful for reducing binge drinking among men. These findings not only provide clues to a structural source of binge drinking disparities, but also possible avenues for advocacy in reducing these disparities and improving the overall health and well-being of LGB women in the United States. Examining public policy may reveal important information about the roots of binge drinking disparities among lesbian, gay, and bisexual (LGB) populations and aid in developing interventions.

Figure 5.1: Distribution of alcohol policy scores among states with and without inclusive nondiscrimination statutes, 2014-2017



**Table 5.1: Summary statistics for alcohol policy scores among states with and without inclusive nondiscrimination protections, 2014-2017**

	<b>N</b>	<b>Mean (SD)</b>	<b>Min</b>	<b>Q25</b>	<b>Median</b>	<b>Q75</b>	<b>Max</b>
States with inclusive statutes <sup>1</sup>	16	56.7 (8.18)	43.1	50.5	58.0	63.5	69.5
States without inclusive statutes <sup>2</sup>	19	61.8 (10.3)	44.8	57.8	59.3	64.7	83.8

<sup>1</sup>California, Colorado, Connecticut, Delaware, Hawaii, Illinois, Iowa, Maryland, Massachusetts, Minnesota, Nevada, New York, Rhode Island, Vermont, Washington, Wisconsin

<sup>2</sup>Florida, Georgia, Idaho, Indiana, Kansas, Kentucky, Louisiana, Mississippi, Missouri, Montana, North Carolina, Ohio, Oklahoma, Pennsylvania, South Carolina, Tennessee, Texas, Virginia, West Virginia

**Table 5.2: Association between alcohol policy score and binge drinking among women stratified by presence of inclusive nondiscrimination statutes, 2015-2018**

	States without inclusive statutes (n=19)			States with inclusive statutes (n=16)		
	OR	95% CI	p-value	OR	95% CI	p-value
APS (10 units)	0.98	[0.93 – 1.03]	0.4781	<b>0.93</b>	<b>[0.89 – 0.97]</b>	<b>0.0003</b>
Lesbian	<b>1.71</b>	<b>[1.27 – 2.31]</b>	<b>0.0004</b>	1.19	[0.92 – 1.54]	0.1777
Bisexual	<b>1.84</b>	<b>[1.55 – 2.18]</b>	<b>&lt;.0001</b>	<b>1.34</b>	<b>[1.13 – 1.60]</b>	<b>0.0008</b>
Heterosexual	Ref	Ref	Ref	Ref	Ref	Ref

Adjusted for: age, race, education, income, marital status, population 21+, population male, population white, percent LGB, Catholic rate, region

**Table 5.3: Association between alcohol policy score and binge drinking stratified by presence of nondiscrimination law and sexual identity among men, 2015-2018**

<b>States with inclusive statutes<sup>a</sup></b>									
	<b>Heterosexual</b>			<b>Gay</b>			<b>Bisexual</b>		
	OR <sup>b</sup>	95% CI	p	OR <sup>b</sup>	95% CI	p	OR <sup>b</sup>	95% CI	p
APS score (10 units)	1.00	[0.97 – 1.05]	0.72	0.92	[0.71 – 1.12]	0.54	0.95	[0.68 – 1.32]	0.74
<b>States without inclusive statutes<sup>a</sup></b>									
	<b>Heterosexual</b>			<b>Gay</b>			<b>Bisexual</b>		
	OR <sup>b</sup>	95% CI	p	OR <sup>b</sup>	95% CI	p	OR <sup>b</sup>	95% CI	p
APS score (10 units)	0.99	[0.95 – 1.03]	0.56	0.85	[0.64 – 1.12]	0.25	1.08	[0.76 – 1.53]	0.69

<sup>a</sup> Model adjusted for individual variables (age, race-ethnicity, education level, income level, relationship status) and state-level factors (population age 21+ years; population adult male; population Non-Hispanic white; population lesbian, gay, bisexual; law enforcement officers per capita; median household income; population living in urban areas; Catholics per 1,000 pop; census region)

<sup>b</sup> Odds ratio

**Table 5.4: Supplementary Table A - Demographic characteristics among women stratified by states with vs without inclusive nondiscrimination statutes, BRFSS 2015-2018**

	States with inclusive statutes			States without inclusive statutes		
	Unweighted Sample	Weighted %	95% CI	Unweighted sample	Weighted %	95% CI
Heterosexual	223,582	95.4	95.2 – 95.6	198,155	95.8	95.6 – 95.9
Lesbian or gay	3,163	1.5	1.4 – 1.6	1,916	1.3	1.2 – 1.5
Bisexual	5,541	3.1	2.9 – 3.3	3,564	2.9	2.7 – 3.1
Age 18 to 24	13,300	11.8	11.5 – 12.2	11,232	11.8	11.5 – 12.2
Age 25 to 34	26,448	17.2	16.8 – 17.6	22,652	16.4	16.1 – 16.7
Age 35 to 44	31,172	16.2	15.8 – 16.6	26,556	15.9	15.6 – 16.2
Age 45 to 54	43,872	16.8	16.5 – 17.2	36,568	16.5	16.2 – 16.8
Age 55 to 64	59,023	16.7	16.4 – 17.0	52,001	16.8	16.5 – 17.1
Age 65 or older	96,382	21.2	20.9 – 21.6	95,838	22.6	22.3 – 22.9
White, Non-Hispanic	203,866	58.5	57.9 – 58.9	184,896	65.7	65.3 – 66.1
Black, Non-Hispanic	17,248	9.5	9.2 – 9.7	29,969	15.9	15.5 – 16.2
Hispanic	21,517	19.6	19.2 – 20.1	15,933	13.6	13.2 – 13.9
Other race, Non-Hispanic	15,576	10.9	10.4 – 11.3	6,489	3.6	3.4 – 3.8
Multiracial, Non-Hispanic	7,348	1.5	1.4 – 1.6	3,675	1.2	1.1 – 1.3
Did not graduate HS	16,458	13.2	12.8 - 13.6	21,558	13.4	13.1 – 13.7
Graduated HS	66,695	23.8	23.4 - 24.2	72,732	28.8	28.4 – 29.2
Some College	75,373	32.0	31.6 - 32.5	69,485	32.4	31.9 – 32.8
College Graduate	110,580	30.9	30.5 - 31.3	80,226	25.4	25.0 – 25.7
Less than \$15K	21,286	12.5	12.1 - 12.9	25,339	12.7	12.4 - 13.0
\$15K to <\$25K	35,589	15.4	15.2 - 15.8	40,500	20.6	20.2 - 21.0
\$25K to <\$35K	23,046	9.8	9.5 - 10.1	23,925	11.6	11.3 - 11.9
\$35K to <\$50K	29,901	12.3	11.9 - 12.7	28,254	13.7	13.4 - 13.9
\$50K or more	110,098	49.9	49.4 - 50.4	79,510	41.4	40.9 - 41.8
Married	130,519	48.8	48.3 - 49.3	116,457	49.3	48.9 - 49.7
Divorced	39,338	10.9	10.6 - 11.2	36,278	11.9	11.7 - 12.1
Widowed	41,797	9.3	9.1 - 9.6	46,593	10.7	10.5 - 10.9
Separated	5,758	2.7	2.6 - 2.9	6,203	3.0	2.9 - 3.2
Never Married	41,445	22.7	22.3 - 23.1	31,793	20.9	20.6 - 21.4
Member of unmarried couple	9,159	5.5	5.2 - 5.7	5,939	4.1	3.9 - 4.3



**Table 5.5: Supplementary Table B – Demographic characteristics among men stratified by states with vs without inclusive nondiscrimination statutes, BRFSS 2015-2018**

	States with inclusive statutes			States without inclusive statutes		
	Unweighted Sample	Weighted %	95% CI	Unweighted Sample	Weighted %	95% CI
Heterosexual	182336	95.8	95.6 – 96.0	145238	96.6	96.4 – 96.8
Lesbian or gay	4626	2.5	2.3 – 2.6	2532	1.8	1.7 – 1.9
Bisexual	3002	1.7	1.6 – 1.8	1926	1.6	1.5 – 1.7
Age 18 to 24	15501	13.1	12.8 – 13.5	12550	13.3	12.9 – 13.7
Age 25 to 34	25738	18.7	18.3 - 19.1	20527	17.7	17.4 – 18.1
Age 35 to 44	27181	16.9	16.6 – 17.4	21621	16.5	16.2 – 16.9
Age 45 to 54	37330	17.2	16.9 – 17.6	29142	16.9	16.5 – 17.2
Age 55 to 64	48883	16.5	16.1 – 16.8	39453	16.5	16.2 – 16.8
Age 65 or older	67759	17.5	17.2 – 17.9	59954	19.0	18.7 – 19.3
White, Non-Hispanic	165284	58.6	58.1 – 59.1	139356	65.7	65.3 – 66.2
Black, Non-Hispanic	11658	8.3	8.1 – 8.6	17974	14.3	13.9 – 14.7
Hispanic	18311	20.6	20.1 – 21.0	12197	14.3	13.9 – 14.7
Other race, Non-Hispanic	15740	10.8	10.4 – 11.2	6622	4.3	4.1 – 4.5
Multiracial, Non-Hispanic	6326	1.6	1.5 – 1.8	3282	1.3	1.2 – 1.4
Did not graduate HS	15176	14.1	13.7 – 14.5	16271	14.7	14.3 – 15.1
Graduated HS	58216	27.0	26.6 – 27.4	54773	31.7	31.3 – 32.1
Some College	55993	29.6	29.2 – 30.1	46514	28.9	28.6 – 29.4
College Graduate	92006	29.3	28.9 – 29.6	65032	24.6	24.3 – 24.9
Less than \$15K	13811	8.8	8.5 – 9.2	13173	8.7	8.4 – 8.9
\$15K to <\$25K	24186	13.1	12.8 – 13.5	24546	16.8	16.4 – 17.1
\$25K to <\$35K	17478	9.3	8.9 – 9.6	16818	10.5	10.2 – 10.8
\$35K to <\$50K	25341	12.3	12.0 – 12.7	23374	14.4	14.1 – 14.8
\$50K or more	110323	56.4	55.9 – 56.9	79459	49.7	49.2 – 50.1
Married	121603	51.4	50.9 - 51.9	103076	52.5	52.1 - 52.9
Divorced	26369	8.8	8.5 - 9.0	23934	10.8	10.6 - 11.1
Widowed	12506	3.1	2.9 - 3.2	12338	3.7	3.5 - 3.8
Separated	4166	2.3	2.1 - 2.4	3906	2.4	2.2 - 2.5
Never Married	47366	28.9	28.4 - 29.4	33327	26.0	25.6 - 26.4
Member of unmarried couple	8658	5.5	5.3 - 5.7	5514	4.5	4.3 - 4.7

**Table 5.6: Supplemental Table C – Logistic regression interaction effects between alcohol policy score, sexual identity, and presence of nondiscrimination laws associated with binge drinking among women, 2015-2018**

<b>Term<sup>a</sup></b>	<b>Model 1<sup>b</sup></b>		<b>Model 2<sup>b</sup></b>		<b>Model 3.1<sup>b</sup></b>		<b>Model 3.2<sup>c</sup></b>	
	<i>B</i>	<i>p</i>	<i>B</i>	<i>p</i>	<i>B</i>	<i>p</i>	<i>B</i>	<i>p</i>
APS score	-0.003	0.68	-0.003	0.63	<b>-0.004</b>	<b>0.0040</b>	<b>-0.004</b>	<b>0.0052</b>
Nondiscrimination law (Yes)	-0.236	0.56	-0.146	0.14	<b>-0.158</b>	<b>0.0084</b>	<b>-0.147</b>	<b>0.0125</b>
APS score x Nondiscrimination law (Yes) interaction	0.001	0.83	-0.000	0.90	-	NA	-	NA
Lesbian vs Heterosexual (Ref)	0.234	0.50	0.211	0.57	<b>0.177</b>	<b>0.0004</b>	<b>0.177</b>	<b>0.0004</b>
Bisexual vs Heterosexual (Ref)	0.085	0.69	0.143	0.50	<b>0.228</b>	<b>&lt;.0001</b>	<b>0.229</b>	<b>&lt;.0001</b>
APS score x Lesbian interaction	-0.001	0.85	-0.001	0.92	-	NA	-	NA
APS score x Bisexual interaction	0.003	0.47	0.001	0.67	-	NA	-	NA
Nondiscrimination law (Yes) x Lesbian interaction	-0.043	0.90	-0.092	0.09	-0.091	0.07	-0.091	0.07
Nondiscrimination law (Yes) x Bisexual interaction	-0.228	0.29	<b>-0.074</b>	<b>0.02</b>	<b>-0.078</b>	<b>0.0098</b>	<b>-0.078</b>	<b>0.0098</b>
APS score x Nondiscrimination law (Yes) x Lesbian interaction	-0.001	0.87	-	NA	-	NA	-	NA
APS score x Nondiscrimination law (Yes) x Bisexual interaction	0.003	0.44	-	NA	-	NA	-	NA

<sup>a</sup>: The joint test for an effect is a test that all the parameters associated with that effect are zero.

<sup>b</sup>: Models adjusted for individual variables (age, race-ethnicity, education level, income level, relationship status) and state-level factors (population age 21+ years; population adult male; population Non-Hispanic white; population lesbian, gay, bisexual; law enforcement officers per capita; median household income; population living in urban areas; Catholics per 1,000 pop; census region)

<sup>c</sup>: Model adjusted for individual variables (age, race-ethnicity, education level, income level, relationship status) and significant state level factors (population age 21+ years; population adult male; population Non-Hispanic white; population lesbian, gay, bisexual; Catholics per 1,000 pop; census region)

**Table 5.7: Supplemental Table D – Logistic regression interaction effects between alcohol policy score, sexual identity, and presence of nondiscrimination laws associated with binge drinking among men, 2015-2018**

<b>Term<sup>a</sup></b>	<b>Model 1<sup>b</sup></b>	
	<i>B</i>	<i>p</i>
APS score	-0.006	0.2775
Nondiscrimination law (Yes)	0.385	0.2744
APS score x Nondiscrimination law (Yes)	-0.007	0.2537
Gay vs Heterosexual (Ref)	0.091	0.6474
Bisexual vs Heterosexual (Ref)	0.238	0.4246
APS score x Gay	-0.002	0.5649
APS score x Bisexual	-0.004	0.4395
Nondiscrimination law (Yes) x Gay	<b>0.518</b>	<b>0.0089</b>
Nondiscrimination law (Yes) x Bisexual	-0.173	0.5598
APS score x Nondiscrimination law (Yes) x Gay	<b>-0.008</b>	<b>0.0119</b>
APS score x Nondiscrimination law (Yes) x Bisexual	0.002	0.6223

<sup>a</sup> The joint test for an effect is a test that all the parameters associated with that effect are zero.

<sup>b</sup> Models adjusted for individual variables (age, race-ethnicity, education level, income level, relationship status) and state-level factors (population age 21+ years; population adult male; population Non-Hispanic white; population lesbian, gay, bisexual; law enforcement officers per capita; median household income; population living in urban areas; Catholics per 1,000 pop; census region)

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## **CHAPTER 6 – CONCLUSION**

## Summary of Findings

The purpose of this research was to examine how state-level alcohol policy environments and state-level nondiscrimination statutes contribute to disparities in binge drinking between sexual minority adults (i.e., lesbian, gay, bisexual) and heterosexual adults in the United States. The research uses a validated measure, the Alcohol Policy Scale (APS) score, to assess the combined strength of individual alcohol policies implemented in a state (i.e., the alcohol policy environment). Moreover, the research combines data from several sources including population-level survey data, census data, and administrative data to account for covariates at both the individual and state level that may confound the associations between the primary outcome, binge drinking, and the independent variables of interest: the alcohol policy environment, state-level nondiscrimination statutes inclusive of sexual orientation, and an individual's sexual identity. This chapter summarizes the findings from the three individual research studies, discusses overall strengths and limitations of this research, considers the policy and practice implications that can be drawn from these findings, and outlines areas for future research using these and other data sources.

The first aim of this dissertation was to examine the association between state-level alcohol policy environments, binge drinking, and sexual identity (Chapter 3). The study hypothesized that the association between the alcohol policy environment and binge drinking would be the same for sexual minority (i.e., lesbian, gay, and bisexual) compared with heterosexual women and men. This hypothesis rests on traditional economic theory in which constructs such as price, supply, and demand are assumed to have similar impacts on subgroups within the population.

Traditional economic theory was applied because many alcohol policies included in the Alcohol Policy Scale score, such as alcohol taxes, are associated with lower binge drinking prevalence by reducing the availability, accessibility, and affordability of alcohol products. Moreover, alcohol policies included in the Alcohol Policy Scale score that increase the civil and criminal punishments associated with when and by whom alcohol cannot be used (e.g., drinking and driving) would be assumed to be equally distributed among a population regardless of sexual identity.

The findings from this study support the hypothesis that the association between the alcohol policy environment and binge drinking does not significantly differ for sexual minority and heterosexual adults, particularly among women. However, while the alcohol policy environment does not exacerbate differences in binge drinking by sexual identity, it also does not reduce these disparities either. Lesbian and bisexual women were still significantly more likely to binge drink compared with heterosexual women even after accounting for the strictness of the alcohol policy environment. There was a similar finding comparing bisexual and heterosexual men.

The second aim of this research was to examine the association between state-level nondiscrimination statutes that include sexual orientation and binge drinking disparities between sexual minority and heterosexual women and men (Chapter 4). The study hypothesized that binge drinking disparities between sexual minority and heterosexual populations would be narrower in states with nondiscrimination statutes that include protections on the basis of sexual orientation. This hypothesis was grounded in the theory of structural stigma. A major construct in structural stigma is structural discrimination – that is when powerful groups embed discriminatory views into institutions through laws, policies, and social norms. This study takes a resiliency view rather than a deficit view by asking whether the presence of inclusive nondiscrimination statutes (as opposed to the absence of these statutes) is associated with 1) lower binge drinking among sexual minority populations and 2) narrower binge drinking disparities between sexual minority and heterosexual populations.

The findings from this study support the hypothesis among women, but not men. Among women, the disparity in binge drinking between sexual minority women and heterosexual women was narrower in states with inclusive nondiscrimination statutes compared with states without inclusive nondiscrimination statutes. In fact, the disparity between lesbian women and heterosexual women disappears in states with inclusive nondiscrimination statutes which suggests how powerful state-level nondiscrimination laws can be as public health tools.

The study did not find support for the hypothesis among men. This finding underscores the “gender paradox” that pervades research on alcohol consumption. The gender paradox is a consistent finding in the research on alcohol consumption showing that heterosexual women drink far less than heterosexual men while sexual minority women drink at the same or higher levels than sexual minority men. One hypothesis for this difference in alcohol use across sex and

sexual orientation is the role of gender norms in alcohol use. Hughes et al. suggest that sexual minority women eschew traditional feminine norms by engaging in drinking patterns more typical of men including drinking more often and consuming more drinks per episode. Another hypothesis is that heterosexual and sexual minority women make different choices regarding the creation of families. Alcohol use changes over the life course. Individuals tend to drink heavily during emerging adulthood (18-25 years) with drinking tapering off in middle adulthood due to increased responsibilities, such as caring for children.<sup>1</sup> Given that sexual minority women are more likely than heterosexual women be nulliparous,<sup>2</sup> these external changes to drinking patterns may not occur for sexual minority women as they do for heterosexual women. Moreover, it has been suggested that alcohol may not be the drug of choice among gay, bisexual, and other sexual minority men.<sup>3</sup>

Finally, the third aim of this research was to examine both the alcohol policy environment and state-level inclusive nondiscrimination statutes and their combined contribution to binge drinking disparities by sexual identity in the United States. This study hypothesized that inclusive nondiscrimination statutes strengthen the negative association between state-level alcohol policy environments and binge drinking among sexual minority adults and reduce binge drinking disparities between sexual minority and heterosexual adults. This hypothesis is grounded in both traditional economic theory, as proposed in the first aim, and structural stigma, as proposed in the second aim. Overall, the study proposes that state-level policies that get at both the economic and social roots of binge drinking and binge drinking disparities will be most useful in reducing both outcomes.

The findings of this study support the hypothesis, but only among women. In states with inclusive nondiscrimination statutes there is a significant negative association between the alcohol policy environment and binge drinking among women. In states without inclusive nondiscrimination statutes, there is not a significant association between the alcohol policy environment and binge drinking among women. Moreover, the disparity between sexual minority women and heterosexual women is narrower in states with versus without inclusive nondiscrimination statutes. As with second aim, this study did not find support for the hypothesis among men. This may be due to lack of variability in binge drinking between gay, bisexual, and heterosexual men as well as the “gender paradox” as described above.

Overall, this research has attempted to bring together two disparate literatures. The first examines the impact of alcohol policy on alcohol consumption among the overall population, and recently started to examine potential differences among subgroups.<sup>4</sup> The second examines the disparities in alcohol consumption and related harms among lesbian, gay, bisexual, and other sexual minority populations. The first literature often takes an economic view on how policy can lead to behavior change while the second literature is grounded in social theories that conceptualize disparities as rooted in the fundamental differences in the way sexual minority populations are treated in society from the individual through the interpersonal, community, and policy levels of the social-ecological framework. By taking these two literatures together, this research attempts to bring a health equity perspective to the alcohol policy field as well as bring possible policy level interventions to the LGBT health field.

## **Strengths and Limitations**

Based on a thorough review of both the alcohol policy literature and the literature on alcohol consumption and disparities among lesbian, gay, and bisexual populations, the studies in this dissertation appear to be the first to examine the intersecting associations between state-level alcohol policy environments, nondiscrimination laws, and binge drinking disparities by sexual identity. As a result, there are several major strengths and some limitations that should be considered when contextualizing the findings from this dissertation.

The first major strength of this research is the use of a validated measure of the alcohol policy environment, the Alcohol Policy Scale score, as provided by researchers at Boston University. While strong evidence exists that individual alcohol policies are strongly associated with reduced binge drinking and alcohol-related harms, examining individual policies in isolation potentially misses the synergistic effects embedded within a policy environment. The driving force for developing the Alcohol Policy Scale score lies in attempting to measure and account for synergy between many different individual alcohol policies all contributing to binge drinking prevalence, overall alcohol consumption, and alcohol-related harms.

A second major strength of this work is the use of data from a large population survey. The Behavioral Risk Factor Surveillance System (BRFSS) is one of the largest and longest continuously running datasets produced by the Centers for Disease Control and Prevention (CDC). In 2011, the BRFSS sampling methodology was augmented to include both landline and

cellphone numbers to ensure that individuals sampled were representative of the adult (18+ years) non-institutionalized civilian population. The BRFSS not only produces prevalence estimates of health behaviors at the national level, but also at the state level, and in some cases county and municipal levels as well. Moreover, the inclusion of the Sexual Orientation and Gender Identity module means that the BRFSS contains one of the largest samples of sexual and gender minority adults of any population-based survey on health behaviors. Other datasets were considered for this analysis, yet the BRFSS was chosen for these reasons (see Appendix A).

A third strength of this research is the inclusion and importance of social theory to guide the research question, the choice of variables, and the interpretation of findings. The understanding of binge drinking disparities was grounded in the structural stigma theoretical framework which places binge drinking and binge drinking disparities into a larger population-level context rather than an individual context. While most literature examining LGB health disparities focuses on interpersonal and intrapersonal experiences of discrimination, prejudice, and homophobia, this dissertation sought to bring a structural-level perspective. An individual need not personally have negative experiences related to being a sexual minority in order to experience the stigma associated with being a sexual minority. Stigma can be enacted through law and policies that not only functionally treat sexual minority individuals differently, but also symbolically make it clear that sexual minority individuals and communities are not equal to heterosexuals.

There are also important limitations to consider in this research. The first major limitation is that the cross-sectional nature of the data limits the ability to make causal inferences about the associations between alcohol policy environments, nondiscrimination laws, sexual identity, and binge drinking. While the studies included in this dissertation found strong associations, they cannot speak to causality between the variables studied. Moreover, these studies can provide only moderate evidence that policies, such as nondiscrimination laws, may narrow binge drinking disparities between sexual minority and heterosexual populations. However, the studies do account for several individual and state-level covariates which reduces the possibility for alternate explanations for the associations found.

A second major limitation concerns the use of the Behavioral Risk Factor Surveillance System. Although the BRFSS has one of the largest samples of sexual and gender minorities by US state among publicly available population-based surveys, the Sexual Orientation and Gender

identity module used to collect these data is optional for states. Therefore, between 2015-2018, not all states included this module and thus not all states collected these data. To determine how and to what degree this might create selection bias in this study, an exploratory analysis was conducted examining differences between states that did and did not use the Sexual Orientation and Gender Identity (SOGI) module. Generally, the distribution of alcohol policy scores by use/non-use of the SOGI module reveals that there is not a significant difference in the strength of the alcohol policy environment by whether a state used the module or not. Additional results of this analysis can be found in Appendix B.

A third limitation is the underestimation of binge drinking in population surveys. Binge drinking prevalence estimated by the BRFSS accounts for 22-30% of alcohol sales.<sup>5</sup> Underestimation of binge drinking may bias the associations in this analysis towards the null.

Finally, the Alcohol Policy Scale score accounts for policies enacted at the state-level, but not those enacted at the county or city level. Therefore, these analyses cannot account for potential within state differences in the strength of the alcohol policy environment. However, few counties and cities enact additional alcohol policies, partially due to pre-emption by the state.

## **Policy and Practice Implications**

### *Implications for data collection in the Behavioral Risk Factor Surveillance System*

In 2011, the Institute of Medicine released a groundbreaking report calling for increased examination on the health of lesbian, gay, bisexual, and transgender populations in the United States.<sup>6</sup> A major call to action was the inclusion of sexual orientation and gender identity (SOGI) measures on national surveys. By 2016, several large population-based surveys in the United States added SOGI measures including the Behavioral Risk Factor Surveillance System, the Youth Risk Behavior Surveillance System, the National Health and Nutrition Examination Survey, the National Survey on Drug Use and Health, the National Health Interview Survey.

Despite this trend, there are still major issues with the collection of SOGI data in population-based surveys. As discussed above, a major limitation with using the Behavioral Risk Factor Surveillance System to examine the health of lesbian, gay, and bisexual populations is the fact that the SOGI module used to collect this information is optional for states. While our exploratory analyses found only minor differences between states that did and did not use the

module in reference to the proposed research question, the fact remains that these and other analyses are limited in making inferences about health outcomes among lesbian, gay, and bisexual adults at the national level or making comparison between all 50 states using BRFSS data.

While other national surveys do include SOGI measures, important questions about health behaviors including tobacco and alcohol use as well as use of healthcare services are only asked on the BRFSS. Moreover, BRFSS provides both state-level and national level prevalence estimates for these health behaviors which would allow researchers to examine differences in health outcomes and behaviors within and between states and across time. Inclusion of SOGI measures in the BRFSS for all states is imperative to collect the necessary data to surveil health disparities across sexual orientation and gender identity and look for possible public health solutions.

#### *Implications for alcohol policy research and health equity*

This dissertation found that 1) alcohol policy environments had the same association with binge drinking for both sexual minority and heterosexual adults and 2) in states with inclusive nondiscrimination laws, alcohol policy environments have a stronger negative association with binge drinking among women regardless of sexual identity compared to states without inclusive nondiscrimination laws. Alcohol policy environments do not exacerbate disparities in binge drinking between sexual minority and heterosexual adults. However, alcohol policy environments do work synergistically with nondiscrimination laws leading to lower binge drinking and narrower disparities among women in US states with both strict alcohol policy environments and inclusive nondiscrimination laws. These findings lead to the question: What responsibility do alcohol policy researchers have in acknowledging these disparities and examining the role of alcohol policies through a health equity lens?

Healthy People 2020 defines health equity as “attainment of the highest level of health for all people. Achieving health equity requires valuing everyone equally with focused and ongoing societal efforts to address avoidable inequalities, historical and contemporary injustices, and the elimination of health and health care disparities.”<sup>7</sup> Inherent in achieving health equity is the elimination of health disparities which are “systematic, plausibly avoidable health differences.”<sup>8</sup> based on any number of social categorizations including, but not limited to, race-



ethnicity, gender, sexual orientation, gender identity, ability, or geography. Public policies can play a critical role in eliminating health disparities to achieve health equity.<sup>9</sup>

A major implication of this research is that alcohol policy researchers must take a health equity perspective going forward. We cannot assume that policies that we think are universal in nature will have the same impact on alcohol outcomes among all population subgroups. Moreover, it is unethical for us to ignore the disparities in the prevalence and incidence of alcohol-related outcomes and harms among marginalized groups, including lesbian, gay, bisexual, and other sexual minorities.

#### *Implications for public policy and Bostock v Clayton County case*

The findings of the research moderately support the conclusion that public policies, such as nondiscrimination laws that include sexual orientation, are important and effective tools for reducing binge drinking disparities, and achieving health equity for lesbian, gay, bisexual, and other sexual minority populations. At the time these data were collected (time frame 2015-2018), 19 states had laws that did not include sexual orientation as a protected ground in employment, housing, and public accommodations compared with 16 states that did. However, in June 2020 the US Supreme Court released a landmark opinion, *Bostock v Clayton County, Georgia*, which held that employment discrimination (e.g., firing, hiring decision) against gay or transgender individuals constitutes “sex discrimination” under Title VII of the Civil Rights Act and thus “an employer who fires an individual merely for being gay or transgender defies the law.”<sup>10</sup> Although the data in this dissertation were collected before this decision, the findings still have implications for the new policy environment created by this decision given that Title VII will now be interpreted as a statute inclusive of sexual orientation and gender identity.

According to the Supreme Court’s decision, gay and transgender individuals in all states working for employers with 15 or more employees are protected under Title VII and are thus able to seek legal recourse in the case that they are discriminated against in employment on the basis of their sexual orientation or gender identity. Not only does the decision provide legal recourse, but it also sends a clear message that lesbian, gay, bisexual, and transgender people are protected under federal civil rights law— a change that might influence social norms and attitudes towards LGBT people. In this way, the landmark case may have significant impacts on substance use and other health behaviors among LGBT people that are warranted for future study.

The current dissertation may help to hypothesize the direction of these associations. This research considers state statutes that protect an individual from discrimination in employment as well as housing and public accommodations. While the dissertation was unable to disentangle the impacts of nondiscrimination laws in employment, housing, and public accommodations (as these laws are often passed together) and their independent associations with binge drinking, the structural stigma theory on which this dissertation is based would suggest that protections in all these fundamental areas is necessary to reduce health disparities and reach health equity for sexual minority populations. *Bostock v Clayton County* may expand protections in other areas as the analysis of “sex discrimination” in this case could apply to other state and federal statutes that have protections on the basis of sex.

However, while this mandate from the Supreme Court ensures that LGBT people will be protected from employment discrimination in all 50 states (if they work for employers with 15 or more employees), more work is necessary at both the state and federal level to ensure that individuals cannot be treated unfairly because of their sexual orientation or gender identity. Passage of the Equality Act (H.R. 5, S. 788), a bill that would protect LGBT people from discrimination in housing, employment, education, credit, public spaces, and in federally-funded programs, would be the strongest measure, besides a Constitutional amendment, for ensuring equal rights for LGBT people in the United States, a necessary prerequisite for health equity.

## **Areas for Future Research**

The focus of this research was to examine the associations between alcohol policy environments, state-level nondiscrimination laws, sexual identity, and binge drinking disparities. In many ways, the research question for this dissertation was wide in scope as no other studies had approached this particular subject matter before with this particular perspective. However, because the research was broad, it was unable to go into depth. Therefore, there are four major areas where this research could go next either with the current datasets used in this research or with other publicly available data.

*Examining additional alcohol policies and public policies on binge drinking among LGB populations*

This research fills a particular gap in the literature on the role of alcohol policy environments and nondiscrimination laws on binge drinking disparities between lesbian, gay, bisexual and heterosexual adults in the United States. However, it is only a beginning. Prior research shows that individual alcohol policies, such as alcohol taxes, may also have differential effects on alcohol consumption among population subgroups.<sup>4</sup> Moreover, alcohol policies that impact the price and physical availability of alcohol have stronger associations with lowering binge drinking among the general population than other policies (e.g., sobriety check points, dram shop liability).<sup>11</sup> While this dissertation did not find evidence that alcohol policy environments had different associations with binge drinking when comparing sexual minority and heterosexual populations, it is possible that individual alcohol policies (e.g., alcohol taxes) or alcohol policy groups may have differential associations with binge drinking and binge drinking disparities among lesbian, gay, and bisexual populations. Therefore, future research may consider examining these individual policies and alcohol policy subgroups and their association with binge drinking disparities between sexual minority and heterosexual adults in the United States.

This dissertation takes a resiliency perspective by examining whether the presence of inclusive nondiscrimination laws is associated with lower binge drinking among sexual minority groups and narrower binge drinking disparities between sexual minority and heterosexual populations. By treating this variable as binary, the research combines states that do not have inclusive nondiscrimination protections with states that actively have discriminatory legislation in the form of religious freedom laws. The binary nature of this variable as well as examining these associations at the state level oversimplifies a complex policy environment. First, the absence of inclusive nondiscrimination protections may not confer the same risk to health and well-being for LGB populations as the presence of discriminatory laws. Second, lack of protections at the state level does not necessarily mean lack of protections in general. Municipalities may pass ordinances that protect individuals from discrimination on the basis of sexual orientation and gender identity. Examination of these within-state differences may shed additional light on the power of public policy to shape substance use behaviors among lesbian, gay, and bisexual populations.

*Examining the role of alcohol policy environments and public policy on alcohol consumption among gender minority and transgender populations*

This research specifically focused on binge drinking disparities at the intersection of sex and sexual identity. The decision to not specifically include gender minority or transgender populations in this research was deliberate because sexual orientation (i.e., sexual identity, sexual behavior, and sexual attraction) is separate from the constructs of biological sex, gender, gender identity, and gender expression. However, there is an urgent need for alcohol research among gender minority and transgender populations.<sup>12</sup> Like lesbian, gay, and bisexual populations, gender minority and transgender populations face minority stress and structural stigma.<sup>13</sup> Results from the U.S. Transgender Survey, the largest survey of transgender adults in the United States to date, found that experiences of transphobia and transphobic discrimination was associated with several forms of alcohol misuse including binge drinking and frequent binge drinking.<sup>14</sup> Future research is needed not only to fully elucidate disparities in excessive alcohol use between transgender and cisgender populations, but also to determine whether and which public policies have the potential to reduce excessive use of alcohol, alcohol-related harms, and alcohol-related disparities between these groups.

*Incorporating intersectional and life course perspectives into future research*

The current research does not incorporate an intersectional perspective. Sexual minority populations, in particular, may be comprised of individuals who are multiply stigmatized and whose alcohol use may be related to this multiple stigmatization. For example, a recent study conducted by this author found that Black and Hispanic sexual minority women had a significantly higher prevalence of binge drinking and heavy alcohol use in comparison to White heterosexual women.<sup>15</sup> The disparity between sexual minority women of color and White heterosexual women was larger than what would be expected if only race-ethnicity or sexual identity were examined in isolation. In other words, this disparity between those that were doubly marginalized (i.e., sexual minority women of color) and those that were not (i.e., White heterosexual women) was driven by synergy between race-ethnicity and sexual minority identity and might be missed when researchers do not account for these intersections. Therefore, other areas of future research would be to examine how alcohol policy environments and public

policies are associated with excessive alcohol use and alcohol-related harms among multiply marginalized populations.

Furthermore, the current study examined differences in binge drinking across sexual orientation and posits that individual characteristics including age, gender, and race-ethnicity function as confounding variables in the proposed models. While this research is most concerned with binge drinking disparities by sexual orientation, alcohol consumption is highly influenced by other individual characteristics, particularly age, as alcohol consumption changes over the life course.

In particular, problematic alcohol use arises during emerging adulthood (ages 18-25) as individuals leave their home of origin and begin independent lives.<sup>1</sup> During this time, alcohol use factors heavily in social situations. As individuals transition to middle adulthood, they may get married and/or have children. These life events contribute to changes in social interactions and increased responsibilities that may reduce alcohol use.<sup>1</sup> The current study combines individuals at different developmental stages which may cloud the associations between the alcohol policy environment, nondiscrimination laws, and binge drinking. Prior research shows that stricter alcohol policy environments have similar effects on alcohol consumption among youth and adults. However, it remains unclear how sexual identity factors into these associations, and specifically how age and cohort effects around disclosing sexual minority identity may factor into these associations.

#### *Examining the impact of COVID-19 on alcohol consumption and the places that people drink*

Although the data used in this dissertation were collected before the COVID-19 pandemic, it will be critical for future research to examine the short-term and long-term consequences of SARS-COV2 itself and the mitigation strategies used to disrupt the spread of the virus on alcohol consumption and alcohol-related harms. Some alcohol policy researchers are already looking to the outcomes of past pandemics to predict the potential consequences of COVID-19 on alcohol use.<sup>16</sup> They argue that alcohol consumption may decrease as a result of stay at home orders that encourage individuals to only leave home for essential trips. However, the authors are also clear that the effects of the pandemic may be different for subpopulations.

There are also good reasons to believe that alcohol use may be increasing in many populations. A commentary published in *The Lancet Public Health* argues that increased stress

caused by the fears surrounding the virus itself as well as the massive changes to daily life may increase alcohol consumption because of reduced emotional regulation, particularly at a time when individuals are isolated.<sup>17</sup> Lesbian, gay, and bisexual individuals may experience unique consequences related to drinking during and after the pandemic because of already present general stressors and minority stressors as well as an already higher prevalence of alcohol consumption. Future research on binge drinking disparities across sexual orientation will have to account for this period effect.

While many US states have strong alcohol policies in place to regulate the sale and distribution of alcohol products, these measures are being relaxed during the pandemic. A recent webinar held by the National Alcohol Beverage Control Association titled “Alcohol Home Deliveries and Enforcement Challenges” points to challenges in the enforcement of current alcohol policies, particularly the breakdown of the 3-tier system and the difficulties upholding age restrictions with alcohol home delivery.<sup>18</sup> The 3-tier system prohibits companies from creating vertical monopolies in which they make, distribute, and sell alcohol to the consumer.<sup>19</sup> This system provides “checks and balances” that ensure that states can collect taxes on alcohol products and control what can be sold and to whom. Many US state governments have listed off-premises alcohol outlets as “essential businesses” during the stay-at-home orders. Future research will have to account for these period effects. On the one hand, sexual minority women, specifically, tend to drink in their or friend’s homes.<sup>20</sup> As such, the restrictions on movement during the pandemic may lead to increased alcohol use among individuals already using alcohol excessively in their own homes. On the other hand, frequenting lesbian and gay bars is also associated with increased alcohol use, particularly during the “coming out phase”.<sup>21</sup> With many of these spaces closed or operating as “off-premise” outlets, alcohol consumption among LGB populations may decrease during this period. Nonetheless, the impact of COVID-19 on the health and well-being, as well as specifically on alcohol consumption, of the overall population and marginalized population subgroups will be important areas for study for many years to come.

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## **CHAPTER 7 – APPENDICES**

## **Appendix A: Exploration of Possible Data Sources**

### *Behavioral Risk Factor Surveillance System (BRFSS)*

The Behavioral Risk Factor Surveillance System (BRFSS) is a repeated cross-sectional survey overseen by the Centers for Disease Control and Prevention. Each US state, the District of Columbia, and US territories (Puerto Rico, Guam, Virgin Islands) are tasked with collecting interviews. The BRFSS uses multistage sampling and random digit dialing to produce a nationally and sub-nationally representative sample of US adults 18+ years.

The BRFSS includes up to four sections of questions: 1) Standard Core; 2) Rotating Core; 3) CDC-approved optional modules; 4) State-added modules. The Standard Core includes questions that are asked of every participant in every jurisdiction every year. The Alcohol Consumption module which includes questions used to calculate binge drinking, binge frequency, and heavy drinking are included in this module. The Rotating Core includes questions that are asked in every jurisdiction every other year. The proposed research does not intend to utilize questions in the Rotating Core. The Sexual and Gender Identity module is a CDC-approved module. CDC-approved modules have been validated and cognitively tested. Finally, jurisdictions can add questions to their survey; however, these questions are not included in the public BRFSS data available at the CDC website and the questions are not tracked by CDC.

The major limitation in using BRFSS data for this research is that the Sexual and Gender Identity module is not used by all states. The module identifies individuals who are lesbian, gay, bisexual and/or transgender. Although the BRFSS includes all 50 states and the District of Columbia, the research question necessitates having to distinguish which individuals identify as sexual minorities (lesbian, gay, or bisexual). Therefore, not all states will be included in the analysis. Section III in this report provides an in-depth analyses on potential selection bias within the BRFSS comparing states that used the module to those that did not.

However, in comparison to other possible data sources, the BRFSS has the largest samples size. Additionally, unlike other potential data sources, BRFSS data is publicly available without fees and can be easily downloaded from the CDC website without a waiting period.

Source: BRFSS Data User Guide.; 2013.

[https://www.cdc.gov/brfss/data\\_documentation/index.htm](https://www.cdc.gov/brfss/data_documentation/index.htm).

**Table 7.1: Unweighted counts of participants by state and sexual identity, BRFSS 2014-2017**

	2014		2015		2016		2017	
State	LGB	Straight	LGB	Straight	LGB	Straight	LGB	Straight
All States	3783	143057	4507	157199	6441	191104	6697	189090
California <sup>1,2,3,4</sup>	0	0	0	0	429	9540	338	7593
Colorado <sup>1,2,3,4</sup>	0	0	318	10554	0	0	0	0
Connecticut <sup>1,2,3,4</sup>	0	0	314	9422	286	9425	287	8514
Delaware <sup>1,3,4</sup>	128	3803	142	3350	133	3358	138	3299
Florida	0	0	0	0	0	0	538	16921
Georgia	0	0	86	3551	129	4010	147	4236
Hawaii <sup>1,3,4</sup>	228	6090	200	5798	265	6795	281	7206
Idaho	97	4752	84	4860	91	4465	0	0
Illinois <sup>1,2,3,4</sup>	0	0	127	4291	132	3791	157	4260
Indiana	267	9892	111	4943	248	9260	363	11404
Iowa <sup>1,2,3,4</sup>	128	6969	0	0	130	6040	180	6141
Kansas	235	11779	435	18653	0	0	0	0
Kentucky	161	8885	0	0	264	9057	0	0
Louisiana	140	6081	0	0	112	4366	133	3760
Maryland <sup>1,3,4</sup>	305	11132	239	10339	0	0	0	0
Massachusetts <sup>1,2,3,4</sup>	0	0	354	7027	389	6331	280	5393
Minnesota <sup>1,2,3,4</sup>	398	14190	424	14156	449	14197	446	13779
Mississippi	0	0	0	0	57	4601	68	4101
Missouri	0	0	153	5986	146	6125	0	0
Montana	121	6730	0	0	0	0	116	5249
Nebraska	0	0	0	0	0	0	0	0
Nevada <sup>1,2,3,4</sup>	105	3178	90	2321	146	3597	140	2968
New York <sup>1,2,3,4</sup>	211	5335	367	9336	1103	27621	483	8918
North Carolina	0	0	0	0	0	0	99	3722
Ohio	250	9625	226	9889	266	10558	296	10085
Oklahoma	0	0	0	0	0	0	130	5477
Pennsylvania	266	9439	134	4546	170	5482	190	5111
Rhode Island <sup>1,3,4</sup>	0	0	0	0	186	4597	212	4528
South Carolina	0	0	0	0	0	0	205	9388
Texas	0	0	261	10684	257	8696	323	8842
Vermont <sup>1,2,3,4</sup>	256	5590	0	0	227	5656	264	5323
Virginia	235	8155	188	7277	209	7297	277	7754
Washington <sup>1,2,3,4</sup>	0	0	0	0	496	11988	469	10681
West Virginia	0	0	100	5386	0	0	0	0
Wisconsin <sup>1,2,3,4</sup>	157	5894	154	4830	121	4251	137	4437
Wyoming	95	5538	0	0	0	0	0	0
1: State had non-discrimination employment statute in 2017								
2: State had non-discrimination education statute in 2017								
3: State had non-discrimination housing statute in 2017								
4: State had non-discrimination public accommodations statute in 2017								

### *National Alcohol Survey (NAS)*

The National Alcohol Survey (NAS) is a repeated cross-sectional survey conducted by the Alcohol Research Group (ARG) every 5 years. The most recent data was collected in 2014-2015. NAS uses random-digit dialing to produce a representative sample of US adults 18+ years. The 2014-2015 NAS sample includes 7,071 participants. NAS collects information on drinking and drug use patterns, harms from drinking both to those that consume alcohol and those that do not, and information on emotional health and stressful life events.

As of September 27, 2019, it is unclear whether the NAS 2014-2015 includes questions about sexual orientation (identity, behavior, or attraction). The researcher was unable to locate these questions in the 2014-2015 questionnaire. The researcher was able to find questions related to sexual orientation in the NAS 2009-2010 questionnaire. The lack of questions related to sexual orientation in the most recent NAS data renders this data set unsuitable to answer the research question.

Moreover, it is unclear whether NAS data can provide state-level estimates of patterns of excessive alcohol as the sampling is designed to provide national level estimates.

Source: National Alcohol Survey. <http://arg.org/center/national-alcohol-surveys/> [Accessed: September 27, 2019]

Source: 2014-2015 National Alcohol Survey Questionnaire. Available at: [http://arg.org/wp-content/uploads/2016/10/N13\\_Questionnaire\\_FINAL-from-ICF\\_not-searchable-Rev.pdf](http://arg.org/wp-content/uploads/2016/10/N13_Questionnaire_FINAL-from-ICF_not-searchable-Rev.pdf) [Accessed: September 27, 2019]

Source: 2009-2019 National Alcohol Survey Landline Questionnaire. Available at: <http://arg.org/wp-content/uploads/2015/02/N12-FINAL-Landline-Questionnaire.pdf> [Accessed: September 27, 2019]

### *National Epidemiologic Survey on Alcohol-Related Conditions-III (NESARC-III)*

The National Epidemiologic Survey on Alcohol-Related Conditions-III (NESARC-III) is a cross-sectional survey conducted by the National Institute of Alcohol Abuse and Alcoholism from April 2012 through June 2013. NESARC-III uses multistage probability sampling to produce a nationally representative sample of the non-institutionalized civilian population 18+ years. The final sample size for NESARC-III was 36,309.

NESARC-III includes questions about drinking patterns and measures alcohol use disorder with the AUDIT-5. Unlike other national surveys, NESARC-III includes questions that measure all three dimensions of sexual orientation (identity, behavior, attraction).

Given that the primary sampling units are individual counties, it is unclear whether NESARC-III is suitable for producing state-level estimates that would be necessary to answer the research question.

Source: <https://www.niaaa.nih.gov/research/nesarc-iii> [Accessed: September 27, 2019]

Source: Source and Accuracy Statement. Available at:

<https://www.niaaa.nih.gov/research/nesarc-iii/methodology>. [Accessed: September 27, 2019]

### *National Survey on Drug Use and Health (NSDUH)*

The National Survey on Drug Use and Health (NSDUH) is a repeated cross-sectional survey conducted by the Substance Abuse and Mental Health Services Administration. NSDUH samples individuals from the non-institutionalized civilian population 12+ years. NSDUH employs multistage sampling to select approximately 70,000 individuals each year.

NSDUH includes questions about alcohol, tobacco, and illicit drug use as well as depression, anxiety, and other mental health disorders. Since 2015, NSDUH has included questions about sexual orientation, namely identity and attraction.

NSDUH data that includes geographic location for participants is part of the Restricted Access Data. This data is available in 5 ways [personal communication]:

1. The Restricted-use Data Analysis System (RDAS) <https://rdas.samhsa.gov/#/> is a user-friendly application for online analyses to create and output crosstabs and perform logistic regression from your web browser on 2+-year datasets. RDAS allows users to analyze restricted data, which includes certain geographic identifiers like state while

suppressing results that may present disclosure risks. With RDAS, you can see values by state using datasets from 2002 to 2017.

2. Online interactive state estimates: <https://pdas.samhsa.gov/saes/state>. This also has graph capabilities and uses 2+-year datasets.
3. Interactive NSDUH substate estimates <https://pdas.samhsa.gov/saes/substate>
4. Data tables and reports are available here: <https://www.samhsa.gov/data/>
5. Full restricted use data files are available onsite at an NCHS Research Data Center (RDC).

For more information about applying for access to these data, see the links available here: <https://datafiles.samhsa.gov/info/data-portal-nid17200>

Option 5 is the most suitable for conducting the analysis for the proposed research question. However, this option would cost the researcher \$3,000. Moreover, the Committee Chair, Dr. Renee Johnson, has stated that it is possible that access to full restricted use data files can take upwards of 15 months. Although NSDUH would provide data from all 50 states and the District of Columbia, the restricted access data is both cost and time prohibitive for this research.

Source: National Survey on Drug Use and Health. <https://www.samhsa.gov/data/data-we-collect/nsduh-national-survey-drug-use-and-health>. [Accessed: September 27, 2019]

Source: Substance Abuse and Mental Health Services Administration. (2019). 2018 National Survey on Drug Use and Health: Methodological summary and definitions. Rockville, MD: Center for Behavioral Health Statistics and Quality, Substance Abuse and Mental Health Services Administration. Retrieved from <https://www.samhsa.gov/data/>

### *Other Possible Data Sources*

Besides the data sources listed above, there are three other data sources that were briefly reviewed for their suitability for this research: National Health and Nutrition Examination Survey (NHANES), National Health Interview Survey (NHIS), and the Pride Study.

NHANES is a repeated cross-sectional survey conducted by the National Center for Health Statistics (NCHS) at the Centers for Disease Control and Prevention (CDC). NHANES collects information via survey and physical examination. Each year the NHANES team selects randomly selects approximately 15 counties in the United States and approximately 5,000 participants. The sampling methodology and small sample size may NHANES unsuitable to

estimate state-level prevalence of alcohol consumption. Moreover, it is unclear that NHANES has includes questions about sexual orientation within several years of survey data.

NHIS is a repeated cross-sectional survey conducted by the National Center for Health Statistics (NCHS) at the Centers for Disease Control and Prevention (CDC). According the online source for NHIS, the “sampling plan follows an area probability design that permits the representative sampling of households and non-institutional group quarters (e.g., college dormitories).” NHIS samples approximately “35,000 households containing about 87,500 persons.” The target population for NHIS is the US civilian non-institutionalized population. Similar toe NSDUH, geographic location for individual participants in NHIS is only available through the Restricted Access Dataset. Therefore, NHIS has the same cost and time constraints making it unsuitable for the research.

The Population Research in Identity and Disparities for Equality (PRIDE) Study is one of the first large-scale surveys specifically designed to collect health and other information about lesbian, gay, bisexual, transgender, and other sexual and gender minorities living in the United States. The PRIDE Study is overseen by researchers at Stanford University and the University of California, San Francisco. The study began in January 2015 with a small pilot phase. The larger Phase II began collecting data through online sources in 2017. The study is set to continue collecting data for the next 10 years. Participants self-select to provide data to the PRIDE Study, rather than being randomly selected from a source population. As such, estimates of health behaviors may be biased. Moreover, the exclusion of heterosexual participants eliminates the possibility to examine differences in health behaviors by sexual orientation. However, the PRIDE Study is an important research venture that may provide valuable data for future research projects examining the health and well-being of sexual and gender minorities in the United States.

Source: National Health and Nutrition Examination Survey.

<https://www.cdc.gov/nchs/nhanes/index.htm>. [Accessed: September 27, 2019]

Source: About the National Health Interview Survey.

[https://www.cdc.gov/nchs/nhis/about\\_nhis.htm](https://www.cdc.gov/nchs/nhis/about_nhis.htm). [Accessed: September 27. 2019]

Source: The Pride Study FAQ. <https://pridestudy.org/faq>. [Accessed: September 27, 2019].

## **Appendix B: Exploratory Study of Selection Bias in BRFSS**

### *Selection Bias*

The Dictionary of Epidemiology by Miquel Porta defines selection bias as “bias of the estimated effect of an exposure on an outcome due to conditioning on a common effect of the exposure and outcome.” Another definition provided by the Porta dictionary defines selection bias as “a distortion in the estimate of the effect due to the manner in which subjects are selected for the study.” In other words, selection bias can occur when participation in a study is associated with both the exposure and outcome of interest or when there are baseline differences in the group that participates versus those that do not. If there is reason to believe that selection bias has occurred in a study, there is no statistical means that can correct the bias.

The following section of this report presents analyses of the BRFSS data according to the aforementioned definitions of selection bias. First, the report presents an analysis of whether there are significant differences in both individual level and state level characteristics between states that used the sexual and gender identity module and those that did not. Second, the report presents an analysis of whether there are associations between the use of the sexual and gender identity module and the exposure and outcomes of interest.

Source: Porta, M. (Ed.). (2014). *A dictionary of epidemiology*. Oxford university press.

### Part 1

The researcher examined differences in population characteristics and state region by whether a state used the Sexual and Gender Identity (SGI) module in 2018 (Table 1). The average proportion of individuals across age groups, gender groups, and household income groups did not differ between the groups of states that used the SGI module and those that did not. The average proportion of individuals identifying as White, Non-Hispanic was higher among states that did not use the SGI module in comparison to those states that did use the module. The average proportion of individuals identifying as Black, Non-Hispanic was higher among states that did use the module in comparison to those states that did not use the module. The average proportion of lesbian, gay, and bisexual adults was similar between states that used the SGI module and those that did not use the module. Among states that used the module, there



was a higher proportion of states in the Southern region compared with states that did not use the module.

**Table 7.2: Population and characteristics of US states by use of Sexual Orientation and Gender Identity module in BRFSS, 2018**

VARIABLE	NO MODULE		MODULE	
<b>AGE GROUP</b>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>
18-24 YEARS	12.7	1.3	12.3	0.8
25-34 YEARS	17.8	2.6	16.9	1.1
35-44 YEARS	16.2	1.2	15.9	0.9
45-54 YEARS	15.9	1	16.1	0.6
55-64 YEARS	16.7	1.6	17.1	0.8
65+ YEARS	20.8	2.6	21.8	1.8
<b>GENDER</b>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>
FEMALE	50.8	1.2	51.3	0.7
MALE	49.2	1.2	48.7	0.7
<b>RACE-ETHNICITY</b>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>
AIAN	2.5	3.2	1.3	1.5
ASIAN	3.3	3.6	4.7	7.4
BLACK	8.9	10.6	12.1	9.4
HISPANIC	11.3	11.2	9.7	8
MULTIRACIAL	1.5	0.8	1.8	2.6
NWPI	0.5	0.3	1.5	3.4
OTHER	0.6	0.3	0.6	0.3
WHITE	72.4	16.4	69.5	15.4
<b>HOUSEHOLD INCOME</b>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>
LESS THAN \$15,000	9.1	2.8	9.1	2.2
\$15 - 24,9999	15.1	3.1	16.6	2.8
\$25 - 34,000	10	1.6	10.5	1.7
\$35 - 49,000	13.4	1.9	13.3	1.6
\$50,000+	52.4	7.1	50.5	6.9
<b>LGB ADULTS</b>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>
% LGB	3.9	1.1	3.7	0.6
<b>REGION</b>	<i>Percent</i>	<i>n</i>	<i>Percent</i>	<i>N</i>
MIDWEST (2)	26.1	6	21.4	6

NORTHEAST (1)	17.4	4	17.9	5
SOUTH (3)	21.7	5	42.9	12
WEST (4)	34.8	8	17.9	5

## Part 2

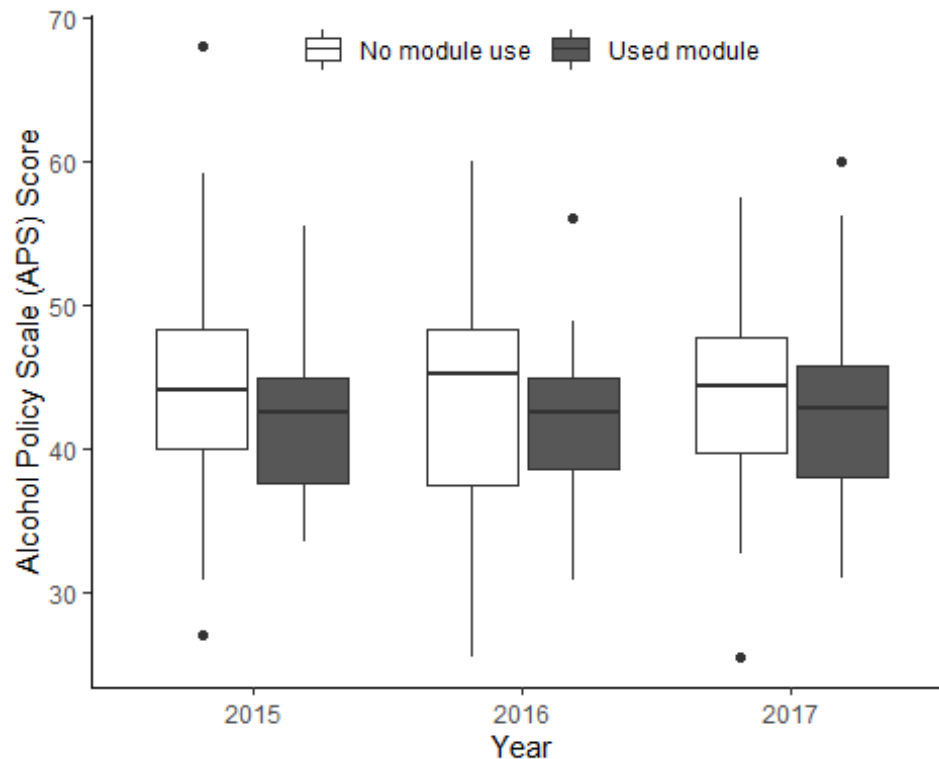
### Association between SGI Module use and the Alcohol Policy Environment

The researcher examined whether there was an association between the use of the Sexual and Gender Identity (SGI) module and the first exposure of interest: the alcohol policy environment. The alcohol policy environment has been operationalized using Alcohol Policy Scale (APS) scores calculated by researchers at Boston University.

Between 2015-2017, the states using the SGI module have lower median APS scores compared with states not using the SGI module. In 2015 and 2016, the variability of APS scores appears greater among those states not using the SGI module compared to those states using the SGI module. In 2017, there does not appear to be a substantial difference in the variability of APS scores by the use of the SGI module. Moreover, there are important outliers in the data that should be considered in future analyses (Figure 1).

For each individual year, there was not a statistically significant difference in the mean APS score by use of the SGI module (Table 2). This provides limited evidence that use the SGI module is related to a state's alcohol policy environment.

**Figure 7.1: Distribution of APS score by year and use of SOGI module, 2015-2017**



**Table 7.3: Test of mean differences in APS scores by use of SOGI module, 2015-2017**

Year	Mean APS: No module use	Mean APS: Module use	Welch t-statistic	p-value
2015	44.4	42.2	1.0553	0.2965
2016	44.8	41.9	1.3505	0.1843
2017	44.6	42.4	0.9624	0.3413

#### Association between SOGI module and Nondiscrimination Statutes

The researcher categorized states into mutually exclusive categories: 1. state used the module and has the law 2. state did not use the module and has the law 3. state used the module and does not have the law 4. state did not use the module and does not have the law. The researcher conducted a Fisher's exact test to examine whether the use of the module (binary 1/0 variable) was associated with the presence (binary 1/0) of a nondiscrimination statute in each of three categories: employment, housing, and public accommodations across years 2015, 2016, 2017, and 2018. The results of these analyses are presented below in Tables 3 - 5.

*Employment Nondiscrimination:* Between 2015-2018, the same number of states (n=24) included sexual orientation in their nondiscrimination employment statutes (Table 1). For years 2015-2017, the odds ratio for the association between use of the SGI module and presence of the nondiscrimination employment statute provide a signal that states that use the module have higher odds of also having the statute. In 2018, the odds ratio is less than 1 suggesting that states that use the module have lower odds of having nondiscrimination employment statutes. However, for each year, 2015-2018, the association between use of the SGI module and presence of nondiscrimination employment statutes is not statistically significant. The Fisher's exact test has been critiqued for being too conservative; however, the p-values provided by this test for the association in each year are much higher than 0.05.

**Table 7.4: Categorization of states by use of SOGI module and presence of employment nondiscrimination law, odds ratios and p-value for Fisher’s exact tests, 2015-2018**

Year	Use the module / Has the law	No use the module / Has the law	Use the module / Does not have the law	No use the module / Does not have the law	odds ratio	p-value
2015	12	12	9	18	1.97	0.2651
2016	14	10	11	16	2.01	0.2668
2017	14	10	13	14	1.50	0.5772
2018	13	11	15	12	0.95	1.0000

*Housing Nondiscrimination:* It appears that states that include sexual orientation in employment nondiscrimination laws also include sexual orientation in housing nondiscrimination laws.

Therefore, the association between the use of the SOGI module and the presence sexual orientation in state-level nondiscrimination housing laws is the same as for employment nondiscrimination laws.

**Table 7.5: Categorization of states by use of the SOGI module and presence of housing nondiscrimination law, odds ratios, and p-value for Fisher’s exact tests, 2015-2018**

Year	Use the module / Has the law	No use the module / Has the law	Use the module / Does not have the law	No use the module / Does not have the law	odds ratio	p-value
2015	12	12	9	18	1.97	0.2651
2016	14	10	11	16	2.01	0.2668
2017	14	10	13	14	1.50	0.5772
2018	13	11	15	12	0.95	1.0000

*Public Accommodations:* Between 2015-2018, the same number of states (n=23) included sexual orientation in their public accommodations nondiscrimination law (Table 5). From 2015-2018, the odds ratio for the association between use of the SOGI module and presence of the nondiscrimination public accommodations statute provide a signal that states that use the module have higher odds of also having the statute. The strength of the associations decreases from 2015 through 2018. The p-values from the Fisher’s exact test suggest that the associations are not statistically significant and thus the associations could be due to chance.

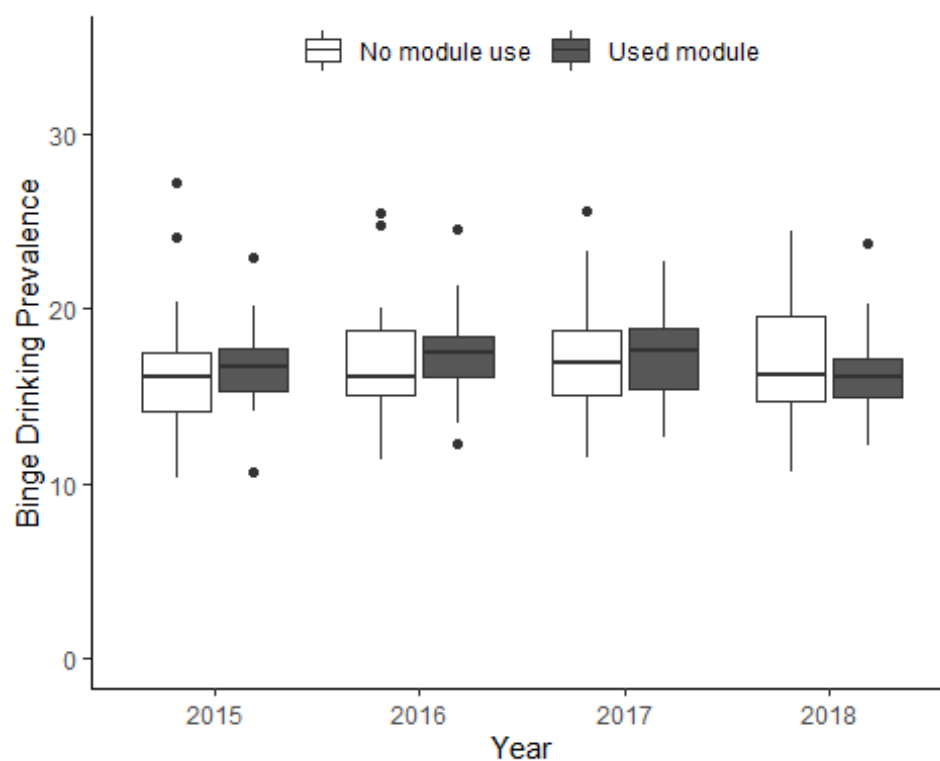
**Table 7.6: Categorization of states by use of SOGI module and presence of public accommodations nondiscrimination law, odds ratios, and p-value for Fisher’s exact tests, 2015-2018**

Year	Use the module / Has the law	No use the module / Has the law	Use the module / Does not have the law	No use the module / Does not have the law	odds ratio	p-value
2015	12	11	9	19	2.26	0.1668
2016	14	9	11	17	2.36	0.1637
2017	14	9	13	15	1.77	0.4004
2018	13	10	15	13	1.12	1.0000

#### Association between SGI module and Binge Drinking

The distribution of the prevalence of binge drinking by use of the sexual and gender identity module hovers between 10% and 29% from 2015-2018 (Figure 2). In 2015, 2016 and 2018, the distribution of binge drinking prevalence among states that did not use the SGI module is greater than among those that did use the module. In 2017, the distribution of binge drinking prevalence appears similar between states that use and did not use the SGI module. In 2015-2017, states that used the SGI module have a higher median prevalence of binge drinking compared with states that did not use the module. Despite differences in the spread, the median binge drinking prevalence appears similar between states that did and did not use the module in 2018. For each year of data, there are outliers that should be considered in future analyses. There was not a statistically significant difference in mean binge drinking prevalence by use of the SGI module for any of the included years (Table 6).

**Figure 7.2: Distribution of binge drinking prevalence by use of the SOGI module, 2015–2018**



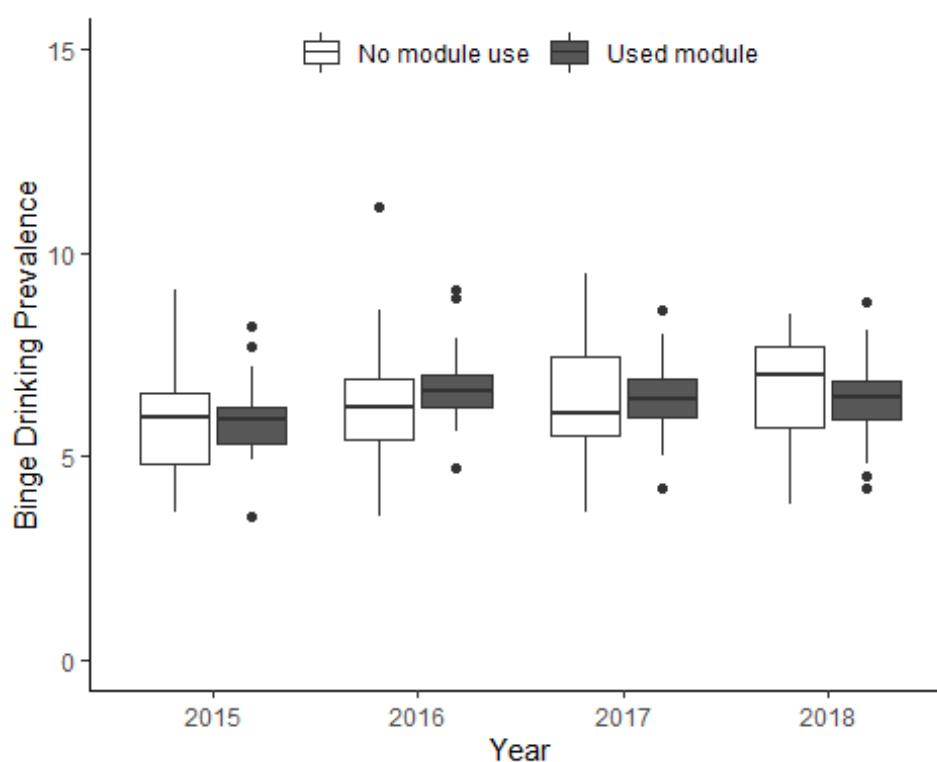
**Table 7.7: Tests of mean differences in binge drinking prevalence by use of SOGI module, 2015–2018**

Year	Mean Binge Prev: No module use	Mean Binge Prev: Module use	Welch t-statistic	p-value
2015	16.4	16.6	-0.2736	0.7855
2016	16.8	17.5	-0.8074	0.4236
2017	16.9	17.3	-0.4128	0.6819
2018	17.1	16.3	0.9926	0.3271

### Association between SGI module and Heavy Drinking

Overall, it appears that the prevalence of heavy drinking is lower than the prevalence of binge drinking. Between 2015-2018, the distribution of heavy drinking prevalence was much wider in states that did not use the SGI module compared with states that did (Figure 3). There was no statistically significant difference in mean heavy drinking prevalence comparing states that used the SGI module with those that did not use the module in any of the years (Table 7).

**Figure 7.3: Distribution of heavy drinking prevalence by use of the SOGI module, 2015–2018**





**Table 7.8: Tests of mean differences in heavy drinking prevalence by use of SOGI module, 2015-2018**

Year	Mean Hvy Drink Prev:		Welch t-statistic	p-value
	No module use	Module use		
2015	6.0	5.9	0.2994	0.7659
2016	6.3	6.7	-1.1707	0.2484
2017	6.3	6.5	-0.3708	0.7128
2018	6.7	6.4	0.8972	0.3745

### Conclusion

Disparities in excessive alcohol consumption by sexual orientation have been well documented in the United States. At this time, there is a need to figure out how to reduce these disparities as well as reduce excessive alcohol consumption at the population level. The research question under study is attempting to do just that.

There are several publicly available datasets that include questions about aspects of sexual orientation (identity, attraction, or behavior). Each dataset has strengths and limitations. The researcher has decided to use the Behavioral Risk Factor Surveillance System (BRFSS) as a source of information on both individual sexual identity and excessive alcohol use. While it would be preferable to use the National Survey on Drug Use and Health (NSDUH) which includes the sexual orientation questions and individuals from all 50 states and the District of Columbia, time constraints render this data set unusable for the research to be completed within a timely manner. The researcher, recognizing the possible biases in the BRFSS data, undertook a series of analyses outlined in this report to determine the extent of such potential bias. Selection bias can be thought of in two ways. First, selection bias may occur when those that participate in a study are substantially different from the source population. Thus the measures of association estimated with the study population cannot reasonably be applied to the larger source and target populations.

Second, selection bias may occur when participation in a study is associated with both the exposure and outcome of interest. Taking these definitions as a basis, the researcher conducted analyses to see if 1) those that live in states that used the SGI module were significantly different

on individual characteristics (age, sex, race, household income) compared with those living in states that did not use the module; 2) there was an association between the use of the SGI module and both the exposures (APS scores, nondiscrimination statutes) and the outcomes (binge drinking, heavy drinking).

The first analyses show that there were not significant differences in individual-level characteristics between states that used the SGI module and states that did not the SGI module. However, states from certain geographic regions may be underrepresented. The second analyses show that there was no association between the use of the SGI module and either the exposures or outcomes of interest. Taken together, these analyses provide some evidence that the BRFSS data can potentially estimate the association between the exposures and outcomes of interest and that these estimates may be reasonably applied to a particular source population. Moreover, because individuals who participate in BRFSS have been selected with a known probability (rather than volunteering), participants will always be representative of the states from which they were selected even if the estimates may not appropriately be applied to the entire United States.

The BRFSS is an important source of public health surveillance from health and risk behaviors. Unlike the other surveys discussed in this report, BRFSS not only provides national estimates, but also yearly stable state-level estimates for health and risk behaviors. It is the recommendation of this researcher that sexual orientation be added to the demographics section of the Standard Core so that every state must include the Sexual and Gender Identity module. Not only would this improve the utility of the BRFSS for answering questions such as the ones undertaken by this researcher, but it would increase the available data on the health and well-being of sexual and gender minority populations both at the national and state level.

## Appendix C: Merged Data Codebook

Col Num	Level	Data Source	Variable Name	Variable Label	Variable Type	Format	Codes	Original Data File	Processed Data File	User Created	Notes
1	state	Census	FIPS	State FIPS Code	numeric		NA	all-geocodes-v2017.csv	fips.csv	No	The fips code is a substring from a longer variable. This variable will be used to merge all datasets because it appears in all datasets.
2	individual	Behavioral Risk Factor Surveillance System	YEAR	BRFSS Survey Year	categorical		NA	llcp[YYYY]_s.csv	[YYYY]_brfss.csv	Yes	
3	individual	Not applicable	STATE	State Name	character		NA	NA	NA	No	State is available in all original data files.
4	state	CDC BRFSS Program	SGL_MOD	State used Sexual and Gender Identity module	numeric		1 = Yes 0 = No	sgm.csv	[YYYY]_sgm.csv	Yes	Naomi created individual files for each year survey year
5	state	Alcohol Policy Scale	APS_YEAR	State alcohol policy score year	numeric		NA	APS_Greene_2004-20017_5.22.2019.csv	[YYYY]_aps.csv	No	
6	state	Alcohol Policy Scale	APS_SCORE	State alcohol policy score	numeric		NA	APS_Greene_2004-20017_5.22.2019.csv	[YYYY]_aps.csv	No	
7	state	Movement Advancement Project	MAP_EMPLOY	State nondisc employment law includes sexual orientation (MAP)	numeric		1 = Yes 0 = No				
8	state	Movement Advancement Project	MAP_HOUS	State nondisc housing law includes sexual orientation (MAP)	numeric		1 = Yes 0 = No				
9	state	Movement Advancement Project	MAP_ACCOM	State nondisc public accommodations law includes sexual orientation (MAP)	numeric		1 =Yes 0 = No				
10	state	Movement Advancement Project	MAP_SO_TALLY	MAP Sexual Orientation State Law Tally	numeric		NA				
11	state	Human Rights Campaign	HRC_EMPLOY	State nondis employment law includes sexual orientation (HRC)	numeric		1 =Yes 0 = No				
12	state	Human Rights Campaign	HRC_HOUS	State nondisc housing law includes sexual orientation (HRC)	numeric		1 =Yes 0 = No				
13	state	Human Rights Campaign	HRC_ACCOM	State nondisc public accommodations law includes sexual orientation (HRC)	numeric		1 =Yes 0 = No				
14	state	Human Rights Campaign	HRC_EDU	State nondisc education law includes sexual orientation	numeric		1 =Yes 0 = No				

Col Num	Level	Data Source	Variable Name	Variable Label	Variable Type	Format	Codes	Original Data File	Processed Data File	User Created	Notes
15	state	Human Rights Campaign	HRC_ADOPT	State allows second parent adoption for same-sex couples	numeric		1 =Yes 0 = No				
16	state	Human Rights Campaign	HRC_HIVCRIME	State criminalizes behaviors with low risk of HIV transmission	numeric		1 =Yes 0 = No				
17	state	Human Rights Campaign	HRC_SEI_CAT	HRC State Equality Index	numeric		1 = Working towards innovative equality 2 = Solidifying equality 3 = Building equality 4 = High priority to achieve basic equality				
18	state	American Community Survey	POP_AGE18_E	Population age 18 and over - number	numeric		NA	ACSDP[#Yyyyy].DP05_data_with_overlays_2019-10-14T135524.csv	[YYYY]acs[#]y_age_sex.csv	Yes	For years 2015, 2016, and 2017, I used 5-year estimates. For 2018, I used 1-year estimates
19	state	American Community Survey	POP_AGE18_M	Population age 18 and over - number margin of error	numeric		NA	ACSDP[#Yyyyy].DP05_data_with_overlays_2019-10-14T135524.csv	[YYYY]acs[#]y_age_sex.csv	Yes	For years 2015, 2016, and 2017, I used 5-year estimates. For 2018, I used 1-year estimates
20	state	American Community Survey	POP_AGE18_P E	Population age 18 and over - percent	numeric		NA	ACSDP[#Yyyyy].DP05_data_with_overlays_2019-10-14T135524.csv	[YYYY]acs[#]y_age_sex.csv	Yes	For years 2015, 2016, and 2017, I used 5-year estimates. For 2018, I used 1-year estimates
21	state	American Community Survey	POP_AGE18_P M	Population age 18 and over - percent margin of error	numeric		NA	ACSDP[#Yyyyy].DP05_data_with_overlays_2019-10-14T135524.csv	[YYYY]acs[#]y_age_sex.csv	Yes	For years 2015, 2016, and 2017, I used 5-year estimates. For 2018, I used 1-year estimates
22	state	American Community Survey	POP_AGE21_E	Population age 21 and over - number	numeric		NA	ACSDP[#Yyyyy].DP05_data_with_overlays_2019-10-14T135524.csv	[YYYY]acs[#]y_age_sex.csv	Yes	For years 2015, 2016, and 2017, I used 5-year estimates. For 2018, I used 1-year estimates
23	state	American Community Survey	POP_AGE21_M	Population age 21 and over - number margin of error	numeric		NA	ACSDP[#Yyyyy].DP05_data_with_overlays_2019-10-14T135524.csv	[YYYY]acs[#]y_age_sex.csv	Yes	For years 2015, 2016, and 2017, I used 5-year estimates. For 2018, I used 1-year estimates
24	state	American Community Survey	POP_AGE21_P E	Population age 21 and over - percent	numeric		NA	ACSDP[#Yyyyy].DP05_data_with_overlays_2019-10-14T135524.csv	[YYYY]acs[#]y_age_sex.csv	Yes	For years 2015, 2016, and 2017, I used 5-year estimates. For 2018, I used 1-year estimates
25	state	American Community Survey	POP_AGE21_P M	Population age 21 and over - percent margin of error	numeric		NA	ACSDP[#Yyyyy].DP05_data_with_overlays_2019-10-14T135524.csv	[YYYY]acs[#]y_age_sex.csv	Yes	For years 2015, 2016, and 2017, I used 5-year estimates. For 2018, I used 1-year estimates

Col Num	Level	Data Source	Variable Name	Variable Label	Variable Type	Format	Codes	Original Data File	Processed Data File	User Created	Notes
26	state	American Community Survey	POP_MALE18_E	Male population age 18 and over - number	numeric		NA	ACSDP[#Yyyyy].DP05_data_with_overlays_2019-10-14T135524.csv	[YYYY]acs[#]y_age_sex.csv	Yes	For years 2015, 2016, and 2017, I used 5-year estimates. For 2018, I used 1-year estimates
27	state	American Community Survey	POP_MALE18_M	Male population age 18 and over - number margin of error	numeric		NA	ACSDP[#Yyyyy].DP05_data_with_overlays_2019-10-14T135524.csv	[YYYY]acs[#]y_age_sex.csv	Yes	For years 2015, 2016, and 2017, I used 5-year estimates. For 2018, I used 1-year estimates
28	state	American Community Survey	POP_MALE18_PE	Male population age 18 and over - percent	numeric		NA	ACSDP[#Yyyyy].DP05_data_with_overlays_2019-10-14T135524.csv	[YYYY]acs[#]y_age_sex.csv	Yes	For years 2015, 2016, and 2017, I used 5-year estimates. For 2018, I used 1-year estimates
29	state	American Community Survey	POP_MALE18_PM	Male population age 18 and over - percent margin of error	numeric		NA	ACSDP[#Yyyyy].DP05_data_with_overlays_2019-10-14T135524.csv	[YYYY]acs[#]y_age_sex.csv	Yes	For years 2015, 2016, and 2017, I used 5-year estimates. For 2018, I used 1-year estimates
30	state	American Community Survey	POP_FEMALE18_E	Female population age 18 and over - number	numeric		NA	ACSDP[#Yyyyy].DP05_data_with_overlays_2019-10-14T135524.csv	[YYYY]acs[#]y_age_sex.csv	Yes	For years 2015, 2016, and 2017, I used 5-year estimates. For 2018, I used 1-year estimates
31	state	American Community Survey	POP_FEMALE18_M	Female population age 18 and over - number margin of error	numeric		NA	ACSDP[#Yyyyy].DP05_data_with_overlays_2019-10-14T135524.csv	[YYYY]acs[#]y_age_sex.csv	Yes	For years 2015, 2016, and 2017, I used 5-year estimates. For 2018, I used 1-year estimates
32	state	American Community Survey	POP_FEMALE18_PE	Female population age 18 and over - percent	numeric		NA	ACSDP[#Yyyyy].DP05_data_with_overlays_2019-10-14T135524.csv	[YYYY]acs[#]y_age_sex.csv	Yes	For years 2015, 2016, and 2017, I used 5-year estimates. For 2018, I used 1-year estimates
33	state	American Community Survey	POP_FEMALE18_PM	Female population age 18 and over - percent margin of error	numeric		NA	ACSDP[#Yyyyy].DP05_data_with_overlays_2019-10-14T135524.csv	[YYYY]acs[#]y_age_sex.csv	Yes	For years 2015, 2016, and 2017, I used 5-year estimates. For 2018, I used 1-year estimates
34	state	American Community Survey	POP_WNH_E	White Non-Hispanic population age 18 and over - number	numeric		NA	ACSDT[#Yyyyy].B01001H_data_with_overlays_2019-10-14T143241.csv	[YYYY]acs[#]y_wnh.csv	Yes	For years 2015, 2016, and 2017, I used 5-year estimates. For 2018, I used 1-year estimates
35	state	American Community Survey	TOT_POP_AGE_18	Total population age 18 and over - number	numeric		NA	ACSDT[#Yyyyy].B01001H_data_with_overlays_2019-10-14T143241.csv	[YYYY]acs[#]y_wnh.csv	Yes	For years 2015, 2016, and 2017, I used 5-year estimates. For 2018, I used 1-year estimates
36	state	American Community Survey	POP_WNH_PE	White Non-Hispanic population age 18 and over - percent	numeric		NA	ACSDT[#Yyyyy].B01001H_data_with_overlays_2019-10-14T143241.csv	[YYYY]acs[#]y_wnh.csv	Yes	For years 2015, 2016, and 2017, I used 5-year estimates. For 2018, I used 1-year estimates
37	state	American Community Survey	MED_INC_DOLL_E	Population median household income in dollars - number	numeric		NA	ACSDT[#Y]Y[yyyy].B19013_metadata_2019-10-15T092027.csv	[YYYY]acs[#]y_medinc.csv	No	For years 2015, 2016, and 2017, I used 5-year estimates. For 2018, I used 1-year estimates
38	state	American Community Survey	MED_INC_DOLL_M	Population median household income in dollars - number margin of error	numeric		NA	ACSDT[#Y]Y[yyyy].B19013_metadata_2019-10-15T092027.csv	[YYYY]acs[#]y_medinc.csv	No	For years 2015, 2016, and 2017, I used 5-year estimates. For 2018, I used 1-year estimates

Col Num	Level	Data Source	Variable Name	Variable Label	Variable Type	Format	Codes	Original Data File	Processed Data File	User Created	Notes
39	state	Census 2010 Summary File 1	TOT_POP_2010	Census: 2010 Pop (denominator for POP_URB_PE, POP_RUR_PE)	numeric		NA	DEC_10_SF1_P2.csv	allyrs_urban_rural.csv	No	
40	state	Census 2010 Summary File 1	URB_POP_2010	Census: 2010 Pop residing in urban areas	numeric		NA	DEC_10_SF1_P2.csv	allyrs_urban_rural.csv	Yes	
41	state	Census 2010 Summary File 1	RUR_POP_2010	Census: 2010 Pop residing in rural areas	numeric		NA	DEC_10_SF1_P2.csv	allyrs_urban_rural.csv	No	
42	state	Census 2010 Summary File 1	POP_URB_PE	2010 Pop in urban area, percent	numeric		NA	DEC_10_SF1_P2.csv	allyrs_urban_rural.csv	Yes	
43	state	Census 2010 Summary File 1	POP_RUR_PE	2010 Pop in rural area, percent	numeric		NA	DEC_10_SF1_P2.csv	allyrs_urban_rural.csv	Yes	
44	state	U.S. Religion Census Religious Congregations and Membership Study	POP2010	Tot 2010 pop in captured by US Religion Survey	numeric		NA	U.S. Religion Census Religious Congregations and Membership Study, 2010 (State File).csv	allyrs_religion.csv	No	This variable should be equal to TOT_POP_2010 because this data source got this variable from the 2010 US Census.
45	state	U.S. Religion Census Religious Congregations and Membership Study	CATHCNG	Catholic--Total number of congregations (2010)	numeric		NA	U.S. Religion Census Religious Congregations and Membership Study, 2010 (State File).csv	allyrs_religion.csv	No	
46	state	U.S. Religion Census Religious Congregations and Membership Study	CATHADH	Catholic--Total number of adherents (2010)	numeric		NA	U.S. Religion Census Religious Congregations and Membership Study, 2010 (State File).csv	allyrs_religion.csv	No	
47	state	U.S. Religion Census Religious Congregations and Membership Study	CATHRATE	Catholic--Rates of adherence per 1,000 population (2010)	numeric		NA	U.S. Religion Census Religious Congregations and Membership Study, 2010 (State File).csv	allyrs_religion.csv	No	
48	state	U.S. Religion Census Religious Congregations and Membership Study	CATH_POP_PE	Catholic adherents, percent of 2010 pop	numeric		NA	U.S. Religion Census Religious Congregations and Membership Study, 2010 (State File).csv	allyrs_religion.csv	Yes	Calculated by (CATHADH/POP2010)*100)
49	state	Census	REGION	State Census Region	categorical		1 = Northeast 2 = Midwest 3 = South 4 = West	state_regions.csv	all_yrs_region.csv	No	
50	state	Federal Bureau of Investigation Uniform Crime Reporting	TOTAL_OFFICERS	Number of sworn law enforcement officers in state	numeric		NA				
51	state	Federal Bureau of Investigation Uniform Crime Reporting	OFFICERS_CAPITA	Law enforcement officers per capita	numeric		NA				
52	individual	Behavioral Risk Factor Surveillance System	X_PSU	Primary Sampling Unit (Equal to Annual Sequence number)	numeric		NA	llcp[YYYY].s.csv	[YYYY]_brfss.csv	No	

Col Num	Level	Data Source	Variable Name	Variable Label	Variable Type	Format	Codes	Original Data File	Processed Data File	User Created	Notes
53	individual	Behavioral Risk Factor Surveillance System	SEX	Respondant's Sex	categorical	sex.	1 = Male 2 = Female .a = Don't Know/Not Sure .b = Refused	llcp[YYYY]_s.csv	[YYYY]_brfss.csv	No	Rename the SEX1 variable in 2018 dataset to match 2015-2017 data
54	individual	Behavioral Risk Factor Surveillance System	MARITAL	Marital Status	categorical	marital.	1 = Married 2 = Divorced 3 = Widowed 4 = Separated 5 = Never married 6 = A member of an unmarried couple . = System Missing .b = Refused	llcp[YYYY]_s.csv	[YYYY]_brfss.csv	No	
55	individual	Behavioral Risk Factor Surveillance System	EDUCA	Education Level	categorical	educa.	1 = Never attended school or only kindergarten 2 = Grade 1 through 8 (Elementary) 3 = Grade 9 through 11 (Some high school) 4 = Grade 12 or GED (High school graduate) 5 = College 1 year to 3 years (Some college or technical school) 6 = College 4 years or more (College graduate) . = System Missing .b = Refused	llcp[YYYY]_s.csv	[YYYY]_brfss.csv	No	

Col Num	Level	Data Source	Variable Name	Variable Label	Variable Type	Format	Codes	Original Data File	Processed Data File	User Created	Notes
56	individual	Behavioral Risk Factor Surveillance System	EMPLOY1	Employment Status	categorical	employ.	1 = Employed for wages 2 = Self-employed 3 = Out of work for 1 year or more 4 = Out of work for less than 1 year 5 = A homemaker 6 = A student 7 = Retired 8 = Unable to work . = System Missing .b = Refused	llcp[YYYY]_s.csv	[YYYY]_brfss.csv	No	
57	individual	Behavioral Risk Factor Surveillance System	INCOME2	Income level	categorical	income.	1 = Less than \$10,000 2 = Less than \$15,000 3 = Less than \$20,000 4 = Less than \$25,000 5 = Less than \$35,000 6 = Less than \$50,000 7 = Less than \$75,000 8 = \$75,000 or more .a = Don't know/Not sure .b = Refused . = Not asked or Missing	llcp[YYYY]_s.csv	[YYYY]_brfss.csv	No	
58	individual	Behavioral Risk Factor Surveillance System	ALCDAY5	Days in the past 30 had alcoholic beverage	numeric		101 - 199 = Days per week 201 - 299 = Days in the past 30 days .c = No drinks in the past 30 days . = System Missing	llcp[YYYY]_s.csv	[YYYY]_brfss.csv	No	1__ = Days per week 2__ = Days in past 30



Col Num	Level	Data Source	Variable Name	Variable Label	Variable Type	Format	Codes	Original Data File	Processed Data File	User Created	Notes
59	individual	Behavioral Risk Factor Surveillance System	AVEDRNK2	Avg alcoholic drinks per day in past 30	numeric		1 - 76 = Number of drinks 77 = Don't know/Not sure 99 = Refused BLANK = Not asked or Missin	llcp[YYYY]_s.csv	[YYYY]_brfss.csv	No	__ = Number of drinks ALCDAY5 coded 888,777,or 999
60	individual	Behavioral Risk Factor Surveillance System	DRNK3GE5	Binge Drinking	numeric		1 - 76 = Number of Times .c = None 77 = Don't know/Not Sure 99 = Refused BLANK = Not asked or Missing	llcp[YYYY]_s.csv	[YYYY]_brfss.csv	No	ALCDAY5 coded 888,777,or 999
61	individual	Behavioral Risk Factor Surveillance System	MAXDRNKS	Most drinks on single occaasion past 30 days	numeric		1 - 76 = Number of drinks 77 = Don't know/Not sure 99 = Refused BLANK = Not asked or Missin	llcp[YYYY]_s.csv	[YYYY]_brfss.csv	No	ALCDAY5 coded 888,777,or 999
62	individual	Behavioral Risk Factor Surveillance System	SXORIENT	Sexual orientation	categorical	sxorient.	1 = Straight 2 = Lesbian or gay 3 = Bisexual 4 = Other .a = Don't know/Not Sure .b = Refused . = Not asked or Missing	llcp[YYYY]_s.csv	[YYYY]_brfss.csv	No	For 2018 data, this variable was created from SOFEMALE and SOMALE to matched years 2015-2017
63	individual	Behavioral Risk Factor Surveillance System	TRNSGNDR	Gender identity	categorical	transgender.	1 = Yes, Transgender, male-to-female 2 = Yes, Transgender, female to male 3 = Yes, Transgender, gender	llcp[YYYY]_s.csv	[YYYY]_brfss.csv	No	

Col Num	Level	Data Source	Variable Name	Variable Label	Variable Type	Format	Codes	Original Data File	Processed Data File	User Created	Notes
							nonconforming 4 = No .a = Don't know/Not Sure .b = Refused . = Not asked or Missing				
64	individual	Behavioral Risk Factor Surveillance System	X_STSTR	Sample Design Stratification Variable	numeric		NA	llcp[YYYY].s.csv	[YYYY]_brfss.csv	No	
65	individual	Behavioral Risk Factor Surveillance System	X_STRWT	Stratum weight	numeric		NA	llcp[YYYY].s.csv	[YYYY]_brfss.csv	No	
66	individual	Behavioral Risk Factor Surveillance System	X_LLCPWT	Final weight assigned to each respondent: Land-line and cell-phone data	numeric		NA	llcp[YYYY].s.csv	[YYYY]_brfss.csv	No	
67	individual	Behavioral Risk Factor Surveillance System	X_RACE	Computed Race-Ethnicity grouping	categorical	race.	1 = White only, non-Hispanic 2 = Black only, non-Hispanic 3 = American Indian or Alaskan Native only, non-Hispanic 4 = Asian only, non-Hispanic 5 = Native Hawaiian or other Pacific Islander only, non-Hispanic 6 = Other race only, non-Hispanic 7 = Multiracial, non-Hispanic 8 = Hispanic .a = Don't know/Not sure/Refused . = System Missing	llcp[YYYY].s.csv	[YYYY]_brfss.csv	No	

Col Num	Level	Data Source	Variable Name	Variable Label	Variable Type	Format	Codes	Original Data File	Processed Data File	User Created	Notes
68	individual	Behavioral Risk Factor Surveillance System	X_RACEGR3	Computed Five level race/ethnicity category	categorical	racegr.	1 = White only, Non-Hispanic 2 = Black only, Non-Hispanic 3 = Other race only, Non-Hispanic 4 = Multiracial, Non-Hispanic 5 = Hispanic .a = Don't know/Not sure/Refused . = System Missing	llcp[YYYY]_s.csv	[YYYY]_brfss.csv	No	
69	individual	Behavioral Risk Factor Surveillance System	X_RACE_G1	Computed race groups used for internet prevalence tables	categorical	raceg.	1 = White - Non-Hispanic 2 = Black - Non-Hispanic 3 = Hispanic 4 = Other race only, Non-Hispanic 5 = Multiracial, Non-Hispanic .a = Don't know/Not sure/Refused . = System Missing	llcp[YYYY]_s.csv	[YYYY]_brfss.csv	No	
70	individual	Behavioral Risk Factor Surveillance System	X_AGE_G	Imputed age in six groups	categorical	age_g.	1 = Age 18 to 24 2 = Age 25 to 34 3 = Age 35 to 44 4 = Age 45 to 54 5 = Age 55 to 64 6 = Age 65 or older	llcp[YYYY]_s.csv	[YYYY]_brfss.csv	No	
71	individual	Behavioral Risk Factor Surveillance System	X_EDUCAG	Computed level of education completed categories	categorical	educag.	1 = Did not graduate High School 2 = Graduated High School 3 = Attended	llcp[YYYY]_s.csv	[YYYY]_brfss.csv	No	Calculated from EDUCA

Col Num	Level	Data Source	Variable Name	Variable Label	Variable Type	Format	Codes	Original Data File	Processed Data File	User Created	Notes
							College or Technical School 4 = Graduated from College or Technical School .a = Don't know/Not sure/Missing				
72	individual	Behavioral Risk Factor Surveillance System	X_INCOMG	Computed income categories	categorical	incomg.	1 = Less than \$15,000 2 = \$15,000 to less than \$25,000 3 = \$25,000 to less than \$35,000 4 = \$35,000 to less than \$50,000 5 = \$50,000 or more .a = Don't know/Not sure/Missing	llcp[YYYY]_s.csv	[YYYY]_bfss.csv	No	Calculated from INCOME2
73	individual	Behavioral Risk Factor Surveillance System	DRNKANY5	Drink any alcoholic beverages in past 30 days	categorical	drnkany.	1 = Yes 2 = No .a = Don't know/Not Sure .b = Refused/Missing	llcp[YYYY]_s.csv	[YYYY]_bfss.csv	No	Calculated from ALCDAY5 This variable should be used to determine who is a Current Drinker
74	individual	Behavioral Risk Factor Surveillance System	DROCDY3_	Computed drink-occasions-per-day	numeric		0 = No drink-occasions per day 1 - 899 drink occasions per day 900 = Don't know/Not Sure or Refused/Missing	llcp[YYYY]_s.csv	[YYYY]_bfss.csv	No	Calculated from ALCDAY5
75	individual	Behavioral Risk Factor Surveillance System	X_RFBING5	Binge Drinking Calculated Variable	binary	rfbing.	1 = No 2 = Yes .a = Don't know/Refused/Missing	llcp[YYYY]_s.csv	[YYYY]_bfss.csv	No	Use this variable to determine Binge Drinker
76	individual	Behavioral Risk Factor Surveillance	X_DRNKWEK	Computer number of drinks of alcohol beverages per	numeric		0 = Did not drink	llcp[YYYY]_s.csv	[YYYY]_bfss.csv	No	Calculated from ALCDAY5 and DROCDY3

Col Num	Level	Data Source	Variable Name	Variable Label	Variable Type	Format	Codes	Original Data File	Processed Data File	User Created	Notes
		System		week			1 - 98999 = Number of drinks per week 99900 = Don't know/Not sure/Refused /Missing				
77	individual	Behavioral Risk Factor Surveillance System	X_RFDRHV5	Heavy alcohol consumption	binary	rfdrhv.	1 = No 2 = Yes .a = Don't know/Refused /Missing	llcp[YYYY]_s.csv	[YYYY]_bfss.csv	No	Renamed X_RFDRHV6 in 2018 data to match variable name in 2015-2017 data
78	individual	Behavioral Risk Factor Surveillance System	current_drnker	Current Drinker	binary		0 = No 1 = Yes			Yes	Recoded DRNKANY5
79	individual	Behavioral Risk Factor Surveillance System	binge_drnker	Binge Drinker	binary		0 = No 1 = Yes			Yes	Recoded X_RFBING5
80	individual	Behavioral Risk Factor Surveillance System	hvy_drnker	Heavy Drinker	binary		0 = No 1 = Yes			Yes	Recoded X_RFDRHV5
81	individual	Behavioral Risk Factor Surveillance System	lgb	Identifies as lesbian, gay, or bisexual	binary		0 = No 1 = Yes			Yes	Recoded SXORIENT; Something else category is considered missing

## Appendix D: Exploration of High-Frequency Binge Drinking

The prevalence of high-frequency binge drinking, having 5+ binge drinking occasions, is lower than have 1 binge drinking occasion in the past 30 days across sex and sexual identity.

Table D1: Prevalence of binge drinking (4+/5+ drinks for women/men on 1 occasion in the past 30 days) by sex and sexual identity, BRFSS, 2015-2018

	Unweighted sample size	Weighted %	95% CI
All women	427, 031		
Straight women	413, 205	10.9%	10.7 – 11.1
Lesbian women	4,951	20.1%	17.3 – 22.8
Bisexual women	8,875	24.1%	22.3 – 26.0
All men	330, 260	21.6%	21.3 – 21.9
Straight men	318,494	21.4%	21.1 – 21.7
Gay men	6952	25.5%	23.4 – 27.7
Bisexual men	4814	25.4%	22.9 – 28.0

Table D2: Prevalence of high-frequency binge drinking (5+ occasions in past 30 days) among men and women, BRFSS, 2015-2018

	Unweighted sample size	Weighted %	95% CI
All women	204,148	4.5%	4.3 – 4.7
Straight women	195,947	4.1%	3.9 – 4.3
Lesbian women	2,918	9.4%	6.9 – 11.7
Bisexual women	5,283	11.0%	8.8 – 13.2
All men	197,818	10.3%	10.0 – 10.6
Straight men	190,279	10.2%	9.9 – 10.5
Gay men	4,609	11.2%	9.2 – 13.2
Bisexual men	2,930	15.9%	13.0 – 18.8

- *The association between the alcohol policy score and high-frequency binge drinking is weaker than the association between alcohol policy score and binge drinking.*
- *The odds of binge drinking comparing lesbian/bisexual women to straight women are higher for the high-frequency binge drinking outcome compared with the binge drinking outcome.*

*This is the original table in Paper 1*

**Table 4: Association between alcohol policy score, sexual identity, and individual-level binge drinking among women, 2015-2018**

	MODEL 1		MODEL 2		MODEL 3		MODEL 4	
	OR <sup>a</sup> (95% CI)	p	OR <sup>a</sup> (95% CI)	p	OR <sup>a</sup> (95% CI)	p	OR <sup>a</sup> (95% CI)	p
Lesbian	2.05 (1.72 – 2.44)	<0.0001	2.06 (1.73 – 2.45)	<0.0001	1.42 (1.17 – 1.74)	0.0006	1.43 (1.17 – 1.75)	0.0005
Bisexual	2.62 (2.36 – 2.90)	<0.0001	2.60 (2.34 – 2.88)	<0.0001	1.59 (1.41 – 1.79)	<0.0001	1.58 (1.40 – 1.79)	<0.0001
Straight	Reference							
APS Score <sup>b</sup> (10 percentage points)	0.98 (0.95 – 1.00)	0.0511	0.97 (0.95 – 0.99)	0.012	0.93 (0.91 – 0.96)	<0.0001	0.96 (0.94 – 0.99)	0.0028

States included in the models: CA, CO, CT, DE, FL, GA, HI, ID, IL, IN, IA, KS, KY, LA, MD, MA, MN, MS, MO, MT, NV, NY, NC, OH, OK, PA, RI, SC, TN, TX, VT, VA, WA, WI

<sup>a</sup>Odds ratio

<sup>b</sup>Alcohol Policy Scale Score

Model 1: Adjusted for survey year

Model 2: Adjusted for survey year, population age 21+, male population 18+, proportion of population white, percent population LGB, median household income, officers per capita, catholic adherents per 1,000 population, percent population living in urban areas, state region

Model 3: Adjusted for survey year, age, race, income, education, relationship status

Model 4: Adjusted for survey year, population age 21+, male population 18+, proportion of population white, percent population LGB, median household income, officers per capita, catholic adherents per 1,000 population, percent population living in urban areas, state region, age, race, income, education, relationship status

**Table D3: Association between alcohol policy score, sexual identity, and individual-level high-frequency binge drinking (5+ occasions of binge drinking) among women, 2015-2018**

	MODEL 1		MODEL 2		MODEL 3		MODEL 4	
	OR <sup>†</sup> [95% CI]	p	OR <sup>†</sup> [95% CI]	p	OR <sup>†</sup> [95% CI]	p	OR <sup>†</sup> [95% CI]	p

Lesbian	2.39 [1.80 – 3.18]	<0.0001	2.42 [1.82 – 3.22]	<0.0001	2.04 [1.50 – 2.77]	<0.0001	2.03 [1.50 – 2.77]	<0.0001
Bisexual	2.88 [2.30 – 3.61]	<0.0001	2.93 [2.34 – 3.67]	<0.0001	1.77 [1.40 – 2.23]	<0.0001	1.79 [1.42 – 2.25]	<0.0001
Straight	Reference							
APS Score (10 percentage points)	0.98 [0.92 – 1.04]	0.5165	0.98 [0.92 – 1.04]	0.4638	0.93 [0.86 – 0.99]	0.0158	0.95 [0.89 – 1.00]	0.0600

States included in the models: CA, CO, CT, DE, FL, GA, HI, ID, IL, IN, IA, KS, KY, LA, MD, MA, MN, MS, MO, MT, NV, NY, NC, OH, OK, PA, RI, SC, TN, TX, VT, VA, WA, WI

† Odds ratio

Model 1: Adjusted for survey year

Model 2: Adjusted for survey year, population age 21+, male population 18+, proportion of population white, percent population LGB, median household income, officers per capita, catholic adherents per 1,000 population, percent population living in urban areas, state region

Model 3: Adjusted for survey year, age, race, income, education, relationship status

Model 4: Adjusted for survey year, population age 21+, male population 18+, proportion of population white, percent population LGB, median household income, officers per capita, catholic adherents per 1,000 population, percent population living in urban areas, state region, age, race, income, education, relationship status



- *Among men, the association between alcohol policy score and high-frequency binge drinking is significant.*
- *Bisexual men are significantly more likely to engage in high-frequency binge drinking compared to heterosexual men.*

*The original table from Paper 1*

**Table 5: Association between alcohol policy score, sexual identity, and individual-level binge drinking among men, 2015-2018**

	MODEL 1		MODEL 2		MODEL 3		MODEL 4	
	OR <sup>a</sup> (95% CI)	p	OR <sup>a</sup> (95% CI)	p	OR <sup>a</sup> (95% CI)	p	OR <sup>a</sup> (95% CI)	p
Gay	1.25 (1.12 – 1.41)	<0.0001	1.26 (1.24 – 1.41)	<0.0001	1.02 (0.90 – 1.15)	0.7374	1.03 (0.91 – 1.17)	0.6269
Bisexual	1.26 (1.10 – 1.44)	0.0011	1.25 (1.09 – 1.44)	0.0012	1.03 (0.88 – 1.21)	0.7058	1.03 (0.88 – 1.22)	0.6806
Straight								
APS Score <sup>b</sup> (10 percentage points)	0.94 (0.97 – 1.00)	0.1151	0.99 (0.97 – 1.01)	0.3109	0.98 (0.96 – 1.00)	0.0779	1.00 (0.97 – 1.02)	0.7060

States included in the models: CA, CO, CT, DE, FL, GA, HI, ID, IL, IN, IA, KS, KY, LA, MD, MA, MN, MS, MO, MT, NV, NY, NC, OH, OK, PA, RI, SC, TN, TX, VT, VA, WA, WI

<sup>a</sup>Odds ratio

<sup>b</sup>Alcohol Policy Scale Score

Model 1: Adjusted for survey year

Model 2: Adjusted for survey year, population age 21+, male population 18+, proportion of population white, percent population LGB, median household income, officers per capita, catholic adherents per 1,000 population, state region

Model 3: Adjusted for survey year, age, race, income, education, relationship status

Model 4: Adjusted for survey year, population age 21+, male population 18+, proportion of population white, percent population LGB, median household income, officers per capita, catholic adherents per 1,000 population, state region, age, race, income, education, relationship status

**Table D4: Association between alcohol policy score, sexual identity, and individual-level high-frequency binge drinking (5+ occasions of binge drinking) among men, 2015-2018**

	<b>MODEL 1</b>		<b>MODEL 2</b>		<b>MODEL 3</b>		<b>MODEL 4</b>	
	<b>OR† [95% CI]</b>	<b>p</b>	<b>OR† [95% CI]</b>	<b>p</b>	<b>OR† [95% CI]</b>	<b>p</b>	<b>OR† [95% CI]</b>	<b>p</b>
Gay	1.11 [0.90 – 1.36]	0.3292	1.13 [0.92 – 1.39]	0.2315	1.01 [0.81 – 1.25]	0.9658	1.01 [0.82 – 1.26]	0.8999
Bisexual	1.66 [1.33 – 2.07]	<0.0001	1.67 [1.34 – 2.08]	<0.0001	1.34 [1.05 – 1.71]	0.0200	1.34 [1.05 – 1.70]	0.0192
Straight	Reference							
APS Score (10 percentage points)	1.01 [0.97 – 1.04]	0.7320	0.97 [0.94 – 1.01]	0.1172	0.97 [0.94 – 1.01]	0.1618	0.95 [0.92 – 0.99]	0.0131

States included in the models: CA, CO, CT, DE, FL, GA, HI, ID, IL, IN, IA, KS, KY, LA, MD, MA, MN, MS, MO, MT, NV, NY, NC, OH, OK, PA, RI, SC, TN, TX, VT, VA, WA, WI

† Odds ratio

Model 1: Adjusted for survey year

Model 2: Adjusted for survey year, population age 21+, male population 18+, proportion of population white, percent population LGB, median household income, officers per capita, catholic adherents per 1,000 population, state region

Model 3: Adjusted for survey year, age, race, income, education, relationship status

Model 4: Adjusted for survey year, population age 21+, male population 18+, proportion of population white, percent population LGB, median household income, officers per capita, catholic adherents per 1,000 population, state region, age, race, income, education, relationship status

## PAPER 2

- *Overall, lesbian and bisexual women have a higher prevalence of binge drinking and high-frequency binge drinking in states without inclusive nondiscrimination statutes*

### *The original table for Paper 2*

Table 1: Prevalence of binge drinking among women and men by sexual identity comparing states with inclusive nondiscrimination statutes for sexual orientation to states without inclusive statutes, BRFSS, 2015-2018

		States with inclusive statutes <sup>1</sup>		States without inclusive statutes <sup>2</sup>		
	Unweighted sample size	Weighted %	95% CI	Weighted %	95% CI	p-value
<b>All women</b>	484,966	12.8	12.5 – 13.1	11.0	10.7 – 11.3	< 0.01
<b>Straight women</b>	413,205	11.9	11.6 – 12.3	10.0	9.7 – 10.3	< 0.01
<b>Lesbian women</b>	4,951	18.1	15.0 – 21.7	22.0	17.9 – 26.6	0.16
<b>Bisexual women</b>	8,875	23.8	21.5 – 26.3	24.4	21.8 – 27.3	0.74
<b>All men</b>	378,291	22.9	22.5 – 23.3	21.4	21.0 – 21.8	< 0.01
<b>Straight men</b>	318,494	22.3	21.8 – 22.8	20.7	20.3 – 21.1	< 0.01
<b>Gay men</b>	6,952	27.3	24.4 – 30.4	23.4	20.6 – 26.4	0.07
<b>Bisexual men</b>	4,814	26.0	22.7 – 29.7	24.9	21.3 – 28.8	0.67

**Table D5: Prevalence of high-frequency (5+ occasions) binge drinking among women and men by sexual identity comparing states with inclusive nondiscrimination statutes for sexual orientation to states without inclusive statutes, BRFSS, 2015-2018**

		States with inclusive statutes <sup>1</sup>		States without inclusive statutes <sup>2</sup>		
	Unweighted sample size	Weighted %	95% CI	Weighted %	95% CI	p-value
<b>All women</b>		4.3%	4.0 – 4.5	5.2%	4.9 – 5.5	<0.0001
<b>Straight women</b>		3.8%	3.6 – 4.1	4.4%	4.1 – 4.7	0.0034
<b>Lesbian women</b>		6.5%	4.0 – 8.9	12.5%	8.4 – 16.7	0.0091
<b>Bisexual women</b>		9.3%	7.0 – 11.6	12.8%	9.1 – 16.5	0.0960
<b>All men</b>		9.8%	9.4 – 10.2	11.3%	10.9 – 11.7	<0.0001
<b>Straight men</b>		9.4%	9.0 – 9.8	11.0%	10.6 – 11.4	<0.0001
<b>Gay men</b>		11.5%	8.7 – 14.3	10.7%	7.9 – 13.5	0.6733
<b>Bisexual men</b>		14.5%	11.3 – 17.8	17.2%	12.3 – 22.1	0.3515

1: California, Colorado, Connecticut, Delaware, Hawaii, Illinois, Iowa, Maryland, Massachusetts, Minnesota, Nevada, New York, Rhode Island, Vermont, Washington, Wisconsin

2: Florida, Georgia, Idaho, Indiana, Kansas, Kentucky, Louisiana, Mississippi, Missouri, Montana, North Carolina, Ohio, Oklahoma, Pennsylvania, South Carolina, Tennessee, Texas, Virginia, West Virginia

- *Overall, the associations stratified by type of state seem to be consistent whether examining binge drinking or high-frequency binge drinking.*

***The original table from Paper 2***

Table 3: Association between sexual minority identity and binge drinking stratified by presence of inclusive statutes among women in BRFSS, 2015-2018

	States with inclusive statutes				States without inclusive statutes			
	Lesbian vs Straight		Bisexual vs Straight		Lesbian vs Straight		Bisexual vs Straight	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
<b>MODEL 1</b>	1.63	1.30 – 2.05	2.31	2.01 – 2.65	2.53	1.96 – 3.26	2.91	2.50 – 3.40
<b>MODEL 2</b>	1.18	0.92 – 1.52	1.33	1.12 – 1.58	1.71	1.27 – 2.31	1.84	1.56 – 2.19
<b>MODEL 3</b>	1.66	1.32 – 2.08	2.30	2.00 – 2.63	2.54	1.97 – 3.27	2.91	2.49 – 3.39
<b>MODEL 4</b>	1.19	0.92 – 1.53	1.35	1.13 – 1.60	1.71	1.27 – 2.30	1.83	1.55 – 2.17

Model 1: Unadjusted association between sexual identity and binge drinking

Model 2: Model 1 adjusted for age, race, education, income, marital status

Model 3: Model 1 adjusted for pop 21+ years, pop adult male, pop white, percent LGB, median household income, urban pop, catholic rate, region

Model 4: Model 2 adjusted for covariates in Model 3

**Table D6: Association between sexual minority identity and high-frequency (5+ occasions) binge drinking stratified by presence of inclusive statutes among women in BRFSS, 2015-2018**

	States with inclusive statutes				States without inclusive statutes			
	Lesbian vs Straight		Bisexual vs Straight		Lesbian vs Straight		Bisexual vs Straight	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
<b>MODEL 1</b>	1.74	1.16 – 2.61	2.57	1.94 – 3.40	3.09	2.10 – 4.54	3.17	2.26 – 4.545
<b>MODEL 2</b>	1.34	0.86 – 2.08	1.51	1.08 – 2.09	2.72	1.82 – 4.06	1.98	1.43 – 2.75
<b>MODEL 3</b>	1.77	1.18 – 2.66	2.63	1.99 – 3.49	3.08	2.09 – 4.52	3.19	2.28 – 4.46
<b>MODEL 4</b>	1.34	0.86 – 2.09	1.54	1.11 – 2.15	2.71	1.80 – 4.09	1.99	1.44 – 2.76

Model 1: Unadjusted association between sexual identity and binge drinking

Model 2: Model 1 adjusted for age, race, education, income, marital status

Model 3: Model 1 adjusted for pop 21+ years, pop adult male, pop white, percent LGB, median household income, urban pop, catholic rate, region

Model 4: Model 2 adjusted for covariates in Model 3

- *The results among men appear to be consistent between whether using binge drinking or high-frequency binge drinking as an outcome.*

***The original table from Paper 2***

Table 4: Association between presence of nondiscrimination statutes inclusive of sexual orientation and binge drinking among men in BRFSS, 2015-2018

	MODEL 1		MODEL 2		MODEL 3		MODEL 4	
	OR [95% CI]	<i>p</i>	OR [95% CI]	<i>p</i>	OR [95% CI]	<i>p</i>	OR [95% CI]	<i>p</i>
Inclusive statutes	1.10 [1.06–1.14]	<0.01	1.08 [1.03 – 1.12]	0.01	1.02 [0.96 – 1.08]	0.57	1.00 [0.94 – 1.07]	0.99
Gay	1.25 [1.12–1.40]	0.01	1.02 [0.90 – 1.15]	0.75	1.26 [1.13 – 1.41]	<0.01	1.03 [0.91 – 1.16]	0.64
Bisexual	1.25 [1.09–1.43]	0.01	1.03 [0.88 – 1.21]	0.73	1.25 [1.09 – 1.44]	0.01	1.03 [0.88 – 1.21]	0.70
Straight	Ref		Ref		Ref		Ref	

Model 1: Unadjusted model

Model 2: Model 1 adjusted for age, race-ethnicity, education, income, marital status

Model 3: Model 1 adjusted for pop 21+, pop adult male, pop white, pop LGB, median household income, officers per capita, urban pop, catholic rate, region, survey year

Model 4: Model 2 adjusted for all factors in Model 3

**Table D7: Association between presence of nondiscrimination statutes inclusive of sexual orientation and binge drinking among men in BRFSS, 2015-2018**

	MODEL 1		MODEL 2		MODEL 3		MODEL 4	
	OR [95% CI]	<i>p</i>	OR [95% CI]	<i>p</i>	OR [95% CI]	<i>p</i>	OR [95% CI]	<i>p</i>
Inclusive statutes	0.84 [0.79 – 0.90]	<0.0001	0.88 [0.82 – 0.95]	0.0005	0.88 [0.79 – 0.98]	0.0154	0.93 [0.83 – 1.04]	0.2218
Gay	1.12 [0.91 – 1.34]	0.2714	1.01 [0.82 – 1.26]	0.9061	1.13 [0.92 – 1.39]	0.2301	1.01 [0.82 – 1.26]	0.8939
Bisexual	1.67 [1.34 – 2.08]	<0.0001	1.34 [1.05 – 1.70]	0.0201	1.67 [1.34 – 2.09]	<0.0001	1.34 [1.05 – 1.71]	0.0181
Straight	Ref		Ref		Ref		Ref	

Model 1: Unadjusted model

Model 2: Model 1 adjusted for age, race-ethnicity, education, income, marital status

Model 3: Model 1 adjusted for pop 21+, pop adult male, pop white, pop LGB, median household income, officers per capita, urban pop, catholic rate, region, survey year

Model 4: Model 2 adjusted for all factors in Model 3



### PAPER 3

- *The associations between alcohol policy score and high-frequency binge drinking are weaker than for binge drinking among women.*

#### The original table for Paper 3

**Table 2: Association between alcohol policy score and binge drinking among women stratified by presence of inclusive nondiscrimination statutes, 2015-2018**

	States without inclusive statutes (n=19)			States with inclusive statutes (n=16)		
	OR	95% CI	p-value	OR	95% CI	p-value
APS (10 units)	0.98	[0.93 – 1.03]	0.4781	<b>0.93</b>	<b>[0.89 – 0.97]</b>	<b>0.0003</b>
Lesbian	<b>1.71</b>	<b>[1.27 – 2.31]</b>	<b>0.0004</b>	1.19	[0.92 – 1.54]	0.1777
Bisexual	<b>1.84</b>	<b>[1.55 – 2.18]</b>	<b>&lt;.0001</b>	<b>1.34</b>	<b>[1.13 – 1.60]</b>	<b>0.0008</b>
Heterosexual	Ref	Ref	Ref	Ref	Ref	Ref

Adjusted for: age, race, education, income, marital status, population 21+, population male, population white, percent LGB, Catholic rate, region

**Table D8: Association between alcohol policy score and high-frequency (5+ occasions) binge drinking among women stratified by presence of inclusive nondiscrimination statutes, 2015-2018**

	States without inclusive statutes (n=19)			States with inclusive statutes (n=16)		
	OR	95% CI	p-value	OR	95% CI	p-value
APS (10 units)	0.95	0.85 – 1.06	0.34	1.02	0.93 – 1.12	0.67
Lesbian	2.69	1.79 – 4.04	<0.0001	1.35	0.87 – 2.10	0.18
Bisexual	2.01	1.45 – 2.79	<0.0001	1.55	1.11 – 2.15	0.01
Straight	Ref					

Adjusted for: age, race, income, relationship status, population male, population white, population lgb, officers per capita, median household income, population urban, census region

- *The results are consistent whether using high-frequency binge drinking or binge drinking as the outcome.*

#### The original table from Paper 3

**Table 3: Association between alcohol policy score and binge drinking stratified by presence of nondiscrimination law and sexual identity among men, 2015-2018**

<b>States with inclusive statutes<sup>a</sup></b>									
	<b>Heterosexual</b>			<b>Gay</b>			<b>Bisexual</b>		
	OR <sup>b</sup>	95% CI	p	OR <sup>b</sup>	95% CI	p	OR <sup>b</sup>	95% CI	p
APS score (10 units)	1.00	[0.97 – 1.05]	0.72	0.92	[0.71 – 1.12]	0.54	0.95	[0.68 – 1.32]	0.74
<b>States without inclusive statutes<sup>a</sup></b>									
	<b>Heterosexual</b>			<b>Gay</b>			<b>Bisexual</b>		
	OR <sup>b</sup>	95% CI	p	OR <sup>b</sup>	95% CI	p	OR <sup>b</sup>	95% CI	p
APS score (10 units)	0.99	[0.95 – 1.03]	0.56	0.85	[0.64 – 1.12]	0.25	1.08	[0.76 – 1.53]	0.69

<sup>a</sup> Model adjusted for individual variables (age, race-ethnicity, education level, income level, relationship status) and state-level factors (population age 21+ years; population adult male; population Non-Hispanic white; population lesbian, gay, bisexual; law enforcement officers per capita; median household income; population living in urban areas; Catholics per 1,000 pop; census region)

<sup>b</sup> Odds ratio

**Table D9: Association between alcohol policy score and high-frequency binge drinking stratified by presence of nondiscrimination law and sexual identity among men, 2015-2018**

<b>States with inclusive statutes<sup>a</sup></b>									
	<b>Heterosexual</b>			<b>Gay</b>			<b>Bisexual</b>		
	OR <sup>b</sup>	95% CI	p	OR <sup>b</sup>	95% CI	p	OR <sup>b</sup>	95% CI	p
APS score (10 units)	0.98	0.90 – 1.05	0.54	0.84	0.57 – 1.26	0.41	1.69	1.00 – 2.84	0.05
<b>States without inclusive statutes<sup>a</sup></b>									
	<b>Heterosexual</b>			<b>Gay</b>			<b>Bisexual</b>		
	OR <sup>b</sup>	95% CI	p	OR <sup>b</sup>	95% CI	p	OR <sup>b</sup>	95% CI	p
APS score (10 units)	0.93	0.87 – 1.00	0.05	0.79	0.51 – 1.20	0.27	0.90	0.53 – 1.51	0.69

<sup>a</sup> Model adjusted for individual variables (age, race-ethnicity, education level, income level, relationship status) and state-level factors (population age 21+ years; population adult male; population Non-Hispanic white; population lesbian, gay, bisexual; law enforcement officers per capita; median household income; population living in urban areas; Catholics per 1,000 pop; census region)

<sup>b</sup> Odds ratio

## **CURRICULUM VITAE**

# Naomi Greene, MPH, CPH

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## EDUCATION AND TRAINING

Johns Hopkins Bloomberg School of Public Health

Department of Health, Behavior, and Society

Doctor of Philosophy (PhD)

December 2020

- Dissertation Title: Sexual identity disparities in binge drinking: a multilevel analysis of the alcohol policy environment and nondiscrimination statutes
- Dissertation Committee: Joanna E. Cohen (chair), Renee Johnson, Joanne Rosen, Danielle German

CUNY Graduate School of Public Health

Department of Epidemiology and Biostatistics

Masters of Public Health (MPH)

2015

- Master's Thesis: Potential impact of DSNY Organics Collection pilot on local rat activity around NYC public schools
- Advisor: Heidi Jones

Vassar College

Bachelor of Arts, Film

2005

National Board of Public Health Examiners

Certified in Public Health (CPH)

2015

## FELLOWSHIPS AND AWARDS

NCI Predoctoral Fellowship in Cancer Epidemiology, Prevention, and Control

2018 –2020

Walter J. Lear Award Best Student Abstract, LGBT Caucus, APHA

2019

Faculty Research Award, CUNY School of Public Health

2015

James Felt Academic Achievement Award, CUNY School of Public Health

2014

## PUBLICATIONS

### Peer-Reviewed Journal Articles

**Greene N**, Malone J, Adams MA, Dean LT, Poteat T. "This is some mess right here": Exploring interactions between Black sexual minority women and health care providers for breast cancer screening and care. *Cancer*. 2020 Sep 29.

**Greene N**, Esser MB, Vesselinov R, Auman KM, Kerns TJ, Lauerman MH. Variability in antemortem and postmortem blood alcohol concentration levels among fatally injured adults. *The American Journal of Drug and Alcohol Abuse*. 2020 Sep 27:1-8.

**Greene N**, Jackson JW, Dean LT. Examining disparities in excessive alcohol use among Black and Hispanic lesbian and bisexual women in the United States – an intersectional analysis. *Journal of Studies on Alcohol and Drugs*. *Journal of Studies on Alcohol and Drugs*, 2020 Jul;81(4):462-70.

Trangenstein PJ, **Greene N**, Eck RH, Milam AJ, Furr-Holden CD, Jernigan DH. Alcohol advertising and violence. *American Journal of Preventive Medicine*. 2020 Mar 1;58(3):343-51. <https://doi.org/10.1016/j.amepre.2019.10.024>.

**Greene N**, Tomedi L, Reno J, Green D. The role of substance use and resiliency factors on suicidal ideation among middle school students. *Journal of School Health*. 2020 Feb;90(2):73-80.

### **Practice-related Reports**

**Greene, N**. “Health Inequities by Sexual Orientation among New Mexican Adults, 2011- 2014” October 2016. Available at: [http://nmtupac.com/wp-content/uploads/2017/07/Health-Inequities-by-Sexual-Orientation-among-New-Mexican-Adults-2011-2014\\_062317.pdf](http://nmtupac.com/wp-content/uploads/2017/07/Health-Inequities-by-Sexual-Orientation-among-New-Mexican-Adults-2011-2014_062317.pdf).

**Greene, N**. “Amphetamine-Related Emergency Department Visits, New Mexico, 2010-2014. *New Mexico Epidemiology*.” Volume 2016, Issue 4, April 22, 2016. Available at: <https://www.nmhealth.org/data/view/report/1886/>.

### **ORAL PRESENTATIONS**

“Exploring healthcare provider interactions in breast cancer screening and care among Black sexual minority women,” American Public Health Association Annual Conference, November 5, Philadelphia, PA

“Too many outlets? Lessons from the New Mexico Department of Health study on alcohol outlet density,” Alcohol Outlet Density Summit, January 2019, Las Cruces, NM (invited talk)

“Examining excessive alcohol use among sexual minorities through an intersectional framework,” American Public Health Association Annual Meeting, November 2018, San Diego, CA

“Meet me at the crossroads: Examining health disparities among Lesbian, Gay, and Bisexual adults through an Intersectional Framework,” Council of State and Territorial Epidemiologists Annual Conference, June 2017, Boise, ID

“A tale of two cities: Examining alcohol outlet density in small metropolitan areas of New Mexico,” Council of State and Territorial Epidemiologists Annual Conference, June 2017, Boise, ID

“The role of substance use and protective factors on suicidal ideation among middle school students: Findings from the 2013 New Mexico Youth Risk and Resiliency Survey,” Council of State and Territorial Epidemiologists Annual Conference, June 2016, Anchorage, AK

“Evaluation of syndromic surveillance for monitoring suicide attempts in New Mexico,” Council of State and Territorial Epidemiologists Annual Conference, June 2016, Anchorage, AK

“The impact of substance use and protective factors among middle school students: Findings from the 2013 New Mexico Youth Risk and Resiliency Survey,” Society for Prevention Research Annual Conference, June 2016, San Francisco, CA

“Methamphetamine morbidity: Amphetamine-related emergency department surveillance,” New Mexico Public Health Association Annual Conference, April 2016, Las Cruces, NM

## **POSTER PRESENTATIONS**

“Alcohol advertising and violence in Baltimore, MD,” American Public Health Association Annual Meeting, November 2018, San Diego, CA

“Comparison of the impact of two female condom interventions on relationship control,” New York City Epidemiology Forum, February 2014, New York, NY

“Potential impact of organics pilot on local rat activity around schools,” New York City Epidemiology Forum, February 2014, New York, NY

## **RESEARCH WORK EXPERIENCE**

### **Research Assistant**

Johns Hopkins Bloomberg School of Public Health  
Supervisor: Dr. Lorraine T. Dean

July 2018 – Present  
Department of Epidemiology

Hired as member of research team for the Black Sexual Minority Women & Breast Cancer: Improving Access to Care study with Dr. Lorraine T Dean (PI) and Dr. Tonia Poteat (PI)

- Analyzed 15 qualitative interviews with Black sexual minority women discussing experience with healthcare providers during breast cancer screening and treatment
- Organized 2,500 survey records for quantitative data analysis
- Distributed 100 gift card incentives for survey participants

**Data Analyst**

Council of State and Territorial Epidemiologists  
Supervisor: Dr. Marissa Esser

July 2018 – Present  
Alcohol Subcommittee

Collaborated with the Alcohol Subcommittee of the Council of State and Territorial Epidemiologists on the “An Assessment of Blood Alcohol Concentration Testing in the National Violent Death Reporting System” study

- Analyzed prevalence and correlates of alcohol testing in violent using the 2014-2016 National Violent Death Reporting System using SAS
- Created maps of prevalence of alcohol testing in US states using R software for presentation at Council of State and Territorial Epidemiologists 2019 Conference
- Drafted manuscript of study findings for publication

**Research Assistant**

West Baltimore Drug Free Communities Coalition  
Supervisor: Dr. Raimee Eck

September 2018 – March 2019  
Alcohol Assessment Project

Contracted to assist West Baltimore Drug Free Communities Coalition with their Alcohol Assessment Project to understand links between alcohol outlets and neighborhood characteristics

- Developed instrument for collecting observational data on alcohol outlets in West Baltimore
- Programmed physical data collection instrument into Qualtrics
- Collected observational data at 50 alcohol outlets located in West Baltimore

**Data Analyst Contractor**

New Mexico Department of Health  
Project Supervisor: Dr. Laura Tomedi

June 2018 – July 2018  
Substance Abuse Epidemiology Section

Collaborated with epidemiologists at the New Mexico Department of Health to pilot surveillance indicators for substance use and mental health designed by the Council of State and Territorial Epidemiologists

- Analyzed prevalence of substance use and mental health indicators using Behavioral Risk Factor Surveillance System, Youth Risk Behavior Surveillance System, hospital records, and emergency departments visits
- Conducted focus group with epidemiologists from New Mexico Department of Health regarding usefulness of proposed substance use and mental health indicators
- Wrote report on pilot activities, findings from focus group, and recommendations for changes to pilot indicators



**CDC Alcohol Fellow**

Johns Hopkins University  
Supervisor: Dr. David Jernigan

August 2017 – September 2019  
Center on Alcohol Marketing and Youth

Selected as a fellow in the Centers for Disease Control and Prevention Alcohol Fellowship program to build skills and knowledge in alcohol epidemiology and related harms

- Led study on the association between alcohol advertisements posted on alcohol outlets and crime
- Summarized costs of motor vehicle crashes and prevalence of excessive drinking among youth for Baltimore Epidemiology Report
- Geocoded 2017 Baltimore City alcohol outlet data
- Managed TV monitoring project for prevalence of noncompliant alcohol advertisements

**PROFESSIONAL WORK EXPERIENCE****Applied Epidemiology Fellow**

New Mexico Department of Health

July 2015 – July 2017  
Substance Use Epidemiology Section

Served for two years at the New Mexico Department of Health, Epidemiology and Response Division, Substance Abuse Epidemiology Section under the Council of State and Territorial Epidemiologists

- Conducted spatial analysis research on alcohol outlet density and violent crime
- Piloted surveillance on methamphetamine morbidity using emergency department data
- Evaluated syndromic surveillance systems for tracking suicide attempts
- Analyzed sexual orientation disparities in Behavioral Risk Factor Surveillance System
- Presented alcohol outlet density research to 3 community-based stakeholder groups

**Research Assistant**

NYC Department of Health and Mental Hygiene

January 2014 – May 2015

Hired to assist with public health surveillance and community engagement in the Bureau of Environmental Health

- Analyze administrative and surveillance data on complaints about rat activity to draw conclusions about the impact of time on compliance with pest control orders in NYC
- Develop database for Environmental Control Board orders to reconcile dismissed cases
- Designed MS Access database for Organics Pilot Study observations
- Collect observations about rat activity and usage of specialized garbage bins for Organics Pilot Study

**Research Aide**  
Research Foundation

October 2013 – June 2015  
City University of New York

Coordinated the Substance Abuse and Mental Health Services Administration (SAMHSA) GLS-Suicide Prevention Grant

- Administered mental health screening for incoming undergraduate and graduate students at Hunter College
- Analyzed data on prevalence of suicidal ideation, suicide attempts, substance abuse, and awareness of mental health services to incorporate into program planning and evaluation
- Conducted process evaluation for the first year of the suicide prevention and mental health services awareness program
- Coordinated research studies on gatekeeper training and skills-based interventions

**Survey Intern**  
Food Bank of New York City

April 2013 – August 2013

Recruited randomly selected individuals to complete the Hunger in America Survey, a nationally representative survey of individuals accessing emergency food assistance programs

- Resolved issues with pantry and soup kitchen staff at 25 sampling sites
- Supervised sampling and recruited participants at 25 sites

**Research Intern**  
NYC Department of Health and Mental Hygiene

October 2013 – December 2013

Selected as an intern for the H RTP: A Public Health Internship Program and served in the Bureau of Mental Health, Office of Rehabilitative Services

- Analyzed Quarter 2 data on job placements for clients in employment programs
- Wrote report with analysis findings

**Program Coordinator**  
Story Corps

January 2012 – June 2012  
Community Engagement

Coordinated the final months of the National Teachers Initiative, a grant funded program to collect the stories of K-12 teachers and students across the United States

- Designed, implemented, and reported results of an internal evaluation of the National Teachers Initiative (NTI) program focused on best practices for engaging the education community and lessons learned about implementing organization-wide programming
- Coordinated 3 national & 2 regional recording trips with partner organizations in the education field which secured an additional 42 interviews for the NTI collection to help meet grant deliverables

**Facilitator**  
StoryCorps

May 2007 – December 2011  
Community Engagement

Hired as the public face of StoryCorps to carry out the mission of recording, archiving and sharing diverse stories of everyday people throughout the United States

- Recorded 1000+ interviews through partnerships with corporations, nonprofits, universities, and libraries
- Trained 12 volunteers at the Memorial Sloan Kettering Cancer Center to facilitate interviews with participants at the end of life through StoryCorps Legacy Initiative
- Edited interviews, 9 interviews selected for broadcast on NPR Morning Edition
- Wrote an Outreach Guide to standardize staff interactions with diverse communities
- Built partnerships with community-based organizations serving the Haitian community in Brooklyn, NY

**AmeriCorps Volunteer in Service to America (VISTA)**  
Dress for Success

May 2006 – April 2007

Served as the program coordinator at the community-based organization, Dress for Success, to build the outreach capacity and function of the agency

- Established new partnerships with community-based organized; increased active partnerships by 20%
- Designed promotional materials and implemented marketing strategies to increase awareness of program and services within community
- Recruited and managed volunteers who secured \$1000 in financial contributions, over \$5000 of in-kind donations and provided over 150 hours of volunteer service
- Supervised two office interns

## TEACHING EXPERIENCE

**Teaching Assistant**      Policy Intervention for Health Behavior Change (2<sup>nd</sup> term 2019 & 2020)  
Health, Behavior and Society Department, Johns Hopkins Bloomberg School of Public Health

**Guest Lecturer**      *“Excessive Alcohol Use and Individual Level Interventions”*  
Clinical and Public Health Behavior Change (Spring 2019)  
Health, Behavior and Society Department, Johns Hopkins Bloomberg School of Public Health

**Guest Lecturer**      *“Sexual Minorities and Excessive Alcohol Use: A Bird’s Eye View”*  
Alcohol and Social Justice Disparities: A Public Health Perspective (Fall 2017)  
Krieger School of Arts and Sciences, Johns Hopkins University

**PEER REVIEW SERVICE**

Reviewer, Journal of Adolescent Health	2020
Reviewer, Social Science and Medicine Population Health	2019
Reviewer of Abstracts, American Public Health Association, ATOD	2018

**PROFESSIONAL MEMBERSHIPS**

American Public Health Association, Alcohol, Tobacco and Other Drugs Section Member	2017
American Public Health Association, LGBT Caucus Member	2017
Council of State and Territorial Epidemiologists, Alcohol Subcommittee Member	2015

**LEADERSHIP POSITIONS**

Co-Chair, Doctoral Student Council, Johns Hopkins Bloomberg School of Public Health	2020
Secretary, Doctoral Student Council, Johns Hopkins Bloomberg School of Public Health	2019 - 2020
Chair, Forum on Alcohol Research and Advocacy, Johns Hopkins Bloomberg School of Public Health	2017 - 2020