



Generalized Anxiety Disorder Symptoms are Higher Among Same- and Both-Sex Attracted Individuals in a Large, International Sample

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Abstract

Introduction This study examines the severity of generalized anxiety disorder (GAD) symptoms among sexual minorities in a large international sample and analyzes the relationship between GAD symptoms and two nation-level policies discriminating against sexual minorities: marriage inequality and criminalization of same-sex sex acts. Members of sexual minorities show higher rates of GAD. Structural stigma may contribute to poor mental health outcomes among sexual minorities.

Methods We collected GAD symptoms in a sample of 5,929 participants from countries with differing policies restricting the rights of sexual minorities between May 2018 and October 2018. We then used mixed effects regression to examine the effects of sexual orientation and structural stigma (marriage inequality and criminalization of same-sex sex acts) on GAD symptoms.

Results Participants reporting same-sex and both-sex attraction showed more anxiety symptoms than participants reporting opposite-sex attraction. There was no significant interaction effect between marriage inequality or criminalization of same-sex sex acts and sexual orientation on GAD symptoms.

Discussion The higher measured anxiety among sexual minority participants is consistent with previous research; however, the absence of an interaction effect between sexual orientation and discriminatory policies was contrary to our predictions. We hypothesize that this could be due to differential concealment of sexual orientation due to structural stigma or the effects of stigma and discrimination outside of policy.

Policy Implications These findings suggest that changing discriminatory policies may not be sufficient to improve mental health outcomes among sexual minorities; instead, it may be necessary to address sources of stigma beyond direct legal policies.

Keywords Generalized anxiety · Sexual minority · Stigma · Web-based · International

Introduction

Generalized anxiety disorder (GAD), a disorder characterized by excessive worry, is one of the most common psychological disorders. Research in the USA has shown a

lifetime prevalence of 5.1%, with 3.1% of adults reporting GAD in the past 12 months (Hans-Ulrich, 2002). Worldwide prevalence is also high; data from 26 countries (taken from the World Health Organization's World Mental Health Survey Initiative) found a lifetime prevalence of 3.7% and a 12-month prevalence of 1.8%. Prevalence varies between countries; higher-income countries report higher lifetime prevalence (5.0%) compared to middle-income countries (2.8%) and low-income countries (1.6%) (Ruscio et al., 2017). Impairment from GAD symptoms can be severe. 35.3% of people with GAD without comorbid conditions report severe role impairment (Ruscio et al., 2017). GAD contributes significantly to the global burden of disease; anxiety disorders are the cause of 14.6% of years lived with disability due to mental health and substance use disorders (Whiteford et al., 2013). GAD also shows high comorbidity with other disorders (81.9%), particularly with major depressive disorder (52.6%) (Ruscio et al., 2017). Thus,

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GAD symptoms represent a significant source of mental illness-related impairment worldwide.

Sexual minorities, such as lesbian, gay, and bisexual (LGB) people, are at increased risk of anxiety and mood disorders, including GAD (e.g., Cochran et al., 2003). In a study of 30,070 people from the Stockholm public health cohort, LGB individuals were found to be more likely to be in treatment for anxiety disorders and to be taking antidepressants (Bränström, 2017). The National Comorbidity Study, a nationally representative survey conducted in the USA, also found increased prevalence of mood, anxiety, and substance use disorders for people reporting same-sex sexual partners (Gilman et al., 2001). Population-based reports (Fergusson et al., 1999; Cochran & Mays, 2000; Sandfort et al., 2001; Cochran et al., 2003; Borgogna et al., 2019) and meta-analyses (King et al., 2008; Meyer, 2003) have shown that non-heterosexual men and women have at least twice the risk of mood and anxiety disorders compared with heterosexual individuals of the same gender; this relationship is moderated by perceived discrimination and hate crime victimization. Studies of siblings have shown that the relationship between poor psychological outcomes and sexual orientation is related to both genetic and environmental familial factors (Frisell et al., 2010). Twin studies have also suggested that environmental factors, including stigma and microaggressions, play a significant role in the development of rumination, a risk factor for anxiety (Timmins et al., 2017), though these environmental factors do not fully explain observed disparities between heterosexual individuals and sexual minorities. Sexual minorities also report higher levels of general psychological distress than heterosexuals, suggesting lower psychological well-being even in those who are not diagnosed with a mental disorder (Riggle et al., 2009; Leonard et al., 2015). This increased prevalence of anxiety and mood disorders suggests that factors specific to the experience of LGB people may heighten their risk of GAD.

While identification with a sexual minority group may be associated with anxiety, self-identification with a minority sexual group does not in itself arouse anxiety (see Bailey, 1999; Branscombe et al., 1999; Crocker & Major, 1989; Pachankis et al., 2020; Savin-Williams, 2006). One possible contributor to mental health disparities for sexual minorities is structural stigma within the political, institutional, and cultural environment that members of these minority groups inhabit. Structural stigma consists of institutional policies that negatively affect stigmatized groups and dominant cultural norms that mark particular traits or identities as devalued (Hatzenbuehler, 2016). For instance, policies that do not allow same-sex marriage restrict the life experiences of LGB citizens even if those citizens do not have adverse experiences with individual members of their communities. Structural stigma against sexual minorities is

associated with greater concealment of minority sexual orientations (Pachankis, 2007; Pachankis & Bränström, 2018, 2019), indicating that these structural effects can contribute to stigma-related behavior changes. Structural stigma is also associated with adverse mental health outcomes; for instance, LGB residents of US states that passed constitutional amendments against same-sex marriage showed a 248% increase in GAD after the passage of the amendments, while residents of other states showed no increase in the same time period (Hatzenbuehler et al., 2010). The experience of structural stigma can vary within the broader group of sexual minorities. For instance, measures of structural stigma that are not specific to bisexuality do not predict psychosocial and health outcomes among bisexuals (e.g., Hatzenbuehler et al., 2018), and responses to stigma (e.g., concealment) differ for gay and bisexual men (Balsam & Mohr, 2007); these differences may be due to the fact that prejudice and discrimination related to bisexuality involves different stereotypic content and sources than prejudice related to homosexuality (Bostwick & Dodge, 2019; Dodge et al., 2016; Worthen, 2013).

While structural stigma against LGB people remains a worldwide problem, the degree of discrimination that sexual minorities experience varies by cultural context. One source of variation arises from the diverse ways in which governments protect or discriminate against LGB residents. Some nations provide equal or near-equal legal protections and benefits to LGB citizens and heterosexual citizens, while others impose criminal sanctions (up to and including capital punishment) for same-sex sex acts and relationships (Carroll & Mendos, 2017). These differences in structural stigma and risk of discrimination could contribute to differences in mental health. Thus, a comprehensive understanding of this relationship requires the consideration of differences in LGB people's experiences across countries and cultural contexts.

Research among LGB people in the USA has shown that structural stigma is associated with mental health outcomes. For example, in a study of sexual minority men in Massachusetts, mental health care visits and costs decreased after Massachusetts legalized same-sex marriage (Hatzenbuehler et al., 2012). Marriage equality laws have also been found to be associated with a reduction in the proportion of adolescents endorsing past-year suicide attempts (Raifman et al., 2017). In contrast, laws permitting refusal of services to LGB people have been found to be associated with higher rates of mental distress among sexual minority people (Raifman et al., 2018). Within the USA, sexual minority individuals have also been shown to experience greater self-stigmatization and anxiety and lower subjective well-being in environments where same-sex marriage was illegal than in environments in which it was permitted, supporting the relevance of structural stigma to mental health (Tatum, 2017). International research on the role of structural stigma in mental health is more limited but has shown a similar relationship; in a

survey of LGB residents of 28 European countries, international differences in structural stigma explained 60% of international differences in life satisfaction (Pachankis & Bränström, 2018). However, the role of structural stigma in anxiety has not been examined on an international scale. An updated examination of the relationships between sexual minority status and anxiety symptoms across nations with varying levels of acceptance of sexual minority relationships is warranted.

In the current study, we examine the relationship between sexual minority status, structural stigma, and GAD symptoms. We measured GAD symptoms in sexual minority participants in environments with varying legal policies regarding the rights and protections of sexual minorities and compared their symptoms against both heterosexual participants in similar environments and sexual minority participants in different legal and political contexts. Our primary hypotheses are that (1) participants who are members of sexual minority groups will report more GAD symptoms than heterosexual participants, and (2) GAD symptoms in sexual minority participants will be more severe in participants from countries with greater structural stigma. Our hypotheses are grounded in the prior work on sexual minority discrimination and structural stigma.

We chose to focus on two policy areas as examples of structural stigma: marriage inequality and criminalization of same-sex sexual acts. These policies have the power to shape the opportunities available to members of sexual minorities. Previous research indicates that changes in these policy areas can have strong effects on the quality of life and mental health of sexual minorities (Hatzenbuehler et al., 2010; Jain, 2013; Raifman et al., 2017). In addition, there has been widespread change in these policy areas in recent years; over 10 countries have decriminalized same-sex sex acts over the past 10 years (Roeder, 2020; Savage, 2019), while 28 countries have legalized same-sex marriage in the past 3 decades (CFR Staff, 2021). Thus, these policy areas are particularly relevant when examining the potential impact of policy on mental health.

Methods

Participants

Our sample consisted of 5,929 participants who completed the GAD-7 assessment on TestMyBrain.org. Data were collected from May 2018 to October 2018. TestMyBrain is a citizen science research platform that allows people to participate in studies of behavior and cognition, in exchange for individualized feedback on their performance or self-reported characteristics. Data from TestMyBrain.org has been shown to be of similar high quality to data gathered in a lab setting (Germiné et al., 2012). After completing the task, participants received feedback on their results relative to other individuals who had completed the same test.

Participants ranged in age from 18 to 79 years old, with an average age of 33.56 years. The sample contained similar numbers of male and female participants (51.44% male, 48.56% female). In addition to the 5,929 participants included in this analysis, 51 participants reported a gender identity other than male or female. This group was excluded from analysis due to inadequate statistical power. While the majority (64.36%) of the sample reported speaking English as a first language, participants were highly diverse in their national background, with 153 countries represented. For further information on the demographic characteristics of the sample, see Table 1. For more detailed information on the national background of our participant group, see Table 2.

Measures

Generalized Anxiety Disorder Questionnaire (GAD-7; Spitzer et al., 2006)

Symptoms of anxiety were measured using the GAD-7, a 7-item self-report scale assessing the defining symptoms of generalized anxiety disorder. Scores range from 0 to 21, with higher scores indicating more severe anxiety symptoms. The GAD-7 is a valid screening tool for GAD in both primary care settings and the general population (Rutter & Brown, 2017), with strong associations between score and functional impairment due to anxiety symptoms (Spitzer et al., 2006). Internal reliability (split-half method) for this test in our sample was 0.91. Generalized anxiety symptoms were treated as a continuous variable, with higher GAD-7 scores representing more severe anxiety.

Sexual Orientation

To assess sexual orientation, participants were asked to identify themselves as attracted to men, attracted to women, attracted to both men and women, or attracted to neither men nor women. We chose to use a measure of attraction rather than a measure of sexual identity (e.g., asking participants to classify themselves as heterosexual, gay, lesbian, bisexual, asexual, or another identity group) due to cross-cultural differences in the use of sexual identity labels. As such, rates of sexual minority status observed in this sample are related to, but not necessarily directly comparable to, rates of lesbian, gay, bisexual, asexual, or other sexual minority self-identification.

Structural Stigma

The countries in which participants resided while taking the test were classified based on the legal status of same-sex acts and relationships. Information regarding the legal status of

Table 1 Participant characteristics and analysis sample sizes^a

Variable [range]	Analysis <i>N</i>	<i>n</i> (%)	<i>M</i> (<i>SD</i>)
Continent	5,927		
Africa		133 (2.24)	
Asia		1,233 (20.80)	
Australia/Oceania		314 (5.30)	
Europe		1,560 (26.32)	
North America		2,569 (43.34)	
South America		118 (1.99)	
Age [10–89]	5,929		33.56 (14.32)
Gender	5,929		
Male		3,050 (51.44)	
Female		2,879 (48.56)	
Education	5,809		
None		33 (0.57)	
Primary school		22 (0.38)	
Middle school		127 (2.19)	
High school		904 (15.56)	
Some college		1,447 (24.91)	
Technical training/associate's degree		352 (6.06)	
Bachelor's degree		1,595 (27.46)	
Graduate school		1,329 (22.88)	
Sexual attraction	5,929		
Opposite sex		4,874 (82.21)	
Same sex		259 (4.37)	
Both sexes		696 (11.74)	
Neither sex		100 (1.69)	
Race	5,390		
American Indian or Alaska Native		215 (3.99)	
Asian		1,307 (24.25)	
African/Black		294 (5.45)	
European/White		3,803 (70.56)	
Native Hawaiian or Pacific Islander		54 (1.00)	
Ethnicity	5,214		
Hispanic		450 (8.63)	
Non-Hispanic		4764 (91.37)	
Native language	5,929		
English		3,816 (64.36)	
Other		2,113 (35.64)	
National income level	5,920		
High		4,442 (75.03)	
Upper middle		485 (8.19)	
Lower middle		962 (16.99)	
Low		31 (0.52)	

^aParticipants were asked to select all categories that applied when reporting their race. Thus, percentages do not add to 100. Income categories are based on the World Bank Atlas method: low-income countries are those with gross national income (GNI) per capita \leq \$995, lower middle-income countries are those whose GNI per capita is between \$996 and \$3,895, upper middle-income countries are those whose GNI per capita is between \$3,896 and \$12,055, and high-income countries are those with GNI per capita \geq \$12,056 (World Bank, 2019)

Table 2 National background of study participants^a

Country	N (%)	Income	Marriage equality/ civil unions	Criminalization of same-sex sex acts
USA	2,225 (37.53)	High	Yes	No
India	676 (11.40)	Lower middle	No	Yes
UK	609 (10.27)	High	Yes	No
Canada	279 (4.71)	High	Yes	No
Australia	263 (4.44)	High	Yes	No
Sweden	106 (1.79)	High	Yes	No
France	90 (1.52)	High	Yes	No
Germany	81 (1.37)	High	Yes	No
Ireland	70 (1.18)	High	Yes	No
Philippines	69 (1.16)	Lower middle	No	No
Malaysia	68 (1.15)	Upper middle	No	Yes
South Africa	63 (1.06)	Upper middle	Yes	No
Brazil	60 (1.01)	Upper middle	Yes	No
Other countries	1,270 (21.42)	Varied	Varied	Varied

^aTable 2 includes data on countries making up > 1% of the total participant group

sexual minorities in each country was taken from the 2016 report *State-Sponsored Homophobia* from the International Lesbian, Gay, Bisexual, Trans and Intersex Association (Carroll & Mendos, 2017). In our analysis, we chose to focus on two policy areas: laws criminalizing same-sex sex acts and marriage inequality (lack of legal recognition of same-sex marriages or civil unions). These policies were chosen as examples of legal persecution and lack of legal protection for sexual minorities for which data was widely available. Countries were classified based on their policies at the time data was collected; some countries have changed their policies toward sexual minorities since this time.

Data Analysis

All data analysis was performed in R. Statistical significance of the relationship between sexual orientation and structural stigma was assessed using mixed effects models. To examine the main effect of demographic characteristics and sexual orientation within the entire sample, we fit a mixed-effects model (model 1) with fixed effects of sexual orientation, racial background, ethnicity (Hispanic/non-Hispanic), age, and gender, as well as the random effect of country to control for country-level differences in participant characteristics. Due to significant gender differences in self-reported GAD symptoms, models examining the interaction of structural stigma factors and sexual orientation were stratified by gender. To examine the relationship between sexual orientation, marriage inequality, and GAD symptoms, we fit models including fixed effects of marriage inequality, sexual orientation, racial background, ethnicity, age, and gender, interaction effects of marriage inequality and sexual orientation, and the random effect

of country in male participants (model 2) and female participants (model 3). To examine the relationship between sexual orientation, criminalization of same-sex sex acts, and GAD symptoms, we fit models including fixed effects of criminalization of same-sex sex acts, sexual orientation, racial background, ethnicity, age, and gender, interaction effects of criminalization of same-sex sex acts and sexual orientation, and the random effect of country in male participants (model 4) and female participants (model 5). Participants who reported attraction to the opposite sex only were used as the comparison group for the other sexual orientation groups in all models. Racial groups represented in our sample were dummy-coded, with binary variables representing African ancestry, Asian ancestry, Native American/Alaska Native ancestry, Native Hawaiian/Pacific Island ancestry, multiple racial backgrounds, and unknown racial backgrounds; European ancestry was used as the comparison group since it was the largest group in our sample. Bonferroni correction was applied to correct for the number of comparisons when interpreting gender-stratified models (4 comparisons: 2 gender variables and 2 structural stigma variables), with an alpha threshold of 0.05. All reported *p*-values are two-tailed.

Results

Descriptive Statistics

The mean GAD-7 score for all participants was 9.18 (*SD* = 5.80). Of 5,929 total participants, 4,378 (73.84%) were in countries that recognized same-sex marriages and/or civil unions while participating in the study, while

1,010 were in countries with criminal penalties for homosexuality and 532 (8.97%) were in countries with marriage inequality but without criminalization of same-sex sex acts (the remaining 9 did not have enough information to classify). Mixed-effects models showed low intra-class correlation after controlling for demographic factors (model 1: adjusted ICC = 0.027; model 2: adjusted ICC: 0.052; model 3: adjusted ICC: 0.010; model 4: adjusted ICC = 0.051; model 5: adjusted ICC = 0.010), indicating that country-level factors were not a strong predictor of GAD-7 score.

Demographic Predictors of Generalized Anxiety Symptoms

As predicted from previous research of this nature, the average GAD-7 score of female participants was higher than that of male participants (see Rutter et al., 2019), indicating that they reported more symptoms of generalized anxiety (see Table 3). Model 1 showed a significant effect of gender. It also showed a significant effect of age, with GAD-7 scores decreasing with increasing age. There was no significant main effect of race or ethnicity. Parameter estimates derived from model 1 can be found in Table 3.

Sexual Orientation and GAD-7 Scores

Model 1 identified sexual orientation as a significant predictor of GAD-7 scores. Participants who reported attraction to both sexes had higher GAD-7 scores than those who reported attraction to the opposite sex only. Participants who reported attraction to the same sex only also had higher GAD-7 scores than those who reported attraction to the opposite sex only. Participants who reported attraction to neither sex did not significantly differ in GAD-7 scores from those who reported attraction to the opposite sex only. These results support our prediction that sexual minority participants experience more GAD symptoms than those with only opposite-sex attraction. See Table 4 for descriptive statistics on anxiety symptoms stratified by sexual attraction and gender. Parameter estimates derived from model 1 can be found in Table 3.

Sexual Orientation, Structural Stigma, and GAD-7: Interaction Effects

In order to explore the role of structural stigma in the relationship between sexual orientation and GAD symptoms, we also examined the effect of the interaction of reported sexual attraction and country-level discriminatory policies (marriage inequality and criminalization of same-sex

sex acts) on GAD-7 scores. Contrary to our predictions, we found no significant interaction effect on GAD-7 score between any minority sexual orientation status (same-sex, both-sex, or neither-sex attraction) and marriage inequality or criminalization of same-sex sex acts in male or female participants. This indicates that marriage inequality and criminalization of same-sex sex acts did not moderate the relationship between sexual orientation and anxiety symptoms in our sample. See Table 5 for descriptive statistics on anxiety symptoms stratified by nation-level policy, gender, and sexual attraction. Parameter estimates derived from models 2, 3, 4, and 5 can be found in Table 3.

Discussion

The purpose of this study was to examine the relationship between sexual orientation, structural stigma against sexual minorities, and symptoms of generalized anxiety disorder. To examine the differential impact of the experience of structural stigma against sexual minorities, we conducted this study in an international sample that includes participants from environments that differ in the extent to which sexual minority individuals face structural stigma. We hypothesized that sexual minority participants would report higher levels of GAD symptoms than non-minority groups, and that this difference would be greater in countries with policies that discriminate against sexual minorities.

Consistent with our first hypothesis, there was a significant association of same- and both-sex attraction and GAD-7 scores, such that sexual minority participants reported higher levels of anxiety symptoms than opposite-sex attracted participants. However, our second hypothesis was not confirmed; we did not find any significant interaction effects between marriage inequality and criminalization of same-sex sex acts. Our findings on the relationship between sexual minority status and anxiety symptoms across countries are in line with previous studies (conducted using participants from a single country) showing increased rates of generalized anxiety disorder in sexual minority individuals (Bostwick et al., 2010). Our findings on the interaction of sexual orientation, structural stigma, and anxiety symptoms require further explanation, since they contradict our expectations about the effects of discrimination on mental health.

One possible contributor to this unexpected finding is the nature of the information we used to classify sexual minority participants. While laws and policies affect all residents of a country, it is possible that the internalized stigma and deleterious mental health effects linked to structural stigma is contingent upon identifying as a sexual minority (e.g., one would not internalize negative attitudes about gay men if they themselves do not identify as a gay man). Same- or both-sex attracted people who do not personally identify as

Table 3 Parameter estimates from models of sexual orientation, structural stigma, and generalized anxiety symptoms^a

Variable	<i>B</i>	Standard error	<i>t</i>	<i>p</i>
<i>Model 1 (full sample)</i>				
Both-sex attraction	1.61	0.24	6.81	<0.001***
Same-sex attraction	0.99	0.36	2.74	0.006**
Attraction to neither sex	0.39	0.57	0.68	0.50
Female gender	1.05	0.15	6.81	<0.001***
Age	-0.07	0.01	-12.82	<0.001***
African ancestry	-0.71	0.40	-1.76	0.08
Asian ancestry	-0.40	0.24	-1.63	0.10
Native American ancestry	0.87	0.59	1.47	0.14
Pacific Island ancestry	-0.88	1.07	-0.83	0.41
Mixed-race ancestry	0.46	0.35	1.31	0.19
Unknown ancestry	0.14	0.28	0.49	0.62
Hispanic ethnicity	-0.33	0.30	-1.09	0.28
<i>Model 2 (male participants, marriage inequality)</i>				
Both-sex attraction	2.19	0.58	3.77	<0.001***
Same-sex attraction	1.72	0.53	3.26	0.001**
Attraction to neither sex	1.37	1.20	1.14	0.25
Marriage inequality	0.10	0.48	0.21	0.83
Both-sex attraction: marriage inequality	-0.89	0.95	-0.93	0.35
Same-sex attraction: marriage inequality	-2.02	1.65	-1.22	0.22
Attraction to neither sex: marriage inequality	-1.92	1.89	-1.01	0.31
<i>Model 3 (female participants, marriage inequality)</i>				
Both-sex attraction	1.53	0.31	5.00	<0.001***
Same-sex attraction	0.73	0.56	1.30	0.19
Attraction to neither sex	0.39	0.92	0.42	0.68
Marriage inequality	0.14	0.43	0.32	0.75
Both-sex attraction: marriage inequality	-0.90	0.71	-1.28	0.20
Same-sex attraction: marriage inequality	-1.97	1.43	-1.38	0.17
Attraction to neither sex: marriage inequality	-1.71	1.52	-1.13	0.26
<i>Model 4 (male participants, criminalization)</i>				
Both-sex attraction	2.21	0.53	4.20	<0.001***
Same-sex attraction	1.59	0.52	3.09	0.002**
Attraction to neither sex	1.51	1.15	1.31	0.19
Criminalization	0.54	0.59	0.92	0.36
Both-sex attraction: criminalization	-1.49	1.09	-1.36	0.17
Same-sex attraction: criminalization	-1.01	2.05	-0.49	0.62
Attraction to neither sex: criminalization	-2.65	1.95	-1.36	0.17
<i>Model 5 (female participants, criminalization)</i>				
Both-sex attraction	1.52	0.29	5.19	<0.001***
Same-sex attraction	0.56	0.53	1.06	0.29
Attraction to neither sex	0.15	0.84	0.18	0.86
Criminalization	0.45	0.54	0.85	0.40
Both-sex attraction: criminalization	-1.50	0.90	-1.68	0.09
Same-sex attraction: criminalization	-2.40	2.38	-1.01	0.31
Attraction to neither sex: criminalization	-1.72	1.71	-1.01	0.32

^aIn addition to the variables presented, models 2–5 also included variables for age, racial background, and ethnicity

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

Table 4 Mean (SD) GAD-7 scores by reported sexual attraction

Gender	Same sex	Opposite sex	Both sexes	Neither sex
Male	9.75 (6.46)	8.48 (5.67)	10.52 (5.72)	10.08 (6.14)
Female	10.12 (6.35)	9.30 (5.75)	11.36 (5.72)	9.69 (5.80)

a sexual minority would thus not be affected by proximal stress processes in the same way as self-identified members of minority groups. In this study, we used a measure of sexual attraction to operationalize sexual orientation, but we did not assess self-identification; it is possible that the group of people who report sexual minority status in a measure of attraction differ from self-identified members of sexual minority groups in ways that affect their experience of structural stigma. Future research should also assess level of sexual minority self-identification and internal stigma (see Link & Phelan, 2001 for a review).

Another factor that may have impacted our results is barriers to participation. Barriers to participation could differentially affect sexual minority participants or participants in countries with more discriminatory policies. One such barrier is knowledge of English, since study materials, including the GAD-7 were presented in English. A total of 76.76% of participants from countries with marriage equality reported speaking English as a native language, while only 37.00% of participants from countries where same-sex sex acts were criminalized did. A second possible barrier to participation is reluctance to disclose sexual orientation, particularly in high-legal-discrimination environments. Participants from countries where same-sex sex acts were criminalized were far less likely to self-report sexual minority status than participants in other environments; only 10.3% of participants from these countries reported same- or both-sex attraction, compared to 17.6% of participants from countries with marriage equality. This suggests that sexual minority

participants in environments of high structural stigma may be less willing to disclose their sexual orientation or to participate in online research, possibly due to fear of social or legal consequences. A summary of possible barriers to response can be found in Table 6.

The fact that marriage inequality and criminalization of same-sex sex acts were not significant moderators of the relationship between sexual orientation and anxiety symptoms could also suggest that forms of stigma other than structural stigma contribute to the high level of anxiety symptoms seen in sexual minorities. While sexual minority participants in countries with less discriminatory policies against sexual minorities (e.g., marriage equality) experience less structural stigma, homophobia is still widespread in these countries; for instance, as of 2014, 40.1% of respondents in the USA believed same-sex sexual relationships to be “always wrong,” while a 2017 survey showed that 32% of US respondents oppose same-sex marriage (Glick et al., 2015; Pew Research Center, 2017); it is possible that this social stigma, rather than structural stigma, contributes to anxiety symptoms. Structural stigma against sexual minorities is also associated with greater concealment of minority sexual orientations (Pachankis, 2007; Pachankis & Bränström, 2018, 2019), which could affect any relationship between structural stigma on anxiety symptoms, since people who conceal their sexual orientation interact with their social and structural environment differently from those who do not conceal their orientation. Further research would be necessary to investigate these possibilities.

While rates of GAD in same-sex and both-sex attracted individuals have been the subject of previous research, this study is unique in the size and diversity of its sample. Past studies of LGB mental health have often been limited to participants from a single country or region. By contrast, our sample represents a wide variety of national and cultural backgrounds (including participants from 6 continents and

Table 5 Mean (SD) GAD-7 scores by reported sexual attraction and nation-level policy

Policy status	Same sex	Opposite sex	Both sexes	Neither sex
All participants				
Same-sex sex acts criminalized, no marriage equality	9.50 (4.74)	9.56 (5.33)	10.13 (5.27)	8.68 (5.31)
Same-sex sex acts legal, no marriage equality	8.50 (5.35)	8.98 (5.52)	11.14 (4.39)	9.80 (5.07)
Same-sex sex acts legal, marriage equality	10.07 (6.57)	8.65 (5.82)	11.35 (5.93)	10.02 (6.07)
Male participants				
Same-sex sex acts criminalized, no marriage equality	10.38 (3.78)	9.47 (5.27)	10.33 (5.71)	8.54 (5.81)
Same-sex sex acts legal, no marriage equality	7.40 (4.50)	8.63 (5.55)	10.91 (4.72)	12.00 (0.00)
Same-sex sex acts legal, marriage equality	9.80 (6.67)	8.11 (5.78)	10.52 (6.00)	9.82 (5.97)
Female participants				
Same-sex sex acts criminalized, no marriage equality	8.33 (5.96)	9.80 (5.49)	10.00 (5.00)	8.80 (5.03)
Same-sex sex acts legal, no marriage equality	8.92 (5.62)	9.51 (5.45)	11.27 (4.25)	9.25 (5.60)
Same-sex sex acts legal, marriage equality	10.36 (6.47)	9.20 (5.80)	11.53 (5.90)	10.13 (6.20)

Table 6 Structural stigma against sexual minorities and potential barriers to response

Policies	% native English	% same-sex attraction	% both-sex attraction
Same-sex sex acts legal, marriage equality	77.0	5.2	12.4
Same-sex sex acts legal, no marriage equality	18.0	3.3	12.0
Same-sex sex acts criminalized, no marriage equality	34.2	1.4	8.9

159 countries). This allows us to examine differences in anxiety symptoms between participants from different countries and regions, allowing a more comprehensive understanding of the association between sexual orientation, political environment, and GAD.

Our sample also includes a high number of participants who report attraction to people of the same gender, with 16.11% of participants reporting attraction to the same sex only or to both sexes, as well as 1.69% reporting attraction to neither men nor women. This is higher than the 11% of the US population that reports at least some same-sex attraction (Gates, 2011). The high rate of non-heterosexual attraction may be due in part to the fact that surveys were administered anonymously and without direct interaction with researchers, since some participants are more willing to admit to stigmatized sexual behavior when data are collected in completely anonymous surveys compared to confidential but non-anonymous methods (Alexander & Fisher, 2003). Thus, the additional anonymity of research conducted online may encourage more participants to disclose stigmatized sexual orientations, allowing us to examine the role of sexual orientation in detail across social and cultural environments.

While we were able to capture a large and diverse sample, our study design suffers from threats to external validity due to selection bias. Specifically, recruitment of international participants was limited by the fact that all tests and instructions on the TestMyBrain platform are currently available only in English. This likely biases our sample towards participants from English-speaking countries and participants from other parts of the world with higher levels of education, thus limiting generalizability to individuals who do not speak English. In addition, while our sample is larger and more diverse than the majority of previous research on sexual orientation and mental health, it is nonetheless potentially subject to selection effects.

Another limitation is that we relied on limited information to categorize structural stigma. One challenge for future research in this topic is the need for an assessment of an individual's experience of structural stigma that balances objectivity and specificity. While marriage inequality and criminalization of homosexuality provide some important information about the structural stigma to which sexual minorities living in that country are exposed, they cannot be assumed to reflect the experience of each individual participant. Future research could examine the relationship

between anxiety symptoms and a broader range of policies related to the legal status of sexual minorities using a more comprehensive measure such as a structural stigma index (see Pachankis & Bränström, 2018, 2019). An alternative approach is to use self-report measures that examine an individual's perceived experience of structural stigma, although this method would be difficult to interpret in relation to symptoms of anxiety due to the association of anxiety with the interpretation of ambiguous situations as threatening (Muris et al., 2000). Future research may need to develop methods for assessing an individual's specific experiences of sexuality-related structural stigma that are not affected by pre-existing anxiety levels.

Additional research will be needed to examine the unexpected relationship between structural stigma and the effect of sexual minority status on anxiety symptoms. To determine the nature of this association, it may be necessary to examine uncertainty in participants' experience of structural stigma. Further research could also examine the role of other stressors in participants' lives and their interaction with sexual orientation and structural stigma. These factors could include other stressors related to minority identities, including transgender status and minority gender identities. In further studies, one could also increase diversity and representativeness by including surveys and self-report measures in multiple languages, allowing people from non-English-speaking countries to participate.

These findings demonstrate the need to address sexual minority mental health in social policy while also emphasizing the need to look beyond the immediate effects of individual policies related to sexual orientation. While marriage inequality and criminalization of same-sex sex acts can have enormous impacts on the lives of people living under these policies, these policies did not moderate the relationship between sexual orientation and anxiety symptoms. Interventions to improve mental health outcomes in sexual minorities are necessary even in policy environments with little overt legal discrimination. Future research could examine the effects of efforts to address sexual minority mental health in environments that differ in their level of structural stigma. While the policies we examined did not moderate the relationship between sexual orientation and anxiety symptoms in this study, the policy environment could affect the efficacy of interventions to address this disparity.

While not entirely in line with our hypotheses, the results of this study reinforce previous findings that suggest a relationship between sexual orientation and anxiety. Our analysis showed an association between sexual minority status and generalized anxiety symptoms that were not moderated by marriage inequality or criminalization of same-sex sex acts, in contrast to our expectations regarding the relationship between structural stigma and anxiety. The international online sample enabled us to survey a diverse group of participants, providing insight into the experiences of sexual minorities of varied national and cultural backgrounds. Further research will be valuable in determining the relationship between structural stigma and generalized anxiety symptoms in members of sexual minorities worldwide. A nuanced model of this relationship will improve our understanding of the impact of structural stigma on mental health and could contribute to the development of more effective mental health support for sexual minorities in stigmatizing environments.

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Data Availability The datasets generated and/or analyzed during the current study are available in the Open Science Foundation repository project “Associations Between Legally Enforced Discrimination Against Same-Sex Relationships and Generalized Anxiety Disorder Symptoms in an International Sample” at the following link: https://osf.io/8ts4r/?view_only=0873ada91e414f52bc5278077d0969e0

Code Availability Code used to analyze data for this study is available in the Open Science Framework repository project “Associations Between Legally Enforced Discrimination Against Same-Sex Relationships and Generalized Anxiety Disorder Symptoms in an International Sample” at the following link: https://osf.io/8ts4r/?view_only=0873ada91e414f52bc5278077d0969e0

Declarations

Ethics Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the [blinded for peer review] Committee on the Use of Human Subjects under Protocol 15975, and with the 1964 Helsinki declaration and its later amendments.

Consent to Participate All participants completed a digital informed consent form prior to participation.

Consent to Publish Not applicable.

Competing Interests The authors declare no competing interests.

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