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Migraine, Migraine Disability, Trauma, and Discrimination in Sexual and Gender Minority Individuals

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ABSTRACT

Objective: This study sought to describe migrainous headache frequency and severity and to examine the relationship between trauma, discrimination, and migraine-associated disability in a sample of sexual and/or gender minority (SGM) adults.

Methods: We performed a cross-sectional study of SGM people in The Population Research in Identity and Disparities for Equality (PRIDE) Study from August-October 2018. The primary exposure was any trauma or discrimination, regardless of attribution. The primary outcome was moderate-severe migraine disability, as defined by a Migraine Disability Assessment (MIDAS) Questionnaire score ≥ 11 . We performed descriptive analysis comparing respondents with any migrainous headache to those without. Multivariable logistic regression examined the association between trauma/discrimination and migraine disability, controlling first for sociodemographic and clinical factors and then for psychiatric comorbidities.

Results: Of the 3,325 total respondents, 1,126 (33.9%) screened positive for migrainous headache by ID-Migraine criteria. Most people with migraine self-reported moderate (n=768, 68.2%) or severe (n=253, 22.5%) intensity. The median MIDAS score was 11 (interquartile range [IQR] 5-25). Most respondents with migraine (n=1055, 93.7%) reported a history of trauma or discrimination. In unadjusted analysis, exposure to both trauma and discrimination was associated with higher odds of moderate-severe disability (OR 1.76, 95% CI 1.34-2.32). After adjustment for self-reported psychiatric comorbidities of anxiety, depression, and post-traumatic stress disorder, this association lost statistical significance.

Conclusion: Migrainous headache is common among our sample of SGM adults, and prior experiences with trauma and discrimination is associated with increased migraine disability. Our findings suggest that psychiatric comorbidities play a significant role in this relationship, identifying a potentially modifiable risk factor for disability in SGM people with migraine.

INTRODUCTION

Migraine is a common and often debilitating neurologic condition. Migraine is second only to stroke as the leading contributor to disability-adjusted life-years globally.¹ Migraine is associated with a number of comorbidities, including higher rates of ischemic stroke, gastrointestinal disorders and psychiatric disorders, which can contribute to further disability.^{2,3} Studies suggest greater odds of migraine in presumably cisgender lesbian women, cisgender gay men, and bisexual people of any gender;^{4,5} however, little is known about migraine prevalence and severity in transgender and gender non-binary individuals. Risk factors for migraine-associated disability in sexual and/or gender minority (SGM) individuals (an inclusive term used to describe individuals whose sexual orientation and/or gender identity do not align with societal

expectations based on their birth-assigned sex, including, but not limited to, those who identify as lesbian, gay, bisexual, transgender, and queer [LGBTQ+]) are also unknown. Studies in other populations, namely cisgender women and adolescents, have demonstrated associations between a history of trauma and greater prevalence and severity of migraine.⁶⁻⁸ In particular, studies suggest a dose-response relationship between more instances of trauma and both higher migraine disability^{8,9} and evolution of migraine from episodic to chronic.¹⁰ This relationship may, in part, be mediated through mental health. A study of 1,051 young adults found that migraine was associated with the development and severity of post-traumatic stress disorder (PTSD) symptoms, not trauma exposure itself.¹¹

SGM communities face particular risk for trauma, including a high prevalence of interpersonal violence and assault in the setting of societal stigma and discrimination.¹²⁻¹⁵ SGM people experience higher risk of mental and physical disability compared to heterosexual, cisgender (i.e., non-transgender) peers^{16,17} and have disparate prevalence of mental health concerns, including higher rates of depression, anxiety, and PTSD.¹⁷⁻¹⁹ It is also unknown if SGM individuals experience barriers to accessing neurologic care for the treatment of migraine, such as prolonged wait times²⁰, issues with health insurance,²¹ or not being offered appropriate treatment options.²² Understanding the current state of migraine care is an essential step towards improving the neurologic health of SGM individuals.

The purpose of this study, therefore, was to describe migrainous headache frequency, severity, and access to care in a cohort of SGM adults and to examine the relationship between a history of trauma and/or discrimination and migraine-associated disability in SGM individuals.

METHODS

Study Design

We performed a cross-sectional study of SGM individuals in The Population Research in Identity and Disparities for Equality (PRIDE) Study - a national, online, prospective longitudinal cohort study of the physical, mental, and social health of SGM adults.²³ We developed a 68-question survey, incorporating validated measures for screening for migraine-type headache and migraine disability (see “Measurements” below)^{24–27} and using previously created items in The PRIDE Study to identify a history of traumatic and discriminatory experiences (Supplement 1). The survey was reviewed by The PRIDE Study’s Participant Advisory Committee, Research Advisory Committee, and leadership for clarity and language appropriateness before distribution to all participants in The PRIDE Study via its online research platform between August 2018 and October 2018.

Standard Protocol Approvals, Registrations, and Patient Consents

The University of California San Francisco Institutional Review Board (#18-26982) and the Stanford University School of Medicine Institutional Review Board (#48707) approved this study. All procedures performed in this study were in accordance with the ethical standards of the universities’ Institutional Review Board and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all participants via The PRIDE Study’s online platform.

Study Sample

The PRIDE Study participants were recruited via convenience/volunteer sampling using a variety of online advertising, social media, community-based advertising, and word-of-mouth. Additionally, The PRIDE Study's Community Partners sent directed requests to their constituents as facilitated by PRIDENet – the community engagement vehicle that works with The PRIDE Study (pridestudy.org/pridenet). Eligible participants were at least 18 years old at the time of enrollment, lived in the United States or its territories, identified as sexual and/or gender minority, and were comfortable reading and writing in English.

Participants

This study exploring headache in SGM individuals was offered to all participants in The PRIDE Study. Those with any self-reported history of headache, as determined by an initial screening question, were offered the full survey. Because the goal of the study was to investigate the care experiences and disability of those with migrainous headaches, those without a self-reported history of headache were only asked demographic questions.

We identified individuals with migrainous-type headache using the ID-Migraine screening tool (see “Measurements” below). We excluded individuals with missing responses to the ID-Migraine questions and those who did not meet this screening criterion for migraine from the final analysis.

Measurements

Participants were asked for current gender identity (*genderqueer, man, transgender man, transgender woman, woman, or another gender identity with a write-in response such as agender or non-binary*) with the ability to select multiple identities. Participants selected the sex that was assigned to them at birth (SAAB; *female, male*).²⁸ Participants were asked how they described their current sexual orientation (*asexual, bisexual, gay, lesbian, pansexual, queer, questioning, same-gender loving, straight/heterosexual, or another sexual orientation with a write-in response such as demisexual or polysexual*), with the ability to select multiple identities. Participants' age, race/ethnicity, and education level at the time of ancillary study completion were linked through unique participant identifiers to existing demographic data collected in The PRIDE Study online research platform, which has been described elsewhere.²³ Participants identifying as "Native Hawaiian or other Pacific Islander" and "American Indian or Alaska Native" were included in the "another race" category, due to the small number of participants who endorsed these identities.

We identified individuals with migrainous-type headache using the validated ID-Migraine tool, in which answering "yes" to two out of three dichotomous (yes/no) questions (having headache associated with nausea, photophobia or impaired functioning in the last three months) is defined as screening positive for migrainous headache.^{25,27} Respondents who answered "yes" or "I don't know" to the initial headache screening question and met ID-Migraine criteria were classified as having migrainous headache. Those who answered "yes" and did not meet criteria were classified as having non-migraine type headaches, as were those who responded "I don't know" and reported at least 1 headache in the prior 3 months. Migraine disability was assessed using the Migraine Disability Assessment (MIDAS) Questionnaire, in

which participants reported the number of days in the last three months in which they missed or had reduced productivity in work, school, household tasks or social events due to headache through a series of five questions.²⁴

We asked participants if they had ever used gender affirming hormone therapy (feminizing, such as estrogen, or masculinizing, such as testosterone) as these may affect migraine frequency and severity.²⁹ We asked about prior diagnosis of stroke and associated medical comorbidities (hypertension, hyperlipidemia, diabetes), history of psychiatric diagnoses (anxiety, depression, post-traumatic stress disorder [PTSD]), current mood using the Patient Health Questionnaire-9 (PHQ-9), and current or former tobacco use; these comorbidities have all been associated with migraine occurrence and frequency.

To evaluate access to care, participants were asked about any prior use of headache abortive and preventive medications, with a list of possible medication options provided to those who responded “yes” or “I don’t know” to the initial questions. Participants were asked if they had ever wanted or asked to see a neurologist for headache management, if they had trouble finding a neurologist for those interested, and about the primary barrier encountered in finding a neurologist for those who had difficulty.

The primary exposure was a history of violent events, trauma (referred to collectively as “trauma” hereafter) and a history of discrimination events. This exposure was assessed through a series of dichotomous (yes/no) questions assessing lifetime exposure to violence (physical assault, intimate partner violence, or sexual assault), harassment (harassed/name called in public by a stranger, police harassment), and discrimination (unfair treatment in accessing employment, housing, education, physical or mental healthcare, or in accessing services at a business). Prior studies in migraine have predominantly described the association between exposure to trauma

and migraine diagnosis/disability while research on the influence of discrimination is less robust. To explore the potential difference in these exposures, we grouped the exposure variables into those that represented forms of trauma (physical assault, intimate partner violence, or sexual assault) and those that represented forms of discrimination (harassment in public; unfair treatment in employment, housing, education, healthcare, or in accessing services at a business; or police harassment) for analysis. Any history of trauma and/or discrimination was included regardless of the participant's attribution for the experience (*i.e.*, due to sexual orientation, gender identity/expression, race/ethnicity, etc.). For exploratory analyses, we created a continuous variable of the number of different types of experiences, defined as the sum of the number of different types of trauma and discrimination exposures a participant reported (totaling 0-11), which has been used in a prior study.³⁰

Study Outcomes

The primary outcome was moderate-severe migraine disability (versus none-mild), defined as a MIDAS score of 11 or greater, consistent with prior literature and clinical practice.²⁶ Secondary outcomes included number of migraine days over the prior three months and self-reported migraine severity (mild, moderate, severe).

Statistical Analysis

For univariate analysis, we divided the population into those who screened positive for migrainous headache, those with non-migraine headache, and those without headache. Because those without headache were not offered the full survey, we used respondents with non-migraine headache as the comparison group for all analyses other than demographics. We used the chi-

square test to compare categorical variables (gender identity, SAAB, sexual orientation, race, ethnicity, education, and comorbidities) and the analysis of variance (ANOVA) to compare the continuous variable of headache days across headache categories. We used Mann-Whitney U test to compare age, as it was not normally distributed.

For multivariable analysis, we examined the association between migraine disability as a dichotomous outcome (moderate-severe versus none-mild) and a history of any trauma or discrimination using a logistic regression model. The first logistic regression model controlled for sociodemographic and clinical factors associated with migraine occurrence and/or disability: age, race/ethnicity, education, SAAB, and gender-affirming hormone use. The second logistic regression model added psychiatric diagnoses (self-reported history of depression, anxiety, or PTSD). A variance inflation factor (VIF) was checked to ensure that levels of multicollinearity across psychiatric comorbidities were acceptable (VIF: depression 1.21, anxiety 1.26, PTSD 1.22). Because migraine research has not historically analyzed both SAAB and gender identity as distinct variables, it was unclear if gender identity should also be included in the logistic regressions. We therefore performed a sensitivity analysis with and without a dichotomous gender identity variable (gender minority versus cisgender). For this dichotomous variable, cisgender was defined as those participants whose current gender identity was exclusively “man” and SAAB was “male” as well as those whose gender identity was exclusively “woman” and SAAB was “female”; all other participants were defined as a gender minority. Because only 2% of respondents identified as straight/heterosexual, sexual orientation was not included as an independent variable in the multivariable analyses. There were 34 (3.0%) missing race/ethnicity responses, 26 (2.3%) missing education responses, 10 (0.9%) missing gender-affirming hormone

use responses, 4 (0.4%) missing SAAB responses, and 1 (0.1%) missing age response. These observations were excluded from the regression models.

To further explore the associations between migraine disability and different forms of trauma or discrimination, we created three dichotomous outcomes (history of trauma only, history of discrimination only, history of both trauma and discrimination) and repeated the same logistic regression models. We assessed the relationship between migraine disability and a history of any trauma or discrimination using MIDAS as a continuous outcome through a linear regression model with the same independent variables.

We performed a series of exploratory analyses. We used number of trauma/discrimination experiences as a continuous variable to increase power and to explore the effect of accumulating different forms of trauma and/or discrimination over the lifetime. Using the number of experiences and controlling for age, race/ethnicity, education, SAAB, gender-affirming hormone use, and psychiatric diagnoses, we repeated the logistic regression model for migraine disability as a dichotomous variable (severe-moderate versus none-mild) and repeated the linear regression model for migraine disability as a continuous variable (MIDAS score sum).

Statistical significance was set at $\alpha < 0.02$ (Bonferroni correction of $0.05/3$) for both the univariate and multivariate analysis. Statistical analyses were performed using Stata (version 16, StataCorp; College Station, TX).

Data Availability Statement

Members of SGM communities have experienced significant stigma and discrimination from society, including the medical and investigational communities. As such, we are ethically bound to upholding the principle of non-maleficence; we promise our participants to not let any

data (including deidentified) fall into the hands of people who may use it to publish stigmatizing results about the SGM communities. As such, The PRIDE Study developed an ancillary study process in which investigators submit an application that is reviewed by both a Research Advisory Committee (composed of scientists) and Participant Advisory Committee (composed of participants and SGM community leaders) to affirm appropriate data use that aims to improve the health of SGM people. Details about the The PRIDE Study's ancillary study process are available at www.pridestudy.org/collaborate or by contacting us at research@pridestudy.org or 855-421-9991 (toll-free).

RESULTS

A total of 3,325 individuals completed the survey, of which 2,142 (64.4%) had a history of headache. Of those individuals, 1,126 respondents (52.6%) screened positive for migrainous headache (hereafter referred to as respondents with migraine for brevity) using the ID-Migraine criterion (33.9% of the total sample). Respondents predominantly identified as White, not Hispanic/Latinx, and most had obtained at least a 4-year college degree (Table 1). The median age was 32.3 years old (interquartile range 25.9-43.7). About 40% identified as transgender, genderqueer or another gender identity (n=876, 40.9%) and the majority reported a non-heterosexual sexual orientation (n=2113, 98.6%). Overall, 398 (18.6%) respondents with a history of headache had ever used gender-affirming hormone therapy (Table 1).

Migraine in SGM Individuals

Respondents with migraine were younger and less likely to have a graduate degree compared with respondents with non-migraine headache or no headache history (Table 1). Those

with migraine were more likely to have been assigned female sex at birth (Table 1). Gender minority respondents were more likely to have migraine headache (46.3% migraine versus 34.9% non-migraine headache and 27.5% no headache, $p < 0.0001$). Those who identified their sexual orientation as asexual, queer, or pansexual were more likely to have migraine headache, while respondents who identified as gay were less likely (Table 1).

Respondents with migraine were more likely to report having ever had a diagnosis of depression, anxiety, and/or PTSD diagnoses and current tobacco use compared with respondents with non-migraine type headaches (Table 1). Most respondents with migraine self-reported a headache severity of moderate ($n=768$, 68.2%) or severe ($n=253$, 22.5%). The median MIDAS score was 11 (interquartile range [IQR], 5-25). Gender minority respondents with migraine mirrored this pattern, with most self-reporting a headache severity of moderate ($n=365$, 70.7%) or severe ($n=106$, 20.5%), and with a median MIDAS score of 12 (IQR 6-30).

Of the 1126 respondents with migraine, 218 (19.5%) had ever used gender affirming hormone therapy (49 [4.4%] estrogens and/or spironolactone, 168 [14.9%] testosterone). There was no statistically significant difference in the prevalence of moderate-severe migraine disability between those who had used hormones compared with those who had not (32.2% versus 29.4%, respectively, $p=0.285$).

Access to care in SGM individuals with migraine

Most respondents with migraine ($n=971$, 88.0%) had access to a clinic or doctor's office for routine care (Table 2). Forty-two percent ($n=456$) of those with migraine reported that they had wanted to see a neurologist for headache (Table 2). Of these individuals, 170 (37.2%) reported they had difficulty accessing a neurologist. The most commonly endorsed reasons for

this difficulty were lack of insurance approval for the visit (n=35, 20.6%), primary care doctor not placing a referral (n=36, 21.2%), or the neurologist not accepting new patients (n=31, 18.2%). Ten respondents with migraine (5.9%) reported no neurologist in their town/city, and seven (4.1%) reported that the neurologist had refused to see them.

Those with migraine were more likely to report prior use of headache abortive and preventive medications compared with those with non-migraine headache (Table 2). Ibuprofen (n=730, 64.8%), acetaminophen (n=534, 47.4%), and acetaminophen/aspirin/caffeine combination tablets (n=510, 45.3%) were the most common abortive medications used. One hundred respondents with migraine (8.9%) reported using sumatriptan. Topiramate (n=123, 10.9%), magnesium (n=92, 8.2%), and riboflavin (n=78, 6.9%) were the most common preventive agents used. One respondent used erenumab as a preventive and no respondents reported the use of neuromodulatory devices for prevention.

Migraine and Trauma/Discrimination

The majority of respondents with migraine (n=1055, 93.7%) reported a history of trauma and/or discrimination. Of those respondents, most (n=813, 72.2%) reported a history of both trauma and discrimination, while 202 (17.9%) reported a history of discrimination only and 40 (3.6%) reported a history of trauma only (Table 1). Those with migraine who reported a history of trauma and/or discrimination were significantly more likely to report a lifetime history of depression (837 [79.3%] versus 37 [52.1%], $p<0.0001$), current depression (506 [48.0%] versus 15 [22.5%], $p<0.001$), anxiety (779 [73.8%] versus 33 [46.5%], $p<0.0001$), PTSD (416 [39.4%] versus 6 [8.5%], $p<0.0001$), or a history of tobacco use (668 [63.3%] versus 25 [35.2%], $p<0.0001$) compared with those without a history of trauma and/or discrimination. There was no

significant difference in migraine days in the prior three months between those with migraine with a history of trauma/discrimination and those without (mean 12.7 (SD 17.5) versus 10.1 (SD 11.5), $p=0.23$). Respondents with migraine with a history of trauma and/or discrimination were more likely to have used abortive (884 [84.2%] versus 45 [70.3%], $p=0.0038$) and preventive medications (279 [26.4%] versus 9 [13.8%], $p = 0.0241$) than those without a history of trauma and/or discrimination.

In respondents with migraine, in both the unadjusted and adjusted analyses, a history of any experience of trauma or discrimination was not associated with moderate-severe migraine disability (Table 3). These results did not change significantly when performing the analysis with gender identity included in addition to SAAB compared to using SAAB alone (Table 3). A history of any trauma or discrimination was also not associated with chronic migraine (defined as ≥ 15 headache days per month; odds ratio [OR] 5.28, 95% confidence interval [CI] 0.72-38.55).

Using the dichotomous variables of prior experiences of trauma only, discrimination only, or both trauma and discrimination, a history of both trauma and discrimination was associated with moderate-severe migraine disability (OR 1.76, 95% CI 1.34-2.32) in unadjusted analysis (Table 3). This association persisted after adjusting for sociodemographic and clinical factors (aOR 1.78, 95% CI 1.34-2.36); however, significance was lost after adjusting for psychiatric comorbidities (Table 3). Those with prior experiences of discrimination only had lower odds of moderate-severe migraine disability in both the unadjusted analysis (OR 0.63, 95% CI 0.46-0.87) and when adjusting for sociodemographic and clinical factors (aOR 0.62, 95% CI 0.45-0.87). This association again lost significance after adjusting for psychiatric comorbidities (Table 3). These results did not change when performing the analysis with SAAB and gender identity compared with SAAB alone (Table 3).

In the exploratory analysis, the number of experiences of trauma or discrimination was associated with higher odds of moderate-severe migraine disability as a dichotomous variable after adjustment for sociodemographic and clinical factors and psychiatric comorbidities (aOR 1.11, 95% CI 1.05-1.18); however, it was not associated with migraine disability after adjustment for sociodemographic and clinical factors and psychiatric comorbidities when using MIDAS as a continuous variable (coef 1.34, 95% CI 0.56-2.12) (Table 3).

DISCUSSION

In this sample of SGM individuals, approximately half of the respondents with a history of headache screened positive for migrainous headache by ID-migraine criterion with most reporting moderate to severe intensity headache. Despite that finding, only a quarter of those with migrainous headache reported use of preventive medications, and a third of those who were interested in seeing a neurologist for headache experienced barriers to accessing specialized care. The frequency of preventive medication use in this sample mirrors that found in a prior study, although comprehensive sexual orientation and gender identity information was not collected, which limits comparison.³¹ The reasons underlying the low prevalence of preventive care remain uncertain, although may be related to known disparities in healthcare access experienced by SGM individuals, such as disparate rates of insurance coverage and differences in socioeconomic status.^{32,33} Barriers to equitable preventive care for SGM individuals with headache will be important to explore in future research.

In those with migraine, a history of both trauma and discrimination was associated with moderate-severe migraine disability after adjusting for sociodemographic and clinical factors; this association lost significance after adjusting for a history of depression, anxiety, or PTSD.

This analysis suggests that psychiatric comorbidities may mediate the relationship between a history of trauma/discrimination and migraine disability in SGM individuals, a finding that is consistent with studies in other populations.^{7,34} National Health Interview Survey data found that screening positive for a severe mental illness accounted for 9% of the additional prevalence of headache/migraine in gay and bisexual men and 6.6% of the additional prevalence in lesbian and bisexual women compared with heterosexual peers.³⁵ The nature of the relationship between mental health and migraine is complex and likely bidirectional.³⁶ Depression, anxiety, and PTSD are associated with episodic migraine evolving into chronic migraine.^{34,37} PTSD has been associated with higher migraine frequency³⁸ and disability.^{39,40} Other studies suggest a shared genetic predisposition for migraine and depression^{41–43} or a pathophysiologic link through the role of estrogen.⁴⁴ In their 2005 article, Cady and colleagues suggest a framework of cosensitization of the sensory and affective components of pain that can lead to neurologic and psychologic symptoms between headache episodes.⁴⁵ Regardless of the directionality, the consistent findings of the relationship between migraine and mood disorders highlights the importance of addressing mental health in people with migraine.

In this sample, respondents with prior exposure to discrimination and not trauma had lower odds of moderate-severe migraine disability in unadjusted analyses and after controlling for sociodemographic and clinical factors, which lost statistical significance after including psychiatric comorbidities in the model. In the exploratory analysis, a greater number of types of trauma and/or discrimination experiences was associated with increased migraine disability even after adjusting for psychiatric comorbidities. Other studies have found a similar dose-response relationship between recurrent traumatic experiences and headache frequency.^{46,47} Although our analysis was not designed to assess the specific question of cumulative trauma, these findings

raise an intriguing potential direction for future study, particularly considering the ubiquity of trauma exposure in U.S adults.⁴⁸

This study has some limitations. The use of ID-Migraine, with a sensitivity of 84% in screening for migrainous headache, may have led to misclassification.²⁵ It may also have led to underreporting individuals with migraine with aura. One of the ID-Migraine questions asks about headache limiting the respondent's ability to participate in daily activities, and use of this tool to screen for migrainous headache may have led to our sample including those with higher levels of disability from headache. The questionnaire was advertised to The PRIDE Study participants as one investigating experiences of headache, particularly how that experience is influenced by a history of trauma, which may have led to selection bias. This sample reported a high prevalence of trauma and/or discrimination, in part due to the broad definition of these experiences, which led to reduced power when using it as a dichotomous variable. This analysis relied upon retrospective self-report of trauma and comorbidities, which may be subject to recall bias; however, this is consistent with how this history is commonly collected in a clinical setting. The complex relationship between migraine and depression means that we are yet unable to determine if depression is a confounder or mediator between trauma and migraine-related disability, and the cross-sectional design prevents this study from evaluating this. While other sociodemographic factors – such as race/ethnicity^{49,50} and socioeconomic status - affect migraine prevalence and severity, this non-representative sample did not allow for us to explore the interaction of these factors in our analysis and limits the generalizability of our findings.

Despite these limitations, this study adds unique understanding of migraine care experiences and severity in SGM individuals and suggests future directions for investigation and intervention. It will be important to collect inclusive sexual orientation and gender identity data

in future migraine studies to further understand access to care and prevalence of migraine disability, particularly in diverse cohorts that will allow for an intersectional understanding of how social and structural factors, such as racism and poverty, affect migraine in SGM populations. This will likely require targeted outreach coupled with community engagement to ensure appropriate representation of underserved populations. The role of gender minority stress also needs to be more explicitly studied in relation to migraine frequency and severity.³⁶ This study also highlights the important role of depression, anxiety, and PTSD in migraine disability in SGM individuals, identifying a significant and potentially modifiable risk factor for migraine disability in this population that could be targeted in future intervention studies.

Further work in this area would benefit from larger and more diverse SGM samples, inclusive of a broad range of sociodemographic identities. Systematic collection of sexual orientation and gender identity in electronic health records, population health surveys, and patient registries would be an important step towards exploring the role of traumatic experiences in migraine using an intersectional framework and thereby improving neurologic health equity in this underserved community.

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TABLE 1: Population characteristics for sexual and gender minority individuals with and without headache

	Migraine¹ (n=1126)	Non-migraine type headache (n=1016)	No headache² (n=1036)	p-value³
Age (median, IQR)	30.8 (25.2-39.3)	34.3 (26.5-48.8)	33.8 (26.5-51.2)	<0.0001
Gender Identity ⁴				
Genderqueer	289 (25.7)	160 (15.7)	118 (11.4)	<0.0001
Man	250 (22.2)	391 (38.5)	521 (50.3)	<0.0001

Transgender man	149 (13.2)	113 (11.1)	74 (7.1)	<0.0001
Transgender woman	46 (4.1)	52 (5.1)	66 (6.4)	0.0560
Woman	534 (47.4)	409 (40.3)	351 (33.9)	<0.0001
Another gender identity ⁵	171 (15.2)	92 (9.1)	58 (5.6)	<0.0001
Sex assigned at birth				<0.0001
Female	864 (76.7)	595 (58.6)	482 (46.6)	
Male	262 (23.3)	421 (41.4)	554 (53.5)	
Sexual orientation ⁴				
Asexual	153 (13.6)	90 (8.9)	79 (7.6)	<0.0001
Bisexual	323 (28.7)	258 (25.4)	222 (21.4)	0.0005
Gay	279 (24.8)	392 (38.6)	485 (46.8)	<0.0001
Lesbian	274 (24.3)	213 (21.0)	218 (21.0)	0.0967
Pansexual	227 (20.2)	122 (12.0)	106 (10.2)	<0.0001
Queer	503 (44.7)	356 (35.0)	276 (26.6)	<0.0001
Questioning	23 (2.0)	32 (3.1)	15 (1.4)	0.0287
Same-Gender Loving	59 (5.2)	42 (4.1)	30 (2.9)	0.0235
Straight/Heterosexual	15 (1.3)	27 (2.7)	19 (1.8)	0.0803
Another sexual orientation ⁵	44 (3.9)	30 (3.0)	13 (1.3)	0.0007
Race				0.0044
Asian	27 (2.5)	33 (3.3)	49 (4.9)	
Black/African American	22 (2.0)	29 (2.9)	30 (3.0)	
White	959 (87.8)	873 (88.3)	881 (87.3)	
Another race ⁶	84 (7.7)	54 (5.5)	49 (4.9)	
Hispanic/Latinx Ethnicity	59 (5.4)	53 (5.3)	73 (7.2)	0.13
Education				<0.0001
No schooling, high school or vocational training	78 (7.1)	51 (5.1)	47 (4.6)	
Some college or 2-year degree	279 (25.4)	214 (21.6)	184 (18.1)	
4-year degree	382 (34.7)	327 (33.0)	357 (35.1)	
Graduate degree	361 (32.8)	399 (40.3)	430 (42.2)	
Gender-affirming hormone use	218 (19.5%)	180 (19.1%)		0.82
Feminizing	49 (4.4%)	54 (5.3%)		
Masculinizing	168 (14.9%)	128 (12.6%)		
Co-morbidities				
Stroke	19 (1.7)	15 (1.5)		0.70
Hypertension	213 (18.9)	224 (22.0)		0.0726
Diabetes or prediabetes	198 (17.6)	167 (16.4)		0.48
History of depression	874 (77.6)	608 (59.8)		<0.0001
Current depression ⁷	522 (46.4)	227 (22.3)		<0.0001
Anxiety	812 (72.1)	524 (51.6)		<0.0001
Post-traumatic stress disorder	422 (37.5)	217 (21.4)		<0.0001

History of tobacco use	693 (61.5)	588 (57.9)		0.0835
Current tobacco use	147 (13.1)	71 (7.0)		<0.0001
Experiences				
Violence/trauma only	40 (3.6)	60 (5.9)		0.0099
Discrimination only	202 (17.9)	222 (21.9)		0.0233
Both trauma and discrimination	813 (72.2)	577 (56.8)		<0.0001

Data are n (%) unless otherwise indicated.

¹ Defined as ID-Migraine score of 2 or 3.

² Respondents without a history of headache were only asked demographic questions

³ p value reflects the comparison of all three headache categories for demographics (age, gender, sex assigned at birth, sexual orientation, race, ethnicity, education) and the comparison of migraine versus non-migraine type headache for gender affirming hormone use, co-morbidities, and experiences

⁴ These were not mutually exclusive categories as respondents could select multiple identities

⁵ Selection of this option prompted a write-in response

⁶ Includes American Indian or Alaska Native, Middle Eastern or North African, Native Hawaiian or other Pacific Islander and those who selected another race with a write-in option

⁷ Defined as PHQ9 score >9

Table 2: Access to care for sexual and gender minority people with and without migraine-type headache

	Migraine (n=1126)	Non-migraine type headache (n=1016)	p-value
Headache days in the prior 3 months (mean, SD)	12.6 (17.2)	4.5 (9.2)	<0.0001
Migraine treatments			
Ever used an abortive medication	929 (83.4)	703 (74.1)	<0.0001
Ever used a triptan as an abortive medication	308 (27.4)	94 (9.3)	<0.0001
Ever used a preventive medication	288 (25.7)	64 (6.7)	<0.0001
Location to receive routine care			0.32
Clinic or health center	971 (88.0)	846 (89.6)	
None	102 (9.2)	81 (8.6)	
Other ¹	30 (2.7)	17 (1.8)	
Wanted or asked for a neurologist for headache treatment	456 (42.1)	157 (16.9)	<0.0001

	Migraine (n=170) ²	Non-migraine type headache (n=23) ²	p-value
Primary barrier to seeing a neurologist for headache treatment			0.16
Primary provider did not place referral	36 (21.2)	5 (21.7)	
Insurance would not approve visit	35 (20.6)	5 (21.7)	
Neurologist not accepting new patients	31 (18.2)	1 (4.3)	
No health insurance	14 (8.2)	0 (0)	
No neurologist in city/town	10 (5.9)	3 (13.0)	
Neurologist refused	7 (4.1)	0 (0)	
Other reason	37 (21.8)	9 (39.1)	

Data are n (%) unless otherwise specified

¹ Includes emergency department and having multiple locations for routine care

² Question only offered to those who wanted to access a neurologist but experienced difficulty

Table 3: Association between moderate-severe migraine disability and a history of trauma and/or discrimination

	Unadjusted analysis (98% CI)	Adjusted model 1a ¹ (98% CI)	Adjusted model 1b ² (98% CI)	Adjusted model 2a ³ (98% CI)	Adjusted model 2b ⁴ (98% CI)
Regression analysis using MIDAS score as a dichotomous variable					
	OR	OR	OR	OR	OR
Any trauma/discrimination	1.49 (0.81-2.73)	1.59 (0.83-3.06)	1.52 (0.79-2.93)	1.09 (0.56-2.15)	1.07 (0.54-2.10)
Trauma only	0.51 (0.23-1.13)	0.59 (0.26-1.31)	0.60 (0.27-1.33)	0.65 (0.28-1.51)	0.66 (0.28-1.52)
Discrimination only	0.63 (0.43-0.92)	0.62 (0.42-0.92)	0.63 (0.43-0.93)	0.78 (0.52-1.17)	0.78 (0.52-1.18)
Both trauma and discrimination	1.76 (1.28-2.44)	1.78 (1.27-2.49)	1.74 (1.24-2.45)	1.35 (0.94-1.93)	1.34 (0.93-1.92)
Number of experiences of trauma or discrimination	1.17 (1.11-1.24)	1.18 (1.11-1.26)	1.18 (1.11-1.25)	1.11 (1.04-1.19)	1.11 (1.04-1.19)

	Regression analysis using MIDAS as a continuous variable				
	Coef	Coef	Coef	Coef	Coef
Any trauma/discrimination	7.31 (-1.98-16.60)	8.25 (-1.36-17.86)	7.30 (-2.33-16.93)	3.13 (-6.31-12.57)	2.63 (-6.83-12.10)
Number of experiences of trauma or discrimination	2.37 (1.55-3.18)	2.33 (1.47-3.18)	2.23 (1.36-3.09)	1.34 (0.41-2.27)	1.28 (0.34-2.21)

Bold font indicates statistical significance

¹ Adjusted for age, sex assigned at birth, race/ethnicity, education, and use of gender-affirming hormones

² Adjusted for age, sex assigned at birth, gender identity, race/ethnicity, education, and use of gender-affirming hormones

³ Adjusted for the variables in Model 1a + self-reported history of depression, anxiety, and/or post-traumatic stress disorder

⁴ Adjusted for the variables in Model 1b + self-reported history of depression, anxiety, and/or post-traumatic stress disorder

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