HHS Public Access

Author manuscript

Sleep Health. Author manuscript; available in PMC 2023 April 01.

Published in final edited form as:

Sleep Health. 2022 April ; 8(2): 153–160. doi:10.1016/j.sleh.2021.10.006.

Examining the associations of gender minority stressors with sleep health in gender minority individuals

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Abstract

Objectives: Investigate the associations of gender minority stressors (including stigma consciousness [SC] and gender-related discrimination [GRD]) with sleep health in gender minority individuals.

Design: Cohort.

Participants: 279 gender minority individuals.

Measurements: SC and GRD were measured using the Stigma Consciousness and Everyday Discrimination scales, respectively. Sleep disturbance was assessed using the PROMIS Sleep Disturbance measure. Subjective short sleep duration (< 7 hours) was assessed. We used k-means longitudinal clustering to identify minority stress (including SC and GRD scores) clusters. Linear and logistic regression models were used to examine the associations of these clusters with sleep disturbance and sleep duration, respectively, adjusted for demographic characteristics.

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Declaration of Conflicts of Interest
The authors have no conflicts of interest to disclose.

Results: Mean age was 36.9±13.6 years; most were non-White (54.5%), 52.5% were transmasculine, and 22.6% were heterosexual. Mean sleep disturbance score was 17.2±6.1 (range 6–30) and 52% reported short sleep duration. We identified three minority stress clusters. Compared to participants with low SC/low GRD, those with high SC/low GRD (*B* 3.33, 95% CI = 1.64, 5.01) and high SC/high GRD (*B* 4.51, 95% CI = 2.63, 6.39) had worse sleep disturbance scores. Participants in the high SC/high GRD cluster were more likely to report short sleep duration relative to the low SC/low GRD cluster (AOR 2.17; 95% CI = 1.11–4.26).

Conclusions: Participants with both high SC and high GRD had worse sleep health. Future longitudinal studies should examine factors that drive the link between gender minority stress and sleep health in gender minority individuals to inform sleep health interventions tailored for this population.

Keywords

Sleep health; sleep duration; gender minority; minority stress

Introduction

Sleep and Health

Sleep is an important contributor to mental and physical health. A recent meta-analysis of 36 longitudinal studies found that sleep problems (e.g., short sleep duration) were directly associated with mental health disorders among young adults.[1] Self-reported short sleep duration (< 7 hours per night) and poor sleep quality are associated with dysregulation of physiological systems including, but not limited to, inflammation and coronary artery calcification.[2] Short sleep duration and poor sleep quality are also associated with incident cardiovascular disease and all-cause mortality.[3,4] Despite its important role for overall health and wellbeing, it is estimated that approximately 35% of American adults report short sleep duration.[5] Therefore, increasing the proportion of American adults that sleep at least 7 hours per day has been identified as an objective of *Healthy People 2030*.[6]

Minority Stress and Health in Gender Minority Populations

Gender minority (GM; e.g., transgender, nonbinary) individuals are a health disparity population at high risk for poor sleep health.[7] There is increasing recognition that GM individuals in the United States (U.S.) experience greater health problems compared to their cisgender (non-transgender) counterparts, such as a higher prevalence of depression, suicidal and nonsuicidal self-injury, tobacco use, and cardiovascular disease (e.g., heart attack and stroke).[8–13] The Minority Stress Model, originally developed to describe how minority stressors influence health outcomes in sexual minority individuals,[14] has been adapted to explain mental and physical health disparities in GM populations.[15,16] Minority stressors, chronic stressors that are common and unique to stigmatized populations, are hypothesized as the predominant reasons for the health disparities observed in GM individuals.[14–16] Minority stressors include proximal (i.e., subjective processes such as anticipating or expecting rejection) and distal (i.e., objective observable events, such as harassment) forms.[14–16] Stigma consciousness (SC), a proximal minority stressor, refers to one's anticipation of being stereotyped and rejected by others.[17] Gender-related discrimination

(GRD), a distal minority stressor, includes unfair treatment during interpersonal interactions due to one's gender identity.[15,16,18] Although the Minority Stress Model has been used to study a variety of health outcomes among GM individuals, there is limited research that has examined factors that influence sleep health in this population.

Minority Stress and Sleep Health

Experiences of discrimination have been posited to contribute to sleep health disparities among stigmatized adults in the U.S.[19,20] A systematic review of 39 studies found a direct relationship between discrimination and sleep difficulties among adults, particularly racial and ethnic minority individuals.[19] The aforementioned review included mostly cross-sectional studies that assessed experiences of discrimination with limited evidence on SC as a determinant of sleep health.[19] An exception was a study in which investigators examined the associations of SC with sleep health.[21] In a sample of Asian-American college students, Ong et al.[21] found that SC was associated with self-reported shorter sleep duration and worse sleep quality. There is a need for research examining the associations of other forms of minority stress, beyond experiences of discrimination, with sleep health.[19,20]

Sleep Health in GM Populations

Despite evidence that minority stressors are associated with poor sleep health outcomes in other stigmatized groups, studies examining these associations among GM individuals are limited.[22] A recent review found that only four studies had assessed sleep among GM populations with the earliest study published in 2011.[22] Analyses of population-based data in the U.S. found that GM adults were more likely to report very short sleep duration (less than or equal to 5 hours per day) than their cisgender counterparts (35.5% vs. 12.2%).[23] Similarly, analyses of data from the National College Health Assessment II found that transgender college students had a higher prevalence of sleep problems, including insomnia symptoms and daytime sleepiness, relative to cisgender college students.[24]

A small, but growing body of literature, suggests gender minority stressors contribute to poor sleep health in GM populations. These studies have been limited by their cross-sectional designs and small sample sizes.[22] For instance, a qualitative study with 40 GM adults living in New York City identified that participants indicated their sleep disturbances were related to their gender identity concerns, such as anxiety and stress about gender identity and gender-affirming medical treatment.[25] Investigators have yet to comprehensively assess the associations of gender minority stressors with sleep health outcomes among GM adults.

Purpose and Hypotheses

Informed by an adaptation of the Minority Stress Model specific to GM populations,[15,16] the purpose of this study was to fill knowledge gaps on sleep health among GM individuals. We used data from a longitudinal multi-city cohort of GM individuals to test the hypotheses that: 1) participants with longitudinal trajectories characterized by increasing combined exposure to both SC and GRD would have worse sleep health outcomes, and 2) participants with persistently high combined exposure to both SC and GRD would have worse sleep health outcomes. Using k-means longitudinal cluster (KML) analysis we used longitudinal data on

gender minority stressors to create minority stress clusters that jointly accounted for SC and GRD exposure across three waves of data.

Participants and Methods

Sample

The study included GM participants from Project AFFIRM (N = 332), a multi-site longitudinal study of transgender identity development, risk and resilience. Detailed information on study procedures is described elsewhere.[26] Data were collected at three time points: Wave 1 (2016–17), Wave 2 (2017–18), and Wave 3 (2018–19). Investigators used venue-based recruitment in New York City, San Francisco, and Atlanta, followed by quota sampling to compose the initial cohort. Venues for recruitment included six categories: bars and clubs/non-bar establishments/outdoors, events, community groups, online, transgender-specific clinical sites, and referral by friends. Sampling quotas were based on study site (New York City, San Francisco, and Atlanta), sex assigned at birth (male or female), and age (16–20 years, 21–25, 26–39, 40–60, and 60+). The inclusion criteria for Wave 1 were: self-identification as a transgender or gender nonbinary person and age 16 years or older. Exclusion criteria were: cognitive impairment, being unable or unwilling to provide contact information for longitudinal follow-up, or planning to leave the study region within the next three years.

Wave 1 included 332 participants (ages 16–87) of whom 288 were retained at Wave 2 (86.7%) and 280 (84.0%) were retained at Wave 3 (approximately two years later). Loss to follow-up from Waves 1–3 was not predicted by any of the variables in the present study, except gender identity with those identifying as transfeminine (i.e., those self-identifying as a woman, transgender woman, male-to-female, nonbinary, or genderqueer with male sex assigned at birth) more likely to be lost to follow-up (n = 52; 71% vs. 29%, $p < 0.01$). The present analysis included 279 out of 280 participants at Wave 3.

Trained interviewers at each site administered structured interviews and entered participant responses into a secure database using a laptop or tablet. Structured questionnaires were administered by research staff in English or Spanish based on participants' preference. At all waves, participants age 18 and over gave informed consent and participants 16–17 years old gave assent. The New York State Psychiatric Institute/Columbia Psychiatry Institutional Review Board, which approved this study, waived the requirement for parental consent for participants younger than age 18 due to potential harm associated with disclosure of transgender or nonbinary identity to parents. Participants were compensated $40 at Wave 1, $45 at Wave 2, and $55 at Wave 3. They received an additional $25 bonus for completing all three interviews.

Measures

Gender minority stressors.—SC was measured at each wave using the 10-item Stigma Consciousness Scale, which did not specify a time period.[17,27] Items include statements such as "My being transgender does not influence how others act with me" and "Most individuals have a lot more transphobic thoughts than they actually express." Participants

rated each item from 1 = “strongly disagree” to 7 = “strongly agree.” The total score at each wave was the mean of the 10 item ratings (range 1–7). Higher scores represent higher SC. Cronbach’s alpha in our sample was 0.77 at Wave 1 and 0.80 in both Waves 2 and 3.

GRD was measured at each wave using the Everyday Discrimination Scale, which did not specify a time period.[28,29] This measure has been widely used among GM populations.[30] Participants were asked 10 items that assessed the frequency of various types of day-to-day discrimination such as “being called names or insulted,” and “being treated with less respect.” Frequency was measured using a four-point Likert scale with the responses “never,” “rarely,” “sometimes,” or “often.” For every discriminatory experience that participants reported happened “sometimes” or “often,” they were then asked to identify the main reason for this experience. Response options for main reason included “gender,” “ancestry or national origins,” “race,” “age,” “religion,” “appearance,” or “sexual orientation.” Participants could endorse as many reasons as were applicable. To assess GRD, we assigned one point for each item that participants reported their gender was a main reason for the discriminatory experience. We then created a count of how many experiences they reported happened “sometimes” or “often” due to their gender. Scores ranged from 0 to 10 with higher scores representing higher levels of GRD. Cronbach’s alpha in our sample was 0.83 at Wave 1 and 0.86 at Waves 2 and 3.

Sleep health.—Sleep disturbances in the past seven days were assessed at Wave 3 using the 6-item PROMIS Sleep Disturbance measure.[31] Example items are: “My sleep was restless” and “I had difficulty falling asleep.” Five items were rated on a Likert scale with response options: “not at all,” “a little bit,” “somewhat,” “quite a bit,” and “very much”. The remaining item assessed overall sleep quality using a Likert scale with response options “very poor,” “poor,” “fair,” “good,” and “very good.” Each item was scored from 1 to 5 with the sum of all items ranging from 6–30. Higher scores indicate greater sleep disturbance. Cronbach’s alpha was 0.89 at Wave 3.

To measure short sleep duration, at Wave 3 participants were asked: “During the past month, how many hours of actual sleep did you get each night? (This may be different from the number of hours you spent in bed.).” This item is used to calculate the sleep duration component of the Pittsburgh Sleep Quality Index, a validated and widely used measure of sleep quality.[32] Responses were dichotomized as short sleep duration (< 7 hours = 1) or no short sleep duration (≥ 7 hours = 0) based on recommendations from the American Academy of Sleep Medicine.[33]

Demographic characteristics.—Age was measured as a continuous variable based on participants’ birth date. Following recommendations for assessing gender identity in research,[8] self-reported gender identity and sex assigned at birth were used to create two gender identity groups using the umbrella terms transfeminine spectrum and transmasculine spectrum. Transfeminine spectrum people were those self-identifying as a woman, transgender woman, male-to-female, nonbinary, or genderqueer with male sex assigned at birth. Transmasculine spectrum people were those self-identifying as a man, transgender man, female-to-male, nonbinary, or genderqueer with female sex assigned at birth. Race and ethnicity were categorized as Non-Latinx White, Latinx, Non-Latinx African-American, or

Non-Latinx other race (included American Indian, Alaskan Native, Asian, Hawaiian, Pacific Islander, and multi-racial individuals). Sexual orientation categories were heterosexual or sexual minority (self-reported identifying as lesbian, gay, bisexual, queer, same-gender loving, or a write-in option).

Statistical Analyses

All analyses were conducted in R. Missing data were handled using listwise deletion as only one participant at Wave 3 had missing data across study variables. Given the lack of longitudinal data in prior sleep research among GM adults,[22] it is unknown which temporal dynamics of minority stress may be most associated with sleep in this population. We sought to flexibly capture the longitudinal patterns of gender minority stressors (SC and GRD) in our data across Waves 1–3. Clustering was performed using KML,[34] which extends the commonly used k-means clustering approach, to allow for joint clustering of multiple longitudinal variables.

We used the R package kml3d to apply KML to the three-wave SC and GRD values. We found little within-person variability in gender minority stress exposure across Waves 1–3, which prevented us from testing our first hypothesis that participants with longitudinal trajectories characterized by increasing combined exposure to both SC and GRD would have worse sleep health outcomes. However, we were able to test our second hypothesis that participants with persistently high combined exposure to SC and GRD across three waves would have worse sleep health outcomes.

We considered both interpretability and various cluster quality criteria in order to select the optimal number of clusters.[34] Briefly, we used six established partition criteria to determine the optimal number of clusters including: Calinski-Harabatz, Kryszczuk-Calinski, Genolini-Calinski, Ray-Turi, Davies-Bouldin, and Bayesian Information Criteria (Figure 1).[34] KML clustering was conducted on participants' SC and GRD values across all waves over a range of possible cluster solutions (from 2 to 6 clusters). Each line in Figure 1 represents a given partition performance criterion, and illustrates the relative performance of assuming 2, 3, 4, 5, or 6 clusters in the KML algorithm. Higher values on the Y-axis reflect better performance for a given performance criterion. Some performance criteria were optimized for low numbers of clusters (closer to 2) and others were optimized for higher numbers of clusters (closer to 5 or 6).

The three cluster solution was chosen because it reflected the highest average performance across the six performance criteria examined. The three distinct minority stress clusters identified were: 1) persistently low SC/low GRD, 2) persistently high SC/low GRD, and 3) persistently high SC/high GRD (Figure 2). These clusters capture the persistence of SC and GRD in our sample. We hypothesized there might be a fourth cluster representing persistently low SC/high GRD, but the KML clustering found this was not the case. This suggests that participants with low SC generally did not have high GRD.

After determining the optimal number of clusters, we assessed frequencies, means, and distributions of study variables to characterize the sample. We used ANOVA and chi-square testing to examine differences in continuous and categorical study variables between

clusters, respectively. For bivariate analyses, we used a Bonferonni correction to account for multiple comparisons. A p-value of 0.01 was used to determine statistical significance for bivariate analyses. Regression analyses were used to estimate the associations of minority stress clusters with sleep health outcomes. Linear regression was used to model sleep disturbance scores at Wave 3. Logistic regression was used to estimate adjusted odds ratios (AOR) for the association of minority stress clusters with sleep duration at Wave 3. Regression models were adjusted for demographic characteristics including participants' age, gender identity, race and ethnicity, and sexual orientation measured at Wave 3. To determine which minority stress cluster was at highest risk for worse sleep health outcomes, for all regression analyses we first estimated models with the low SC/low GRD cluster as the reference group (Model A). Then we estimated models with the high SC/high GRD cluster as the reference group (Model B). This allowed us to compare all three clusters to one another, rather than have only one reference cluster.

Results

Descriptive Statistics

Table 1 presents sample characteristics by minority stress clusters. The final sample included 279 GM individuals with a mean age of 36.9 years±13.6 at Wave 3, of which 45.5% were Non-Latinx White, 22.6% identified as heterosexual, and 52.5% were transmasculine. The mean sleep disturbance score was 17.2±6.1 (range 6–30). Approximately 52% of participants reported short sleep duration. There were 91 (32.6%) participants in the persistently low SC/low GRD cluster, 114 (40.9%) in the persistently high SC/low GRD, and 74 (26.5%) in the persistently high SC/high GRD. Participants in the high SC/high GRD cluster were younger than those in the low SC/low GRD cluster (33.9±11.4 vs. 39.9±14.5, $p < 0.01$). Transmasculine participants were more likely to be in the high SC/low GRD cluster than the low SC/low GRD (64.0% vs. 41.8%, $p < 0.01$). Heterosexual participants were more likely to be in the low SC/low GRD cluster ($p < 0.01$). Participants in the high SC/low GRD and the high SC/high GRD clusters had worse sleep disturbance scores than those in the low SC/low GRD cluster ($p < 0.01$). No differences in short sleep duration were found between clusters.

Regression Analyses

Table 2 presents results of linear regression models examining the associations of gender minority stressors with sleep disturbance. The high SC/low GRD (B 3.33; 95% CI = 1.64, 5.01; $p < 0.001$) and high SC/high GRD (B 4.51; 95% CI = 2.62, 6.39; $p < 0.001$) clusters had significantly higher sleep disturbance scores relative to the low SC/low GRD cluster. We found no difference in sleep disturbances scores between participants in the high SC/low GRD relative to those in the high SC/high GRD clusters (B −1.18; 95% CI = −2.96, 0.60; $p = 0.19$).

Table 3 presents results of logistic regression models examining the associations of gender minority stressors with short sleep duration. Participants in the high SC/high GRD cluster were more likely to report short sleep duration relative to the low SC/low GRD cluster (AOR 2.17; 95% CI = 1.11–4.26; $p = 0.02$). There was no difference in short sleep duration

between the high SC/low GRD versus low SC/low GRD clusters (AOR 1.69; 95% CI = 0.93–3.09; $p = 0.09$). There was also no difference in short sleep duration between the high SC/low GRD cluster relative to the high SC/high GRD cluster (AOR 0.78; 95% CI = 0.41–1.46; $p = 0.44$).

Discussion

To our knowledge, this is the first study to jointly investigate the associations of different forms of gender minority stress with sleep health. The present study contributes to the small but growing literature on sleep health in GM populations and provides the most comprehensive analysis of gender minority stressors and sleep health to date. Although participants had consistent SC and GRD values over time, clustering participants based on three waves of data allowed us to capture cumulative exposure to SC and GRD. This is more informative than using data from any one timepoint alone. Our findings are consistent with the limited existing evidence on the associations between gender minority stressors and sleep disturbance in GM adults.[25,35]

In the present study, GM participants who reported both persistently high SC and high GRD were at greatest risk for poor sleep health outcomes. Participants in the high SC/low GRD and high SC/high GRD clusters had worse sleep disturbance scores than those in the low SC/low GRD cluster. Those in the high SC/high GRD cluster were also more likely to report short sleep duration than those in the low SC/low GRD cluster. In contrast, there were no differences in sleep disturbances nor short sleep duration between the high SC/low GRD relative to those in the high SC/high GRD cluster. This indicates that combined exposure to both high SC and GRD may exert a greater influence on sleep health than high levels of either minority stressor alone. This study extends prior research on the impact of gender minority stress on sleep health in GM adults. Most existing research on minority stress and sleep health in GM adults and other stigmatized groups has focused on the examination of one gender minority stressor at a time rather than characterizing cumulative gender minority stress exposure and its effects of sleep.[19,22] The present study supports the use of methods that account for the combined influence of different minority stressors on sleep health among stigmatized adults.

Research Implications

Longitudinal research that examines the link between minority stressors and sleep health in GM individuals is needed to determine causal mechanisms driving sleep health disparities in this population. Such data can identify potential mediators of the associations between minority stressors and poor sleep health. In addition, there is limited research examining the role of social support and other protective factors for poor sleep health among GM adults.[22] Researchers should also investigate whether social support and protective factors can buffer the influence of gender minority stressors on sleep health in GM adults, which can inform future interventions for this population.

Research that investigates which subgroups of GM adults have the greatest risk for poor sleep health is important to inform targeted sleep health interventions. Particular attention should be paid to identifying factors that might contribute to potential differences in sleep

duration within the GM population (e.g., gender identity, race, ethnicity). Intersectionality is a theoretical framework for understanding how an individual's social position is shaped by intersecting systems of oppression that contribute to social and health inequities.[36] Intersectionality can be used to identify how multiple forms of oppression influence health in stigmatized groups. Although the present study focused on gender minority stress, future work should use an intersectional approach to examine sleep health outcomes among GM adults exposed to intersecting forms of minority stress (e.g., experiencing both transphobia and racism). Future research should also assess specific types of GRD experienced by GM individuals. For example, GM individuals who are perceived by others as transgender even though they wish to "pass" (i.e., be perceived as cisgender) may experience different forms of GRD compared to GM individuals who affirm their gender by actively subverting societal norms of gender expression.

Gender minority stressors in Project AFFIRM were measured without specifying a time period (e.g., past year). Thus, our measures may represent relatively stable trait characteristics, rather state characteristics that vary considerably over time. Indeed, participants had little within-person variability in gender minority stressors across Waves 1–3. Future studies should investigate the associations of state forms of gender minority stressors with sleep health. For instance, diary studies that investigate the influence of daily and weekly variations in minority stress exposure on self-reported and objective sleep measures in GM adults may be helpful to better understand these relationships.

Clinical Implications

Our findings have important implications for clinical practice with GM adults. It is well-documented that healthcare professionals receive few hours of formal coursework and continuing education in GM health.[37,38] Healthcare professionals should be educated about factors that drive sleep health disparities in GM individuals. In addition, addressing minority stress in GM individuals may be an important target for psychosocial and behavioral interventions to promote sleep health in GM adults. There are no existing clinical or public health interventions that target minority stress reduction to promote sleep health in GM adults.[39] Overall, the limited number of interventions to reduce minority stress in GM individuals have largely focused on HIV risk reduction.[39] It is important to investigate if effective interventions to reduce gender minority stress can also improve sleep health outcomes in this population.

Limitations

Despite its strengths this study has several limitations. First, we only used self-reported measures of sleep disturbance and sleep duration. Future studies should use objective measures of sleep health, such as actigraphy, to determine whether the observed associations of gender minority stressors with sleep health outcomes are consistent across different data sources. Given growing evidence of the negative health effects of structural minority stressors on sexual minority and GM populations,[40] future work should incorporate structural measures of gender minority stress to examine sleep health in GM adults. We also did not examine other forms of victimization that might contribute to poor sleep, such as interpersonal violence. In a study of 191 GM individuals in the U.S. and Canada,

investigators found that sexual victimization was associated with greater sleep disturbances among GM adults.[35] Research that comprehensively examines multiple forms of minority stress and adverse experiences is needed to determine factors that are most strongly associated with sleep health in GM populations. Further, our sample of GM adults was recruited from three metropolitan areas in the U.S. Thus, our findings are not generalizable to GM adults living in suburban and rural areas which may differ in attitudes towards GM people and in access to GM community resources. In addition, our clusters included gender minority stressors that were assessed at the same timepoint as sleep health outcomes (Wave 3). Therefore, it is possible that sleep problems may have preceded the minority stressors measured at Wave 3. These factors limit our ability to infer causality from our findings. Last, our findings may be biased due to residual confounding. In sensitivity analyses we found that additional variables not included in our analysis (i.e., employment, household income, and city of recruitment) were not associated with minority stress clusters or sleep health. However, additional important factors that may impact sleep health (e.g., use of sleep aids) were not assessed in our study.

Conclusions

These findings contribute to the limited evidence on social determinants of sleep health in GM individuals. Participants who had both high SC and high GRD reported worse sleep health outcomes. Findings highlight the need for future longitudinal research that examines the influence of multiple forms of minority stress on sleep health in GM individuals. This work is needed to identify potential targets for tailored interventions focused on improving sleep health in GM adults.

Acknowledgments

This study was supported by grants from the National Institute on Child Health and Human Development (R01HD07603), National Heart, Lung, and Blood Institute (R01HL151559; K01HL146965; R25HL105444), National Institute on Minority Health and Health Disparities (R01MD013554), National Institute on Mental Health (R01MH112406), National Institute on Nursing Research (T32NR007969), and the Centers for Disease Control and Prevention (U01PS005202). Sponsoring agencies had no role in study design, the collection, analysis, and interpretation of data; the writing of the report; or the decision to submit the article for publication.

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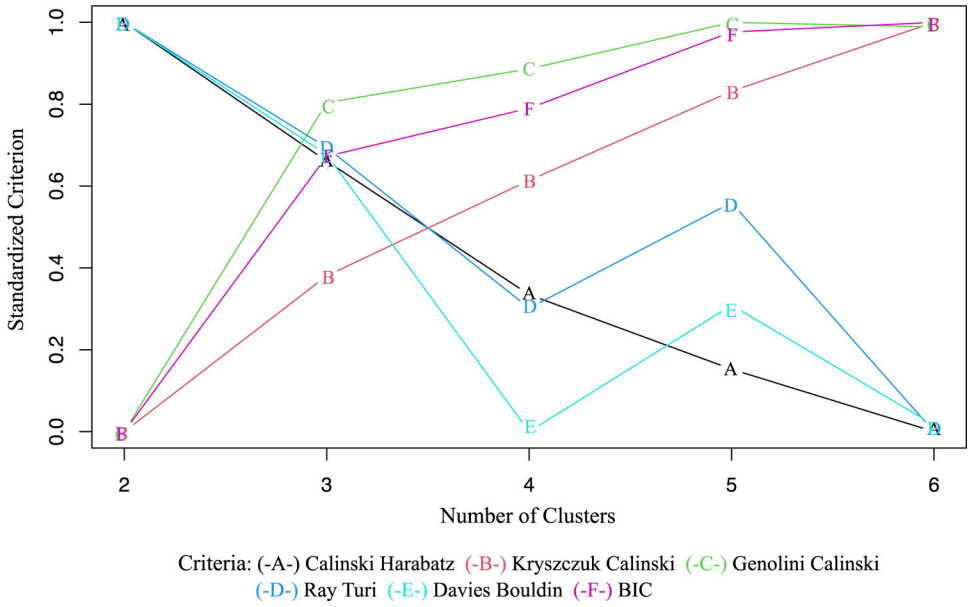

Figure 1. Performance of various cluster sizes across partition criteria in k-means longitudinal cluster analysis.

Each line represents a given partition performance criterion and separately illustrates the relative performance of assuming 2, 3, 4, 5, or 6 clusters in the k-means longitudinal clustering algorithm. Higher values on the Y-axis reflect better performance for a given performance criterion. The three cluster solution reflected the highest average performance across all performance criteria.

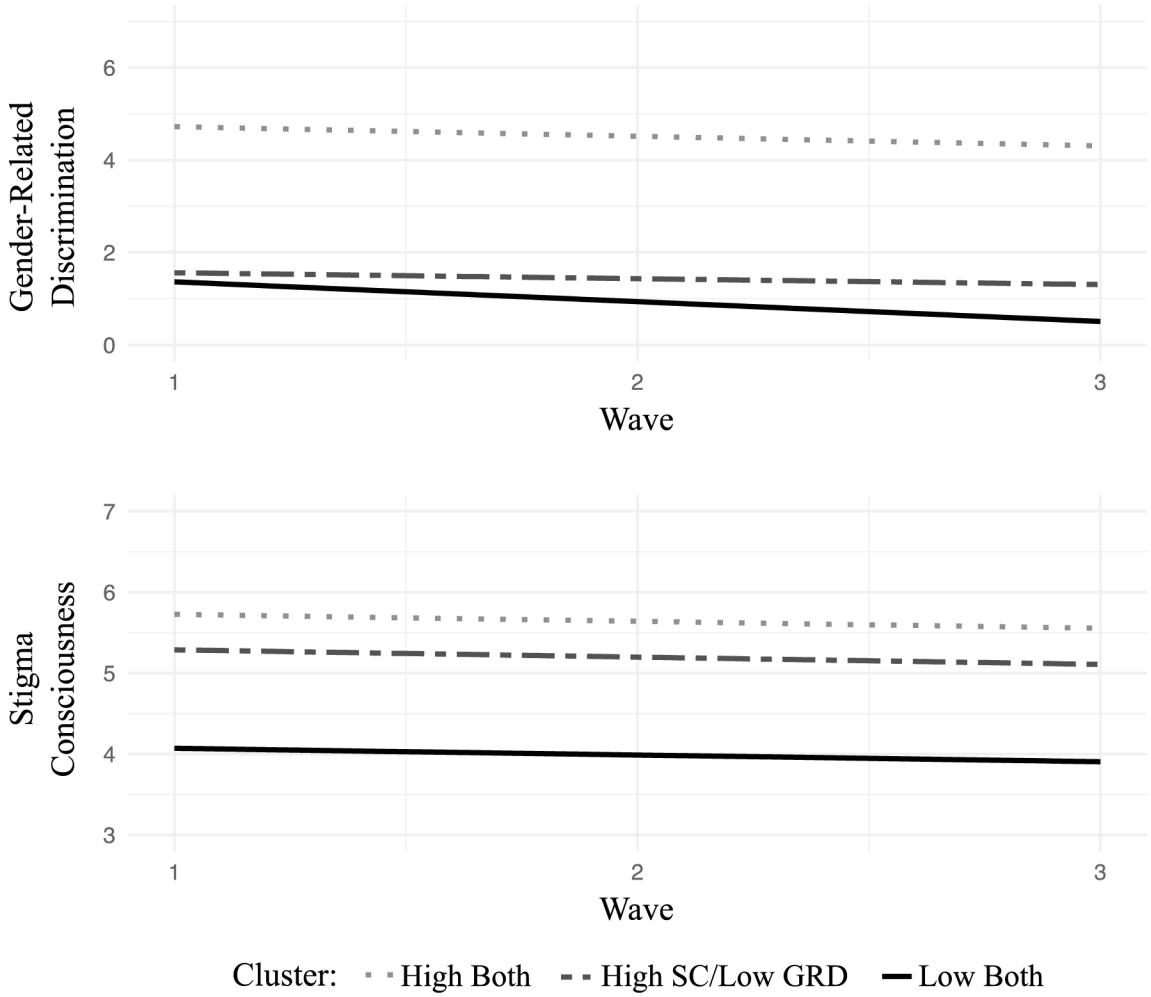

Figure 2. Resulting persistent minority stress clusters from k-means longitudinal cluster analysis.
Three distinct persistent minority stress clusters were identified using k-means longitudinal cluster analysis. Each line represents the average gender-related discrimination (GRD; range 1–10) and stigma consciousness (SC; range 1.9–7.0) scores for participants in a given cluster. These clusters included: 1) persistently low SC/low GRD, 2) persistently high SC/low GRD, and 3) persistently high SC/high GRD. These clusters represent the persistence of SC and GRD across three waves in our sample.

Table 1.

Sample characteristics by minority stress clusters (N = 279)

	Mean (SD)/N (%)			
Demographic characteristics (at Wave 3)	**Total Sample N = 279**	**Persistently Low SC/low GRD N = 91**	**Persistently High SC/low GRD N = 114**	**Persistently High SC/High GRD N = 74**
Age at Wave 3 (in years; range 18–89)[b]	36.9 (13.6)	39.9 (14.5)	36.6 (13.7)	33.9 (11.4)
Transmasculine[a]	147 (52.5)	38 (41.8)	73 (64.0)	35 (47.3)
Race and ethnicity				
Non-Latinx White	127 (45.5)	37 (40.7)	62 (54.4)	28 (37.8)
Latinx	58 (20.8)	18 (19.8)	14 (12.4)	7 (9.5)
Non-Latinx African-American	39 (14.0)	21 (23.1)	19 (16.6)	18 (24.3)
Non-Latinx other race	55 (19.7)	15 (16.4)	19 (16.6)	21 (28.4)
Heterosexual identity[a,b]	63 (22.6)	34 (37.3)	17 (14.9)	12 (16.2)
Gender minority stressors (Waves 1–3)				
Stigma consciousness (SC; range 1.9–7.0)[a,b,c]	4.8 (1.0)	3.7 (0.7)	5.0 (0.6)	5.5 (0.8)
Gender-related discrimination (GRD; range 1–10)[a,b,c]	2.0 (2.3)	0.6 (1.2)	1.3 (1.4)	4.9 (2.0)
Minority stress clusters		-	-	-
Low SC/low GRD	91 (32.6)			
High SC/low GRD	114 (40.9)			
High SC/high GRD	74 (26.5)			
Sleep health outcomes (at Wave 3)				
PROMIS sleep disturbance (range 6–30)[a,b]	17.2 (6.1)	14.7 (5.6)	18.0 (5.8)	19.2 (6.1)
Short sleep duration (< 7 hours)	145 (51.9)	41 (45.1)	61 (53.5)	43 (58.1)

[a] $p < 0.01$; High SC/low GRD vs. low SC/low GRD (reference)

[b] $p < 0.01$; High SC/high GRD vs. low SC/low GRD (reference)

[c] $p < 0.01$; High SC/low GRD relative to high SC/high GRD (reference)

Table 2.

Results of linear regression models examining the associations of gender minority stress clusters with sleep disturbance (N = 279).

	Sleep Disturbance [a]					
	Model A [b]			Model B		
	Beta	**95% CI**	***p***	**Beta**	**95% CI**	***p***
Minority stress clusters						
Persistently low SC/low GRD group	**Reference**	**Reference**		−4.51	−6.39, −2.63	<0.001 ***
Persistently high SC/low GRD group	3.33	1.64, 5.01	<0.01 **	−1.18	−2.96, 0.60	0.19
Persistently high SC/high GRD group	4.51	2.63, 6.39	<0.001 ***	**Reference**	**Reference**	
Age (in years)	−0.02	−0.07, 0.04	0.54	−0.02	−0.07, 0.04	0.54
Gender identity						
Transmasculine spectrum	**Reference**	**Reference**		**Reference**	**Reference**	
Transfeminine spectrum	−0.52	−2.01, 0.97	0.49	−0.52	−2.01, 0.97	0.49
Race and ethnicity						
Non-Latinx White	**Reference**	**Reference**		**Reference**	**Reference**	
Non-Latinx African-American Latinx	0.69	−1.53, 2.91	0.54	0.69	−1.53, 2.91	0.54
Non-Latinx other race	0.63	−1.26, 2.51	0.51	0.63	−1.26, 2.51	0.51
	1.47	−0.47, 3.40	0.14	1.47	−0.47, 3.40	0.14
Sexual orientation						
Sexual minority	**Reference**	**Reference**	0.81	**Reference**	**Reference**	0.81
Heterosexual	0.15	−1.67, 1.98		0.15	−1.67, 1.98	
R^2 /R^2 adjusted		0.111 /0.085			0.111 /0.085	

Note.

* p <0.05

** p < 0.01

$^{***}p < 0.001$. SC = stigma consciousness; GRD = gender-related discrimination.

[a] Sleep disturbance measured with PROMIS Sleep Disturbance scale (continuous). Linear regression analyses performed with result estimates, confidence intervals, and *p*−values.

[b] Model A reference cluster = persistently low SC/low GRD cluster; Model B reference cluster = persistently high SC/high GRD cluster. Covariate estimates for Models A and B are the same. Only the reference cluster and estimates for comparisons between clusters change

Table 3.

Results of logistic regression models examining the associations of gender minority stress clusters with short sleep duration (N = 279).

	Short Sleep Duration [a]					
	Model A [b]			Model B [b]		
	Adjusted odds ratio	95% CI	*p*	Adjusted odds ratio	95% CI	*p*
Minority stress clusters						
Persistently low SC/low GRD group	**Reference**	**Reference**		0.46	0.24 – 0.90	0.02 *
Persistently high SC/low GRD group	1.69	0.93 – 3.09	0.09	0.78	0.41 – 1.46	0.44
Persistently high SC/high GRD group	2.17	1.11 – 4.26	0.02 *	**Reference**	**Reference**	
Age (in years)	1.02	1.01 – 1.04	0.02 *	1.02	1.01 – 1.04	0.02 *
Gender identity						
Transmasculine spectrum	**Reference**	**Reference**		**Reference**	**Reference**	
Transfeminine spectrum	0.76	0.45 – 1.30	0.32	0.76	0.45 – 1.30	0.32
Race and ethnicity						
Non-Latinx White	**Reference**	**Reference**		**Reference**	**Reference**	<0.01 **
Non-Latinx African-American	3.15	1.37 – 7.20	<0.01 **	3.15	1.37 – 7.20	0.92
Latinx	1.04	0.53 – 2.01	0.92	1.04	0.53 – 2.01	0.09
Non-Latinx other race	1.81	0.91 – 3.59	0.09	1.81	0.91 – 3.59	
Sexual orientation						0.88
Sexual minority	**Reference**	**Reference**	0.88	**Reference**	**Reference**	
Heterosexual	1.05	0.93 – 3.08		1.05	0.93 – 3.08	

Note.

* $p < 0.05$

** $p < 0.01$

*** $p < 0.001$. SC = stigma consciousness; GRD = gender-related discrimination.

[a]Short sleep duration defined as < 7 hours of sleep per night based on self-reported data. Logistic regression analysis performed with adjusted odds ratio, confidence intervals, and *p*-values.

[b]Model A reference cluster = persistently low SC/low GRD cluster; Model B reference cluster = persistently high SC/high GRD cluster. Covariate estimates for Models A and B are the same. Only the reference cluster and estimates for comparisons between clusters change.