

**Negative Expectations, Discrimination and Community Connectedness and their Relation
to Sleep Disturbance in Sexual and Gender Minorities**

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Abstract

Sleep disturbances are detrimental to physical as well as psychological health (Dolsen et al., 2022). Research shows that sexual and gender minorities are more prone to sleep disturbance (Butler et al., 2019; Campbell et al., 2023; Dolsen et al., 2022; Gibbs & Fusco, 2023) and this was linked to minority stress theory (Caceres et al., 2022; Belloir et al., 2024; Segovia & Sparks, 2023). The current study aims to investigate whether (1) sexual minorities, gender minorities and gender and sexual minorities experience sleep disorders to a different extent; (2) whether the relationship between discrimination and sleep disturbance is moderated by community connectedness; (3) whether the relationship between negative expectations and sleep disturbance is moderated by community connectedness. The study employed an online questionnaire on an availability sample (n=60). Despite experiencing unique stressors, no differences were found between minority groups. Discrimination showed no correlation with sleep disturbance. Lastly, community connectedness did not moderate the relationship between negative expectations and sleep disturbance. However, in the simple linear model sleep disturbance showed an association with negative expectations. This was not the case in the more complex interaction model. Given that the study was underpowered, this warrants further research.

Keywords: sexual and gender minorities, sleep disturbance, resilience, community connectedness, discrimination

1. Introduction

1.1. Sleep Disturbances

Sleep is an integral part of daily human life, yet when sleep disturbances occur, a vast number of detrimental effects have been observed to take place in the waking life of humans. This is not surprising, as research findings have deemed that sleep is essential for physical, emotional and cognitive functioning (Dolsen et al., 2022). Mental health impairments, including a higher prevalence of suicide-related thoughts and behaviours, emotional dysregulation and impaired judgement have been observed after only a few nights of disturbed sleep (Dolsen et al., 2022).

The psychological consequences of sleep disturbances are various, and they affect multiple aspects of the human wake-life. For instance, disturbed sleep has been linked to sleepiness, which, in turn, negatively impacts learning, memory and performance (Hershner & Chervin, 2014). This happens because different aspects of memory have been linked to separate sleep cycles, which in turn implies that memory formation and recollection is dependent on an orderly succession of sleep stages (Hershner & Chervin, 2014).

However, memory is only one aspect of the detrimental effects of sleep disturbances. On top of that, short sleep duration and poor-quality sleep negatively affect emotional processes (Hamilton et al., 2022; Simon et al., 2020). In their meta-analysis, Simon et al. (2020) found links between sleep disturbance and emotional volatility, irritability, lower positive mood and mood swings, which are factors that lead to compromised decision-making and action-taking processes. This happens because not getting enough sleep and experiencing low-quality sleep cause attentional bias, making individuals more reactive to negative stimuli and causing a blunted perception of positive stimuli (Hamilton et al., 2022; Simon et al., 2020).

Moreover, researchers identified that there is a strong relationship between sleep and depression (Hershner & Chervin, 2014; Simon et al., 2020). Lastly, the importance of sufficient and restful sleep is underlined by the alarming evidence that disturbed sleep is correlated with suicide ideation, attempts and completion (Hamilton et al., 2022; Simon et al., 2020). Specific groups affected by poor sleep are lesbian, gay and bisexual (LGB) and transgender and gender diverse (TGD) people. Compared to heterosexual cisgender people, scientific evidence suggests that LGB and TGD people sleep more poorly and experience sleep disturbances in a higher proportion (Butler et al., 2019; Campbell et al., 2023; Dolsen et al., 2022; Gibbs & Fusco, 2023). This is thought to be linked to minority stress as higher levels of stress have been observed to have a detrimental effect on sleep quality (Campbell et al., 2023).

1.2. Minority Stress Theory

The Minority Stress Theory (MST) emerged from the work of Meyer (2003), as a result of emerging evidence in the scientific literature that the higher prevalence of mental illnesses experienced by the members of a minority group could be better explained by social stress resulting from their minority status, rather than the original stigmatizing belief that homosexuality is a mental illness in itself.

With that in mind, Meyer's (2003) work suggests that two types of social stressors affect an individual, arising from challenges within their environment, i.e. general stressors that are experienced by everyone within the larger population that include the majority of people and all minorities, and minority stressors which are unique to those who are part of a minority group. These aforementioned stress factors are chronic and not mutually exclusive, but interconnected and cumulative in predicting mental health outcomes. Subsequently, individuals who are not a minority are only subject to general stressors under unfavourable circumstances such as holding

a lower socio-economic status or loss of income, while minorities are prone to experiencing both general stressors as well as additional minority stressors (Meyer, 2003).

One of the main differentiating factors between general stressors and minority stressors is that minority stressors originate from prejudice and stigma that can be internal or external (Frost & Meyer, 2023; Meyer, 2003). To further explain, an individual's minority status is an integral part of and influences their social environment. Therefore, MST makes the distinction between proximal and distal minority stressors, the former describing internal stressors such as expectations of rejection and internalised homophobia, while the latter are experienced due to external factors such as events of prejudice or violence against the minority community. However, being a minority is not only linked to negative aspects as developing a minority identity can offer minorities coping strategies, such as a sense of community and belonging (Meyer, 2003). In his later work, Meyer (2015) mentions not only coping, but resilience, defining it as 'the quality of being able to survive and thrive in the face of adversity', pointing out that it is essential in understanding minority stress.

Resilience can be individual- and community-based and both types are key factors in MST (Meyer, 2015). However, individual-based resilience stems from an ideology of meritocracy and individualism, making it dependent on personal qualities, characteristics and traits. This ideology can create an attitude of blaming the victim, and it can negatively impact the health of disadvantaged populations who may face hardship in handling their circumstances (Meyer, 2015). With that in mind, considering the chronic nature of the minority stressors, individual resilience might be the less effective alternative when talking about sleep disturbance.

On the other hand, community-based resilience is less focused on the individual, implying that to benefit from the membership within a community, an individual needs to

identify as a member of said community (Meyer, 2015). By doing this, one has access to community resources that can be tangible, such as community centers, specialized clinics and sources of information, or intangible, such as social norms and values associated with the minority status, which help redefine life goals and measures of success. The positive effects of social support and community membership on buffering the effect of stress are supported by research both in MST and general stress theory (Meyer, 2015; Testa et al., 2015; Haslam et al., 2015). Therefore, in the context of sleep disturbance being connected to a community might buffer the sleep disturbance outcomes in sexual and gender minorities (SGM).

Since its proposal, MST has been successfully implemented in research on LGB minorities, policy-making and clinical interventions, uncovering evidence of the effect of minority stressors on the health of various minority groups while it can be present in various settings, such as the workplace setting, in the family or in romantic relationships (Frost & Meyer, 2023). While Meyer's (2003) original theory focused only on LGB individuals, later studies have shown that MST can also be successfully applied to TGD minorities (Frost & Meyer, 2023; Mezza et al., 2024).

Thus, LGB and TGD minorities experience minority stress in similar ways (Meyer, 2015; Testa et al., 2015). Distal stressors that can affect both minority groups are violence, discrimination and rejection, among others, while examples of proximal stressors that can affect both groups are internalized homophobia or transphobia and negative expectations of victimization, discrimination or rejection (Testa et al., 2015).

Despite having similar experiences, compared to LGB minorities, TGD individuals can also experience stressors that are unique to their minority group (Meyer, 2015; Testa et al., 2015). Some examples are nonaffirmation, i.e. internal sense of gender identity not being

affirmed by others in their interaction with society (Meyer, 2015; Testa et al., 2015), additional discrimination in the form of not being able to access legal documents or medical care because of discrepancies in legal and de-facto name or sex, not being able to safely access public restrooms, and having no decision in identity disclosure due to physical cues (Testa et al., 2015).

1.3. Sleep Disturbance in Sexual and Gender Minorities (SGM)

SGM individuals have been observed to experience sleep disturbance to a higher extent. As research suggests, lesbian and bisexual women show the highest prevalence of sleep disturbance, followed by bisexual men and then gay men (Dai & Hao, 2019; Dolsen et al., 2022). In TGD minorities, more than a third of non-binary people reported experiencing disturbed sleep, followed by transgender men and then transgender women (Dai & Hao, 2019; Dolsen et al., 2022). It is however worth noting that TGD-focused studies on sleep disturbances are even less common than sleep disturbance studies in LGB individuals (Butler et al., 2019).

Further, minority stress is thought to be linked to sleep disturbances in gender and sexual minorities. For instance, certain proximal stressors such as increased internalized homophobia have been linked to a higher probability of being diagnosed with a sleeping disorder (Caceres et al., 2022; Belloir et al., 2024; Segovia & Sparks, 2023). Furthermore, as minority stress is seen as chronic (Meyer, 2003), Gibbs & Fusco (2023) stated that this in turn alters the stress coping mechanisms of minorities, leaving them more prone to anxiety symptoms and altering their perception of their capacity to manage stress, which in turn mediate the effect of minority stress on sleep disturbances.

As a last example of how minority stressors are correlated with sleep disturbances, discrimination, both as a distal and a proximal stressor, i.e. as expectation of discrimination, has been found to have a detrimental effect on sleep quality (Chan & Fung, 2021). Experiencing or

merely having anticipatory negative expectations of discrimination is thought to evoke a sense of threat to basic human needs such as social integration and personal identity, which in turn is linked to sleep disturbance and consequently poor physical and mental health. Moreover, discrimination heightens arousal and alertness by increasing the perception of threat, resulting in obstructed restful sleep (Chan & Fung, 2021).

1.4. Current Study

As mentioned earlier, sleep disturbance has significant detrimental effects on mental health, especially for SGM who show a higher prevalence of sleep disturbance than the general population and are already more prone to mental health issues due to the stress experienced due to their minority status.

The higher prevalence of sleep disturbance in SGM individuals has been linked to minority stress. However, it has been established that while LGB and TGD minorities experience similar minority stressors, TGD minorities also experience a set of unique experiences that contribute to minority stress. Therefore, one aim of the study is to clarify whether these unique experiences are cumulative in their relation to sleep disturbance outcomes.

Furthermore, Chan & Fung (2021) found evidence that discrimination and negative expectations of discrimination and of the outcomes of discrimination are related to sleep disturbance. However, their study was conducted on a collectivistic culture, therefore, the current study aims to investigate whether the same results will be observed in a more individualistic, Western culture. Furthermore, while Testa et al. (2015) suggest that community-based resilience has counteractive effects on negative health outcomes caused by minority stress, this has not yet been investigated in relation to sleep disturbance, therefore the current study takes into account

community-based resilience as a buffer for the effect between discrimination and sleep disturbance, and negative expectations and sleep disturbance.

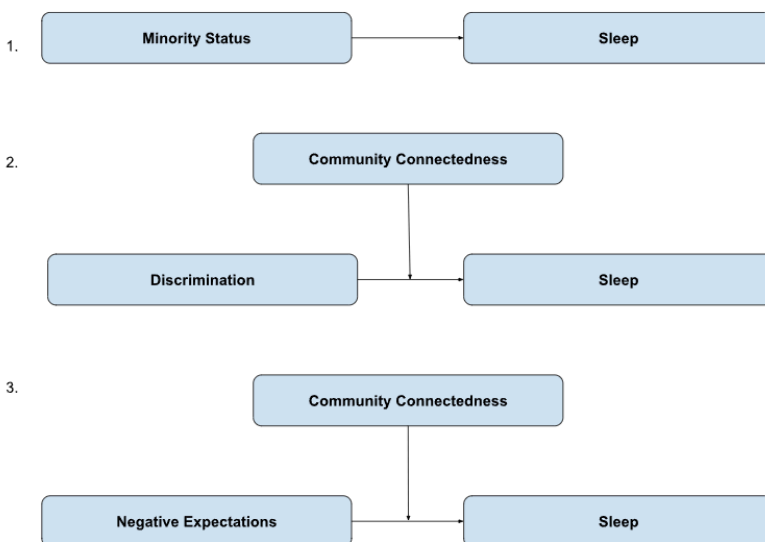
The following hypotheses have been formulated:

1. TGD individuals who are also LGB minorities show a higher prevalence of sleep disturbance than individuals who are uniquely TGD minorities or LGB minorities.
2. The relationship between the distal stressor discrimination and sleep disturbance outcomes is moderated by community connectedness for all SGM subgroups.
3. The relationship between the proximal stressor negative expectations and sleep disturbance outcomes is moderated by community connectedness for all SGM subgroups.

A graphical representation of the hypotheses can be seen in Figure 1.

Figure 1

Graphical representation of the hypotheses



Note. Each of the hypotheses is represented following the number that corresponds to the number of each hypothesis.

2. Methods

2.1. Study design

This study is part of a larger study focused on LGBTQI+ health, administered in the form of an online survey study. The whole questionnaire and the informed consent form can be seen in Appendix 1. The collection and handling of data from human subjects was approved by the BMS Ethics Committee at the University of Twente. The request number of the form submitted to and approved by the ethics committee is 240516.

2.2. Participants

The convenience sample in this study was recruited via multiple means. First, on multiple online platforms, i.e. Facebook, Instagram and Reddit, second on the test subject pool used by the University of Twente (SONA) and third, it has been subject to snowballing and availability sampling.

The participants were required to be over the age of 16, have sufficient proficiency in English and be a gender or sexual minority, or both. The participants were also required to answer all the questions in the questionnaire.

Initially, 114 participants started the questionnaire. After screening for the inclusion criteria, 45 participants were removed from the sample for not completing the whole questionnaire and 9 participants were removed because they reported being cisgender heterosexual individuals. There were no participants under the age of 16 and all included participants agreed to the informed consent form and the handling of their data. The number of participants left for data analysis was 60. The participants left were between the ages of 17 and 49. The mean age of the participants was 25.12 (SD = 5.89). The other demographics gathered are summarized in Table 1. Furthermore, an overview of the gender identity and sexuality demographics are highlighted in a Venn diagram in Figure 2. Importantly, this diagram shows that no participants identified solely as a gender minority, but either as a sexual minority (N=38)

or a gender minority and a sexual minority (N=22). Therefore, only these two groups are used in further comparisons.

Table 1

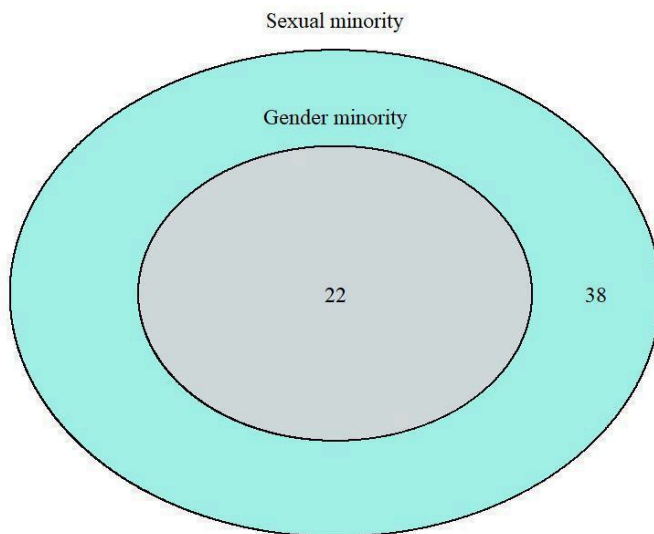
Demographics

Characteristic	n	%
Occupation		
Psychology Student	13	21.7
Student	23	38.3
Working	24	40.0
Country of residence		
Netherlands	39	65.0
Germany	18	30.0
Other	3	5.0

Note. Table 1 contains the frequency of the demographics declared by the participants.

Figure 2

Minority status of the participants



Note. Figure 2 shows the number of participants in each minority category. 38 participants are cisgender sexual minorities, while 22 participants are both sexual and gender minorities. There were no heterosexual gender minority participants.

2.3. Instruments

For the purpose of this paper a number of different scales have been implemented within one online questionnaire administered through the Qualtrics software, version 2024.01.2.3.1.

Gender and Sexuality Demographics

The data concerning the participant's gender, gender expression and sexuality was collected by implementing relevant parts of the Diversity Minimal Item Set, i.e. DiMIS (Stadler et al., 2023). The questions adopted concerned gender identity, sexual orientation and sex at birth, assessed independently in separate questions, such as 'What sex were you assigned at birth (for example, on your birth certificate)?'. The other questions and answer options can be found in Appendix 1.

2.3.2. Sleep Disturbance Assessment

The assessment instrument for sleep disturbance is the 8-item PROMIS Sleep Disturbance Item Bank - short form 8b, version 1.0 (see Appendix 2). The PROMIS questionnaire is intended to be used as a 'thermometer' that assesses sleep disturbance regardless of the underlying causes of these disturbances (Buysse et al., 2010). The 8b short form, due to its multidimensionality, is a best modelled in working with adult samples (Brossoit et al., 2023).

Validity and reliability support have been gathered from testing the item bank both on self-reported and professionally-assigned diagnoses of sleep disturbance, where the differences between afflicted and non-afflicted individuals were observed to be significant (Buysse et al., 2010).

According to the PROMIS scoring manual, each item is assigned a score on a closed interval between 1 and 5, with some exceptions where the scoring is inverted, then a T-score is computed for each participant where an average value of 50 should be normally observed and a standard deviation with the value 10. 4 items required reverse-scoring. For this measure, a higher score is positively correlated with the degree of sleep disturbance.

For all questions, the questionnaire measured events related to the 7 days prior to the questionnaire. 4 items have ‘not at all’ to ‘very much’ as possible answer choices, 3 items offer choices from ‘never’ to ‘always’, while 1 item which asked the participant to self-assess their overall sleep quality displayed the options ‘very poor’ to ‘very good’. The results were scored using R-studio where scores between 1 and 5 were attributed to all answers and then they were added to the tool provided by the PROMIS team on their website for the computation of T-scores which were used as the final sleep disturbance measurement.

The 8b short form displayed a Cronbach’s alpha of .90 in the current sample, suggesting high reliability.

2.3.3. Discrimination, Negative Expectations and Community Connectedness

The variables ‘discrimination’, ‘negative expectations’ and ‘community connectedness’ in gender and sexual minorities were measured using an adapted version of the Gender Minority Stress and Resilience Measure (Testa et al., 2015). Testa’s (Testa et al., 2015) measure has originally been developed for measuring these factors, among others, in gender minorities. However, in his work, Behrens (2024) has adapted the instrument to a more general ‘queer’ population that encompasses both sexual and gender minorities after discussing the idea with field experts at the University of Twente. The adaptation has also been successfully used in the

work of Zirnheld (2024). As for the original instrument, Testa et al. (2015) identified 7 gender minority stress factors and 2 resilience factors that are accounted for in the full questionnaire. The study reported satisfying criterion, convergent and discriminant validity of their measure as well as a Cronbach's alpha of .86, .61 and .89 for community connectedness, discrimination and negative expectations respectively.

A Likert scale was employed in collecting data regarding the three variables. With that in mind, the 'discrimination' variable was assessed using 5 items where the participants could select a choice between 'never', 'sometimes', 'about half the time', 'most of the time' or 'always'. For the other 2 variables, the possible answers were 'strongly disagree', 'somewhat disagree', 'neither agree nor disagree', 'somewhat agree' or 'strongly agree', where negative expectations were assessed using 9 items and community connectedness employed 5 items. All items can be found in Appendix 1.

The scoring was done by adding the points obtained on the 5-point Likert scale where answering 'strongly disagree' implied zero points, while 'strongly agree' was assigned with the highest number of 4 possible points, a higher total value implying a greater experience of the variable. The last 2 items for community connectedness required reverse scoring.

The discrimination scale demonstrated good reliability ($\alpha = .87$) in the current study, with a sample of $n = 60$ participants. Similarly, the assessment tools for negative expectations ($\alpha = .95$) and community connectedness ($\alpha = .82$) demonstrated satisfactory reliability in the current sample ($n = 60$). These values demonstrate reliability and high internal consistency for all the measures.

2.4. Procedure

The questionnaire was administered online, and it was estimated to take about 15 minutes and it was administered in one session. The questionnaire (see Appendix 1) started with the consent form that the participants were asked to read carefully and then informed consent was requested. Then, the demographic questions were presented. After that, the participants were required to fill in answers on different measures, including measures used in other papers that were part of the bigger study mentioned earlier in this section.

2.5. Data Analysis

A-priori to the data collection process a G-power analysis was conducted for a linear multiple regression with a fixed model and one regression coefficient. The effect size was set at 0.15, the type I error probability was 0.05, the power was 0.8 and the number of predictors was 6, accounting for 4 predictors, i.e. minority status, discrimination, negative expectations and community connectedness, and 2 interaction terms, i.e. the interactions between community connectedness and each of the other predictors. The minimum sample size computed was $n = 92$. This was not met in the current study.

The handling of the data was done using RStudio (version 2024.04.0+735). Before data analysis began, the data was cleaned by removing the unnecessary variables for this study and removing the participants who did not fulfil the inclusion criteria (see Participants). The full code used to analyze the data can be found in Appendix 3.

Then the descriptive statistics and figures were computed for the participant demographic information and the variables employed in testing the 3 hypotheses (see Current Study). The test results were calculated for all the instruments used in the paper (see Instruments) and Cronbach's alpha was calculated for all measures.

Next, general correlations between the variables used in the study were computed, followed by the creation of models used to assess the hypotheses. Sleep disturbance was used as the dependent variable in all models, first in assessing the effect of each independent variable on the dependent variable separately, then in interaction models.

All models mentioned have been tested for the parametric assumptions. The assumption of independence was tested using Runs tests, linearity was tested by plotting residual plots, normality was assessed using the Shapiro-Wilk test and homoscedasticity was assessed using the Breusch-Pagan test. Transformations of the variables were attempted in the cases where the parametrical assumptions were not met. Furthermore, the models were tested for multicollinearity (when applicable) using a variance inflation factor (VIF) test where the satisfactory VIF values were smaller than 2.5.

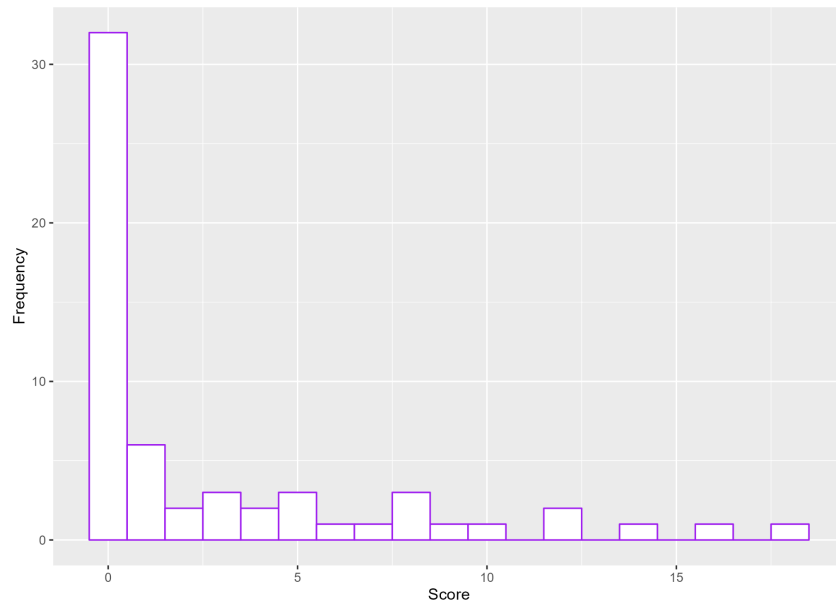
3. Results

3.1. Descriptives

The first concept measured within this study was discrimination. More than half the sample ($n = 32$) reported to have never experienced discrimination, resulting in left-skewed data. The mean for this variable was 2.83 ($sd = 4.49$). A frequency representation can be seen in Figure 3.

Figure 3

Distribution of discrimination scores

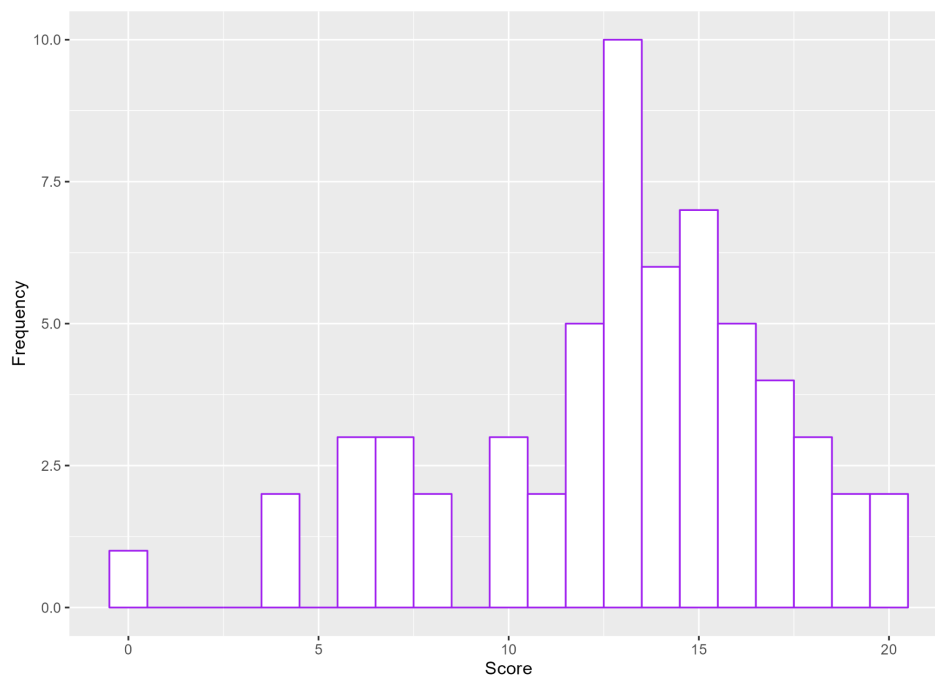


Note. Figure 3 depicts the number of participants that scored each possible value for the variable discrimination.

Further, another variable measured was negative expectations of discrimination. This variable had a mean value of 13.32 (sd = 9.95). Then, another variable employed in this study was community connectedness (mean = 12.8, sd = 4.25). For community connectedness 76.67% (n = 46) of the participants reported scores of over 10 on the 0 to 20 point scale, indicating that most participants experience moderately high to very high community connectedness, appearing slightly skewed. This can better be seen in Figure 4.

Figure 4

Distribution of community connectedness scores



Note. Figure 4 depicts the number of participants that scored each possible value for the variable community connectedness.

Lastly, the score computed for the variable sleep disturbance had a mean of 53.15 (SE = 1.10, $n = 60$).

When broken down into subgroups based on their minority group, individuals who are both sexual and gender minorities score slightly higher in all employed measures. The most prominent difference in the current sample seems to be in negative expectations scores, where sexual minorities reported a considerably lower amount of negative expectations than sexual and gender minority individuals (see Table 2).

Table 2

Descriptive statistics broken down by subgroups

Sexual minorities		Sexual and gender minorities	
Mean	SD	Mean	SD

Discrimination	0.87	3.00	6.23	4.66
Negative expectations	9.63	8.93	19.68	8.40
Community connectedness	12.16	4.61	14.18	3.23
Sleep disturbance	52.38	9.02	54.47	7.71

Note. The table above contains the mean and standard deviation for each of the variables shown in the first column after the data was broken down by subgroup.

3.2. Main Effects

The general correlation between the variables in this study was computed. The direction and strength of the relationships can be seen in Table 3.

Table 3

General correlations between variables

	Minority status	Discrimination	Negative expectations	Community connectedness	Sleep disturbance
Minority status	-	-.58*	-.49*	-.23	-.12
Discrimination		-	.74*	.12	.25
Negative expectations			-	.15	.29*
Community connectedness				-	-.13
Sleep disturbance					-

Note. Table 3 depicts the strength and direction of the relationship between the variables employed in the study.

Being only a sexual but not a gender minority seems to have a moderate negative correlation with discrimination ($r = -.58, p < .001$) and negative expectations ($r = -.49, p < .001$) and a non-significant correlation with community connectedness ($r = -.23, p = .075$) and sleep disturbance ($r = -.12, p = .367$). Discrimination did not show statistically significant correlations with community connectedness ($r = .12, p = .354$) or sleep disturbance ($r = .25, p = .058$), but a strong positive correlation with negative expectations ($r = .74, p < .001$). Negative expectations had a weak positive correlation with sleep disturbance ($r = .29, p = .024$) and no statistically significant correlation with community connectedness ($r = .15, p = .260$). Lastly, the correlation between community connectedness and sleep disturbance was statistically insignificant ($r = -.13, p = .313$). Given the lack of statistical support for a connection between discrimination and sleep disturbance, hypothesis 2 was rejected due to its assumption that sleep disturbance is related to the experience of discrimination. Further assessment of the relationship between the two variables was dismissed.

No significant difference in sleep disturbance was observed between participants who are both sexual and gender minorities ($M = 54.47$) and participants who are only sexual minorities ($M = 52.38$) after conducting a two-sample t-test between the two groups ($t(58) = 0.91, p = .367, 95\text{CI}[-2.51, 6.68]$). Therefore, hypothesis 1 was rejected.

To test hypothesis 3, a linear regression model was created with negative expectations as the predictor variable and sleep disturbance as the dependent variable (see Table 4). The model did not meet the homoscedasticity assumption even after logarithmic, squared root and inverted transformations on the variables. Despite these limitations, the model was run. The relationship between the sleep disturbance and negative expectations ($b = 0.25, SE = 0.11, t(58) = 2.32, p = .024$)

was statistically significant. The model explained a low amount of variance in sleep disturbance (Adj. $R^2 = .068$, $F(1,58)=5.371$, $p=.024$). The residual standard error was 8.257.

Table 4

Regression table for the relationship between negative expectations and sleep disturbance

Term	b	SE	t	p	95% CI
Intercept	49.80	1.79	27.80	<.001	[46.23,53.40]
Negative expectations	0.25	0.11	2.32	.024	[0.03,0.47]

Note. The model did not meet the assumption of homoscedasticity.

3.3. Interaction Effects

Further, an interaction model was created to test for moderation of community connectedness in the relationship between sleep disturbance and negative expectations. Once again, the model did not meet the assumption of homoscedasticity, nor the assumption of linearity even after transformations. There was no multicollinearity. In spite of that, the model was run and the regression table can be seen in Table 5. There was no significant impact of negative expectations ($b=0.78$, $SE=0.41$, $t(56)=1.91$, $p=.062$), community connectedness ($b=-0.03$, $SE=0.36$, $t(56)= -0.08$, $p=.940$), nor the moderation effect ($b= -0.04$, $SE=0.03$, $t(56)=-1.28$, $p=.205$) on sleep disturbance. However, the model explained a low amount of variance in sleep disturbance (Adj. $R^2 = .095$, $F(3,56)=3.074$, $p=.035$). The residual standard error was 8.139. Hypothesis 3 was rejected. **Table 5**

Regression table for the interaction model

Term	b	SE	t	p	95% CI
Intercept	50.11	4.73	10.60	<.001	[40.65,59.59]
Negative	0.78	0.41	1.91	.062	[-0.04,1.60]

expectations					
Community connectedness	-0.03	0.36	-0.08	.940	[-0.75,0.70]
Negative expectations x Community connectedness	-0.04	0.03	-1.28	.205	[-0.10,0.02]

Note. The assumptions of homoscedasticity and linearity were not met.

4. Discussion and Conclusion

4.1. Summary of the results, fit with existing literature and implications

Previous research suggests that sexual and gender minorities experience poor mental health due to minority stress. Therefore, this study aimed to assess how discrimination and the expectation of discrimination contribute to sleep disturbances among minority individuals. Additionally, it explored whether a sense of community connectedness could buffer the effects of these stressors on sleep disturbances. The current study failed to gather sufficient statistical significance to accept any of the hypothesized effects. The results suggest that there are no statistically significant differences in sleep disturbance between the selected minority groups. This could mean either that although different minority groups experience unique sets of minority stressors (Meyer, 2015; Testa et al., 2015) the effects on sleep disturbance remain similar, or that by adopting a rather simplistic grouping strategy, i.e. gathering all gender and sexual minority subgroups under the broader categories of either sexual minorities, gender minorities, or sexual and gender minorities, certain aspects of the experience of belonging to a minority group and which are unique to said group or shared with only other few groups might be overlooked. As data suggests, different SGM minority subgroups experience sleep disturbance to different extents (Dai & Hao, 2019; Dolsen et al., 2022), therefore it is perhaps important to explore group differences further. Then, a third option would be that the lack of heterosexual

gender minority participants did not allow for enough variation within the sample, highlighting the possibility that gender minorities who are also sexual minorities might have a comparable experience of minority stress with sexual minorities due to their shared identity group. A fourth possible explanation would be that minority stress could have a static effect on sleep disturbance, where its mere existence is linked to sleep disturbance outcomes, rather than having a directional correlation where more stressors would have a cumulative effect and a higher influence on sleep disturbance.

Moving on, in the current study discrimination could not explain the variations in sleep disturbance. This does not align with the findings of Chan & Fung (2021) who reported an association between the two variables. A possible explanation for this outcome could be that the experience of discrimination itself may not be directly linked to sleep disturbance, but to other factors caused by discrimination such as the adoption of substance use as a coping strategy (Gibbs, 2022), or the generalized anxiety symptoms resulting from discrimination and the emotional experiences associated with it (Gibbs & Fusco, 2023). Additionally, another pathway for an indirect relationship might be highlighted by research suggesting that different forms of discrimination can be linked to rumination, which in turn can be linked to depressive symptoms (Kaufman et al., 2017; Sarno et al., 2020), which once again have been observed to have an effect on sleep disturbance (Simon et al., 2020).

Despite the significance found in the simple linear model, the relationship between negative expectations and sleep disturbance became insignificant in the interaction model. A plausible explanation for this is that the model was underpowered. Moreover, a potential effect is indicated by the resulted confidence interval, therefore, the results appear inconclusive and

warrant further research. Notably, existing research found multiple relationships between negative expectations and sleep disturbance (Chan & Fung, 2021; Belloir et al., 2024).

Moreover, the current study found no statistically significant correlation between sleep disturbance and community connectedness. Possibly, while community resilience offers a buffer for stress and associated negative outcomes (Meyer, 2015; Testa et al., 2015), it may play a lesser or no role in relation to sleep disturbance. A negative correlation was found between community connectedness and sleep disturbance by Kolp et al. (2019) in the first study to assess the relationship between gender minority protective factors and sleep disturbance, but given that their research focused on victims of sexual assault overgeneralizations ought to be done cautiously. In other words, comparing the findings of Klop et al. (2019) with the findings in this study could lead to erroneous conclusions because of the trauma suffered by the sample in their study that could have possibly led to stress unrelated to one's minority status, while the present study discusses concepts in relation to minority stress. Furthermore, the sample in the current study was a non-clinical sample.

4.2. Strengths and limitations

This study served as both a replication, be it unsuccessful, of the findings of Chan & Fung (2021) on a different population, i.e. individuals from an individualistic culture, and a small-scale exploratory study in the relationship between community-based resilience and sleep disturbance in relation to minority stressors.

However, the generalizability and internal validity of the findings is questionable. The analyses performed are underpowered and some of them could not meet the parametric assumptions.

Another limitation was the lack of variance within the sample and the abnormality of discrimination and community connectedness scores. With that in mind, with there being no heterosexual gender minority participants the sample might have been too homogenous, especially considering that all participants were young adults, most of them either students or working in white-collar industries. This could have had an effect on the data, given that a vast majority of the respondents reported having no experience of discrimination and being well-connected within their minority community.

Furthermore, participants were required to fully complete the questionnaire, which led to losing some of the participants during the data-collection process. Nevertheless, an alternative approach would have been using imputation techniques such as multiple imputation. This can be done using RStudio, or other software, and it works by creating multiple datasets where the missing values are replaced with reasonable values (He, 2010). Then means and standard errors are computed for each dataset, followed by combining the means using formulas that account for variability between and within imputations. Benefits of this approach include increasing the power of the analysis, reducing bias and providing accurate inference (He, 2010).

Last, different sexuality types and gender identities and the combinations of sexualities and gender identities were not taken separately in the data analysis of the current study. Making such combinations would have required an enormous sample size, therefore the mechanisms of the relationship between minority stress and sleep disturbance for different subgroups remain unknown. The idea that different subgroups of sexual and gender minorities are affected by sleep disturbance in different proportions is supported by the findings of Dai & Hao (2019).

4.3. Future research

All things considered, future research should focus on adding more variety to their samples and identifying the main factors contributing to sleep disturbance becoming a problem in sexual and gender minorities. This could be done by combining qualitative and quantitative research methods on larger and more various samples. Qualitative research could be beneficial in further larger-scale exploratory studies focused on identifying minority stressors that are specifically linked to sleep disturbance in sexual and gender minorities and more specific aspect of the stressors that might influence sleep health in the mentioned population. This should also focus on different sleep-related issues, rather than broader sleep disturbance as to identify whether there are different factors that could influence the health of different aspects of sleep.

Moreover, more research on the issue of protective factors in relation to sleep disturbance should be conducted in order to find ways to help the sexual and gender minority community experience healthier sleep.

4.4. Conclusion

To summarize, the study could not provide statistically significant proof to any of the suggested hypotheses. Existing literature included above does not entirely explain the findings, whilst offering possible paths for future exploratory research

However, some findings deserve due attention. The current sample suggests that sexual and gender minority students experience limited sleep disturbance. Their experience of discrimination is also relatively limited, while the connections with their communities are strong.

The current study does not dismiss a potential relationship between minority stress and sleep disturbance. In contrast to previous research, no significant predictors were identified, likely due to the underpowered nature of the study.

Notably, negative expectations were associated with sleep disturbance in a simple model, while that relationship was not found in the more complex model. Taking into account the fact that the study was underpowered, this warrants more research.

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University of Twente.

Appendix 1.

Questionnaire

Start of Block: Consent form

Intro Welcome to our research study!

Participating involves completing a survey containing multiple questionnaires which will take about 15 minutes.

This research project is conducted by Josie de Boer, Mihai Botea, Amelie Henk and Mars Schupiloff in fulfilment of the requirements of the bachelors program of psychology at the University of Twente, under the supervision of Dr Anne van Dongen and Dr Tessa Dekkers. We welcome your participation! In this study we are interested in the experiences of individuals who are part of a sexual and/or gender minority, between the ages of 16 and 42 and who have sufficient knowledge of English.

Sexual and Gender Minority includes individuals whose biological sex, sexuality, gender identity and/or gender expression deviate from majority norms. Encompassing lesbians, gay men, bisexuals and transgender individuals (LGBT); intersex people (people whose bodies do not have typically male or female sex characteristics due to variations in chromosomes, gonads, sex hormones and/or genitals); gender non-conforming people who may not see themselves as transgender; and people involved in same-sex relations who may not see themselves as lesbian, gay or bisexual, possibly preferring another word to self identify (such as polyamorous, queer or two-spirited) or possibly preferring no label at all.

By participating in this study you will get the benefit of earning credit points in the SONA system, if applicable for your situation. Furthermore, your participation will provide valuable information to our understanding of factors that impact the physical and mental health of sexual and gender minority individuals.

It is unlikely that there are any risks involved with participation in this project. The research project has been reviewed and approved by the BMS Ethics Committee at the University of Twente (Enschede, The Netherlands). However, should you experience any discomfort due to undertaking this study, consider giving yourself a moment of rest. Additionally, freely available resources for further support will be provided at the end of the survey.

Your participation in this project is completely voluntary and you may cease participation at any time. If you agree to participate, you can withdraw from participation at any time during the project without comment or penalty. However, once your responses have been analysed and we have de-identified them, you will be unable to withdraw. Your decision to withdraw participation will in no way impact your current or future relationship with the University of Twente.

The information and responses you provide will be treated confidentially and will be accessible only to members of the research team. Your responses to the questionnaire will form part of a larger data response set, which will initially be stored by Qualtrics. Research data from Qualtrics

will be downloaded and stored securely on the University of Twente Google Drive or OneDrive allocation. Data will be password-protected and accessible only to members of the research team and their supervisors. As required by the University of Twente, all research data (survey responses and analysis) will be retained in a password-protected electronic file for a minimum period of five years before being destroyed. Participants' data will not be identifiable in any publication or reporting. Furthermore, the data provided during this project is subject to the European Union's laws and regulations regarding confidentiality and storage of personal data. In the interest of researcher transparency, a strictly de-identified version of the research data will be prepared and made available on the online open data repository Open Science Framework (<https://osf.io/>). Research results will be reported in an academic thesis, and may also be disseminated via journal articles and/or conference presentations.

Please contact the research team members if you have any questions or require further information about the project.

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Dr. Tessa Dekkers, Supervisor: t.dekkers@utwente.nl

No automatic feedback will be given to you about the results of this study. However, if you participate and wish to receive a summary of the research results once the study has been completed, you can email the research team members.

The University of Twente conducts research in accordance with the National Statement on Ethical Conduct in Human Research. If you do have any concerns or complaints about the ethical conduct of the project you may contact the Manager, Research Ethics on ethicscommittee-bms@utwente.nl. This project has received ethical approval from the University of Twente Human Research Ethics Committee BMS/Domain Humanities and Social Science.

Informed consent By continuing this survey, you confirm the following:

1. I have read and understood the participant information sheet. I know that I may ask for more information about the project as it goes on.
2. I understand that this study involves filling out an online questionnaire.
3. I consent voluntarily to be a participant in this study and understand that I can refuse to answer questions and I can withdraw from the study at any time, without having to give a reason.
4. I understand that my participation will be included in a large data set and immediately de-identified.
5. I understand that personal information collected about me that can identify me, [e.g. my email address or my identity code], will not be shared beyond the study team and immediately be de-identified once the data collection has been completed.

6. I understand that information I provided will be used for four academic theses, and may also be disseminated via journal articles and/or conference presentations. I understand that a strictly de-identified version of the research data may be published on the online open data repository Open Science Framework (<https://osf.io/>).

7. I understand that all information will be treated in the strictest confidence and used for research purposes only. I understand that I will not be personally identified on any reports from this project.

8. I assign and waive all claims to patents, commercial exploitation, property or any material or products which may form part of or arise from this study.

9. I understand that this research will comply with the National Health and Medical Research Council's National Statement on Ethical Conduct in Research Involving Humans and with the privacy politics of the University of Twente.

10. I understand that this study has been approved by the University of Twente Human Research Ethics Committee and that if I have any questions I can contact them via ethicscommittee-bms@utwente.nl.

Q28 If you read and understood the information presented above and wish to continue to the survey, please indicate so below.

I have carefully read and I understand the information presented and wish to continue.

(1)

I do not wish to continue. (2)

Skip To: End of Survey If Q28 = I do not wish to continue.

Sona inquiry Are you participating to this study through the SONA-system?

If you do not know what the SONA-system is, please select "No".

No (1)

Yes (2)

Display This Question:

If Sona inquiry = Yes

SONA-ID Please fill in your SONA identity code (you can check this by logging-in to your SONA-systems account and selecting "My Profile", please do not fill in your "User ID" as we cannot see it and assign your credits):

End of Block: Consent form

Start of Block: Default Question Block

date of birth What is your date of birth (month and year)? MM/YYYY

occupation What is your occupation?

- Psychology student (1)
 - Other student, namely: (2)
-
- Working (3)

residence What is your country of residence?

- The Netherlands (1)
 - Germany (2)
 - Other country, namely: (3)
-

Page Break

gender identity Which of the following options applies to you the best? Check all that apply, multiple options may be selected.

- Female (1)
 - Male (2)
 - Non-binary (3)
 - I am still exploring my gender identity (4)
 - I choose to self-identify as (5)
-
- Prefer not to say (6)

sex What sex were you assigned at birth (for example, on your birth certificate)?

- Female (1)
- Male (2)
- Sex could not be determined/registered (3)
- I don't know (4)
- Prefer not to say (5)

intersex Are you intersex? Intersex individuals experience being born in a body that does not align with the typical definitions of male or female.

- Yes (1)
- No (2)
- I don't know (3)
- Prefer not to say (4)

sexual identity Which of the following options best describes how you think of yourself? Check as many as apply, multiple options are possible.

- Heterosexual, I describe myself as someone who is attracted to people of another gender and/or sex (1)
 - Asexual, I describe myself as someone who feels little to no sexual attraction to other people (2)
 - Bisexual, I describe myself as someone who is attracted to people of multiple genders and/or sexes. (3)
 - Pansexual, I describe myself as someone who is attracted to people, regardless of their gender and/or sex (4)
 - Homosexual, I describe myself as someone who is attracted to people of my own gender and/or sex (5)
 - Lesbian, I describe myself as a woman who is attracted to other women (6)
 - I choose to self-identify as: (7)
-
- Prefer not to answer (8)

Page Break

sports Are you doing sports or engage in physical activity regularly (at least one time per week)?

- Yes (1)
- No (2)

sports 1 Choose the option that best describes your situation.

- | | Strongly disagree (1) | Disagree (2) | Partially disagree (3) | Neutral (4) | Partially agree |
|---|-----------------------|-----------------------|------------------------|-----------------------|-----------------------|
| (5) Agree (6) | | | | | |
| Strongly agree (7) | | | | | |
| I consider myself an athlete (1) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Sport is the most important part of my life (2) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

sports 2 Choose the option that best describes your situation.

	Strongly disagree (1)	Disagree (2)	Undecided (3)	Agree (4)	Strongly agree (5)
I know of professional LGB and other sexual minority athletes (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I personally know LGB and other sexual minority athletes (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I know of LGB and other sexual minority people in leadership or other important positions in the sports context (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Sports 3 Choose the option that best describes your situation.

	Never (1)	Rarely (2)	Sometimes (3)	Very often (4)	Always (5)
I see LGB and other sexual minority athletes online or on tv (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Page Break

PHQ-9 & 4 Over the last 2 weeks, how often have you been bothered by any of the following problems?

	Not at all (1)	Several days (2)	More than half the days (3)	Nearly every day (4)
Feeling nervous, anxious, or on edge (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Not being able to stop or control worrying (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Little interest or pleasure in doing things (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Feeling down, depressed, or hopeless (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Trouble falling or staying asleep, or sleeping too much (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Feeling tired or having little energy (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Poor appetite or overeating (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Feeling bad about yourself — or that you are a failure or have let yourself or your family down (8)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Trouble concentrating on things, such as reading the newspaper or watching television (9)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Moving or speaking so slowly that other people could have noticed? Or the opposite — being so fidgety or restless that you have been moving around a lot more than usual (10)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Thoughts that you would be better off dead or of hurting yourself in some way (11)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

End of Block: Default Question Block

Start of Block: MHC-SF

MHC-SF In the past month, how often did you feel ...

	Never (1)	Once or twice a month (2)	About once a week (3)	Two or three times a week (4)	Almost every day (5)	Every day (6)
Happy (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Interested in life (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Satisfied (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
That you liked most parts of your personality (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Good at managing the responsibilities of your daily life (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
That you had warm and trusting relationships with others (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
That you have experiences that challenge you to grow and become a better person (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Confident to think or express your own ideas and opinions (8)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
That your life has a sense of direction or meaning to it (9)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
That you had something important to contribute to society (10)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
That you belonged to a community (like a social group, your neighborhood, your city) (11)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
That our society is becoming a better place for people (12)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
That people are basically good (13)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
That the way our society works makes sense to you (14)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

End of Block: MHC-SF

Start of Block: QMSR

Intro In this section we are interested about your experience as a queer minority. The term queer minority in this questionnaire refers to all individuals non-heterosexual and/or non-cisgender. In the tables below please respond to each question or statement by marking one box per row.

Discrimination Choose the option that best applies to your situation.

- Never (1) Sometimes (2) About half the time (3) Most of the time (4)
Always (5)
- I have had difficulty getting medical or mental health treatment (gender-affirming, sexual health-related, or other) because of my queer identity or expression. (1)
-
- Because of my queer identity or expression, I have had difficulty finding a bathroom to use when I am out in public. (2)
- I have experienced difficulty getting identity documents that match my gender identity. (3)
- I have had difficulty finding housing or staying in housing because of my queer identity or expression. (4)
- I have had difficulty finding employment or keeping employment, or have been denied promotion because of my queer identity or expression. (5)
-

Page Break

Negative expectation Choose the option that best applies to your situation.

- Strongly disagree (1) Somewhat disagree (2) Neither agree nor disagree (3)
Somewhat agree (4) Strongly agree (5)
- If I express my queer identity, others would not accept me. (1)
-
- If I express my queer identity, others would not hire me. (2)
-
- If I express my queer identity, people would think I am mentally ill, "crazy". (3)
-
- If I express my queer identity, people would think I am disgusting or sinful. (4)
-
- If I express my queer identity, most people would think less of me. (5)
-
- If I express my queer identity, most people would look down on me. (6)
-
- If I express my queer identity, I could become a victim of crime or violence. (7)
-
- If I express my queer identity, I could be arrested or harrassed by police. (8)
-
- If I express my queer identity, I could be denied good medical care. (9)
-

Page Break

Community connectedn Choose the option that best applies to your situation.

Strongly disagree (1) Somewhat disagree (2) Neither agree nor disagree (3)
Somewhat agree (4) Strongly agree (5)

I feel part of a community of people who share my queer identity. (1)

I feel connected to other people who share my queer identity. (2)

When interacting with members of the queer community I feel like I belong. (3)

I'm not like other people who share my queer identity. (4)

I feel isolated and separate from other people who share my queer identity. (5)

Page Break

Identity disclosure Choose the option that best applies to your situation

Strongly disagree (1) Somewhat disagree (2) Neither agree nor disagree (3)
Somewhat agree (4) Strongly agree (5)

Because I don't want others to know my queer identity, I don't talk about certain experiences from my past or change parts of what I will tell people. (1)

Because I don't want others to know my queer identity, I modify my way of speaking. (2)

Because I don't want others to know my queer identity, I pay special attention to the way I dress or groom myself. (3)

Because I don't want others to know my queer identity, I avoid exposing my body, such as wearing a bathing suit or nudity in locker rooms. (4)

Because I don't want others to know my queer identity, I change the way I walk, gesture, sit, or stand. (5)

End of Block: QMSR

Start of Block: Sleep Disturbance

Intro In the following section you will be asked about your sleep behaviour and problems you might have encountered regarding sleep. In the tables below please respond to each question or statement by marking one box per row.

Sleep Questionnaire In the past 7 days...

	Not at all (1)	A little bit (2)	Somewhat (3)	Quite a bit (4)	Very much (5)
My sleep was restful. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My sleep was light. (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My sleep was deep. (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My sleep was restless. (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I was satisfied with my sleep. (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My sleep was refreshing. (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt lousy when I woke up. (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I had problems with my sleep. (8)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I had difficulty falling asleep. (9)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt physically tense at bedtime. (10)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Page Break

Sleep Quest2 In the past 7 days...

	Not at all (1)	A little bit (2)	Somewhat (3)	Quite a bit (4)	Very much (5)
I worried about not being able to fall asleep. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt worried at bedtime. (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I had trouble stopping my thoughts at bedtime. (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt sad at bedtime. (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I had trouble getting into a comfortable position to sleep. (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I tried hard to get to sleep. (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Stress disturbed my sleep. (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I tossed and turned at night. (8)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

I was afraid I would not get back to sleep after waking up. (9)

Page Break

Sleep Quest3 In the past 7 days...

	Never (1)	Rarely (2)	Sometimes (3)	Often (4)	Always (5)	
I got enough sleep. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It was easy to me to fall asleep. (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I laid in bed for hours trying to fall asleep. (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I woke up too early and could not fall back asleep. (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I had trouble staying asleep. (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I had trouble sleeping. (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I woke up and had trouble falling back to sleep. (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Sleep Quest4 In the past 7 days...

	Very poor (1)	Poor (2)	Fair (3)	Good (4)	Very good (5)
My quality of sleep was... (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

End of Block: Sleep Disturbance

Start of Block: Gender minority - healthcare context

Display This Question:

If sex = Female

And sex = Female

Or sex = Sex could not be determined/registered

Or intersex = Yes

Or sex = Male

And gender identity != Male

Health Care Avoidanc Have you ever avoided seeing a healthcare provider (even though you felt you needed to) because you were worried about how they might react to your gender identity?

Yes (1)

- No (2)

Page Break

Display This Question:

If Health Care Avoidanc , Yes Is Displayed

Gender Identity Disc Do you believe your healthcare provider (the one you see most often) knows what your gender identity is?

- Yes, I disclosed without being asked (1)
- Yes, I disclosed because my doctor asked (2)
- They probably assume it (3)
- Someone else told them (4)
- No (5)

Display This Question:

If Health Care Avoidanc , Yes Is Displayed

Negative Health Care Have you ever felt you were disrespected by your healthcare provider (the one you see most often) because of your gender identity or expression?

- Yes (1)
- No (2)

Display This Question:

If Health Care Avoidanc , Yes Is Displayed

Negative Health Care Has your healthcare provider (the one you see most often) ever...

Yes (1) No (2)

- Discouraged you from exploring your gender? (1)
- Inconsistently used or misused your name and preferred pronouns? (2)
- Refused to care for you because of your gender? (3)
- Refused to discuss or address gender-related health concerns? (4)
- Told you they did not know enough about gender-related care to provide it? (5)
-
- Used hurtful or insulting language when discussing your gender? (6)

End of Block: Gender minority - healthcare context

Start of Block: Block 5

Debrief You just participated in a research study on different minority stressors (discrimination, negative experiences, identity nondisclosure), and their effects on different mental health

outcomes (depression, distress, GP avoidance, sleep disturbance). The study of minority stressors and variables is important as it allows for increased knowledge of support provided to minority groups and people affected by stigma.

If reporting and thinking about discrimination and similar experiences led to negative emotions, you can utilise the following resources to calm down or reach out for emotional support:

Calming Breathing Exercise <https://www.thetrevorproject.org/breathing-exercise/>

Receiving support at the University of Twente (for students)

Unacceptable Behaviours

If you are a student of the UT and were/are subject to unacceptable behaviour such as intimidation or sexual harassment, discrimination, aggression, violence or bullying (or similar) at the University, reach out to the confidential advisor for students.

General resources for Sexual and Gender Minorities at the UT

Think With Pride

Think With Pride, a collective of employees and students of UT, Saxion and ROC Twente collaborating to create a comfortable and inclusive learning and working climate for people belonging to the LGBTQI+ community, provide a webpage with resources regarding a variety of themes.

General support for Mental Health

If reporting about these stigmatising experiences caused strong psychological consequences, such as panic, distress, or strong anxiety, we recommend reaching out to your General Practitioner (Huisarts) to arrange adequate, professional support for your mental health.

Suicidal Thoughts

If you are actively experiencing suicidal thoughts, please reach out to the National Suicide Prevention (Netherlands) hotline via 0800 - 0113 or 113. You can also reach them via chat at www.113.nl.

End of Block: Block 5

Appendix 2
PROMIS Sleep Disturbance 8b Items

In the past 7 days... Not at all A little bit Somewhat Quite a bit Very much

Sleep108 My sleep was restless 1 2 3 4 5

Sleep115 I was satisfied with my sleep..... 5 4 3 2 1

Sleep116 My sleep was refreshing..... 5 4 3 2 1

Sleep44 I had difficulty falling asleep..... 1 2 3 4 5

In the past 7 days... Never Rarely Sometimes Often Always

Sleep87 I had trouble staying asleep. 1 2 3 4 5

Sleep90 I had trouble sleeping 1 2 3 4 5

Sleep110 I got enough sleep..... 5 4 3 2 1

In the past 7 days... Very poor Poor Fair Good Very good

Sleep109 My sleep quality was..... 5 4 3 2 1

Appendix 3 R-code

```
#!/the following packages may require installing!
library(tidyverse)
library(broom)
library(janitor)
library(readr)
library(lubridate)
library(dplyr)
library(data.table)
library(openxlsx)
library(tidyr)
library(DAAG)
library(modelr)
library(lawstat)
library(car)
library(nortest)
library(lmtest)
library(ggplot2)
library(ggforce)
library(VennDiagram)
library(psych)
library(MASS)
library(corrplot)
library(Hmisc)

#working directory set; different for every computer
#opening data file:
test_data_new <- read_csv("test_data_29_05_24.csv")

####CLEANING DADASET####
#remove non-questions from dataset:
data <- test_data_new[,c(5, 18:123)]

#remove participants that did not give consent for participating
data <- data[!grepl("2", data$Q28),]

#remove columns that are not necessary for my study + the first extra text row
data <- data[,c(1, 5:15, 48:66, 72:98)]

#remove incomplete answers
data$Progress <- as.numeric(data$Progress)
data <- data[data$Progress >= 100,]

# cleaning gender and sexuality variables
```

```

#remove cisgender heterosexual people
data <- subset(data,! (data$`gender identity` == 1 & data$sex == 1 & data$`sexual identity` ==
1))
data <- subset(data,! (data$`gender identity` == 2 & data$sex == 2 & data$`sexual identity` ==
1))

#####REPORTING DEMOGRAPHICS #####
#Age
data <- data[,-c(1)]
birthdays <- data[,c(1)]
years <- numeric(length(birthdays$`date of birth`))
pattern <- "\\b\\d{4}\\b\\b\\d{2}(\\d{2})\\b"
for (i in seq_along(birthdays$`date of birth`)) {
  year_match <- regmatches(birthdays$`date of birth`[i], regex(pattern, birthdays$`date of
birth`[i]))
  if (length(year_match) > 0) {
    if (nchar(year_match) == 4) {
      years[i] <- as.numeric(year_match)
    } else {
      years[i] <- as.numeric(substr(year_match, 3, 6))
    } else {
      years[i] <- NA}}
birthdays$year <- years
data$`date of birth` <- birthdays$year
#actual age:
data$age = 2024 - as.numeric(data$`date of birth`)
columns_to_replace <- data[c("age")]
columns_to_replace[, "age"][is.na(columns_to_replace[, "age"])] <- 22 #checked if it is true
data$age <- columns_to_replace$age

# screening data for age:
data <- data[data$age >= 16,]

mean(data$age)
sd(data$age)
table(data$age)

#age_histogram <- ggplot(data, aes(x = age)) +
# geom_histogram(binwidth = 1, fill = "white", color = "purple") +
# labs(title = "Age Distribution of Participants", x = "Age", y = "Frequency")
#ggsave("age_distribution_histogram.png", plot = age_histogram, width = 8, height = 6)

#Occupation
data$occupation <- data$occupation %>% as.numeric()
data$occupation %>% table() #frequency tables
data$occupation_2_TEXT %>% table()

```

```

#residence
data$residence %>% table() #frequency tables
data$residence_3_TEXT %>% table()

# 6,8,9,10 Demographics: types of sexuality, gender identity and sex at birth
type <- data[,c(6,8,9,10)]
type <- separate_rows(type, `sexual identity`, sep = ",")
type$hetero <- ifelse(type$`sexual identity` == 1, 1, 0)
type$asexual <- ifelse(type$`sexual identity` == 2, 1, 0)
type$bi <- ifelse(type$`sexual identity` == 3, 1, 0)
type$pansexual <- ifelse(type$`sexual identity` == 4, 1, 0)
type$homo <- ifelse(type$`sexual identity` == 5, 1, 0)
type$lesbian <- ifelse(type$`sexual identity` == 6, 1, 0)
type$other <- ifelse(type$`sexual identity` == 7, 1, 0)
type$not_mentioned <- ifelse(type$`sexual identity` == 8, 1, 0)
sum(type$hetero)
sum(type$asexual)
sum(type$bi)
sum(type$pansexual)
sum(type$homo)
sum(type$lesbian)
sum(type$other)
sum(type$not_mentioned)

### break here! I need the code below to go further: pinpoint 1

#sexual and gender identity groups:
data$PIN <- 1:nrow(data)
#SM:
data_sexuality <- data[,c(59,10,11)]
data_sexuality <- separate_rows(data_sexuality, `sexual identity`, sep = ",")
data_sexuality$SM <- ifelse(data_sexuality$`sexual identity` > 1, 1, 0)
data_sexuality <- data_sexuality %>%
  group_by(PIN) %>%
  dplyr::summarize(across(starts_with("SM"), mean, na.rm = TRUE))
#GM:
data_ID <- data[,c(59,6,7,8)]
data_ID$B_sex <- data_ID$sex
data_ID$ID_gender <- data_ID$`gender identity`
data_ID <- separate_rows(data_ID, ID_gender, sep = ",")
data_ID$B_sex <- as.numeric(data_ID$B_sex)
data_ID$ID_gender <- as.numeric(data_ID$ID_gender)
data_ID <- data_ID[,c(1,5,6)]
data_ID_GM <- data_ID %>%
  filter(B_sex == ID_gender)
data_ID_GM$nonGM <- 0

```



```

data_ID_new <- left_join(data_ID, data_ID_GM, by = "PIN")
columns_to_replace <- data_ID_new[c("nonGM")]
columns_to_replace[, "nonGM"][is.na(columns_to_replace[, "nonGM"])] <- 1
data_ID_new$nonGM <- columns_to_replace$nonGM
data_ID <- data_ID_new
data_ID$GM <- data_ID$nonGM
data_ID <- data_ID %>%
  group_by(PIN) %>%
  dplyr::summarize(across(starts_with("GM"), mean))
#SGM:
data_SGM <- data_ID[,c(1,2)]
data_SGM_new <- left_join(data_SGM, data_sexuality, by = "PIN")
data_SGM <- data_SGM_new
data_SGM$SGM <- data_SGM$GM + data_SGM$SM - 1
data_new <- left_join(data_SGM, data, by = "PIN")
data <- data_new

#observation: there are no GM who are not SM, but there are SM who are not GM
#SM_nonGM:
data$SM_nonGM <- (data$GM - data$SM) * (-1)

sum(data$SM_nonGM) #number of SM
sum(data$SGM) #number of SGM

# Venn diagram
venn_counts <- data %>%
  dplyr::summarize(
    Gender_minority = sum(GM),
    Sexual_minority = sum(SM),
    Sex_gen_minority = sum(GM & SM))
venn.plot <- draw.pairwise.venn(
  area1 = venn_counts$Gender_minority,
  area2 = venn_counts$Sexual_minority,
  cross.area = venn_counts$Sex_gen_minority,
  category = c("Gender minority", "Sexual minority"),
  fill = c("pink", "turquoise"),
  alpha = 0.5,
  cex = 2,
  cat.cex = 2,
  cat.pos = 0)
jpeg("venn_diagram.jpg", width = 800, height = 600)
grid.draw(venn.plot)
dev.off()

### this is the continuation pinpoint 1
type <- data[,c(1,2,10)]

```

```

type <- separate_rows(type, `gender identity`, sep = ",")
type <- type %>%
  filter(GM > 0)
type$Sid_fem <- ifelse(type$`gender identity` == 1, 1, 0)
type$Sid_male <- ifelse(type$`gender identity` == 2, 1, 0)
type$Sid_nonbinary <- ifelse(type$`gender identity` == 3, 1, 0)
type$Sid_exploring <- ifelse(type$`gender identity` == 4, 1, 0)
type$Sid_other <- ifelse(type$`gender identity` == 5, 1, 0)
type$Sid_not_mentioned <- ifelse(type$`gender identity` == 6, 1, 0)
#gender minorities
sum(type$Sid_fem)
sum(type$Sid_male)
sum(type$Sid_nonbinary)
sum(type$Sid_exploring)
sum(type$Sid_other)
sum(type$Sid_not_mentioned)

### SCORING DISCRIMINATION, NEGATIVE EXPECTATIONS AND COMMUNITY
COMMUCTEDNESS###
#discrimination:
#chronbach's alpha:
data$Discrimination_1 <- as.numeric(data$Discrimination_1) -1
data$Discrimination_2 <- as.numeric(data$Discrimination_2) -1
data$Discrimination_3 <- as.numeric(data$Discrimination_3) -1
data$Discrimination_4 <- as.numeric(data$Discrimination_4) -1
data$Discrimination_5 <- as.numeric(data$Discrimination_5) -1
data_discrimination <- data[,c(16:20)]
alpha_results <- alpha(data_discrimination)
print(alpha_results)
#scoring:
data$discrimination_score <- data$Discrimination_1 + data$Discrimination_2 +
data$Discrimination_3 + data$Discrimination_4 + data$Discrimination_5
data_discrimination <- data[,c(64)]
data_discrimination$discrimination_dummy <- ifelse(data_discrimination$discrimination_score
> 0, 1, 0)
data_discrimination$discrimination_dummy %>% sum()
data$discrimination_score %>% mean()
data$discrimination_score %>% sd()
discrimination_histogram <- ggplot(data_discrimination, aes(x = discrimination_score)) +
  geom_histogram(binwidth = 1, fill = "white", color = "purple") +
  labs(title = "", x = "Score", y = "Frequency")
ggsave("discrimination_score_histogram.png", plot = discrimination_histogram, width = 8,
height = 6)

#negative expectations

```

```

data$`Negative expectation_1` <- as.numeric(data$`Negative expectation_1`) -1
data$`Negative expectation_2` <- as.numeric(data$`Negative expectation_2`) -1
data$`Negative expectation_3` <- as.numeric(data$`Negative expectation_3`) -1
data$`Negative expectation_4` <- as.numeric(data$`Negative expectation_4`) -1
data$`Negative expectation_5` <- as.numeric(data$`Negative expectation_5`) -1
data$`Negative expectation_6` <- as.numeric(data$`Negative expectation_6`) -1
data$`Negative expectation_7` <- as.numeric(data$`Negative expectation_7`) -1
data$`Negative expectation_8` <- as.numeric(data$`Negative expectation_8`) -1
data$`Negative expectation_9` <- as.numeric(data$`Negative expectation_9`) -1
data$negative_expectations_score <- data$`Negative expectation_1` + data$`Negative
expectation_2` + data$`Negative expectation_3` + data$`Negative expectation_4` +
data$`Negative expectation_5` + data$`Negative expectation_6` + data$`Negative
expectation_7` + data$`Negative expectation_8` + data$`Negative expectation_9`
data$negative_expectations_score %>% mean()
data$negative_expectations_score %>% sd()
data_negarive_expectations <- data[,c(21:29)]
alpha_results <- alpha(data_negarive_expectations)
print(alpha_results)

#negative_expectations_histogram <- ggplot(data, aes(x = negative_expectations_score)) +
# geom_histogram(binwidth = 1, fill = "white", color = "purple") +
# labs(title = "", x = "Score", y = "Frequency")
#ggsave("negative_expectations_histogram.png", plot = negative_expectations_histogram, width
= 8, height = 6)

#community connectedness
data$`Community connectedn_1` <- as.numeric(data$`Community connectedn_1`) -1
data$`Community connectedn_2` <- as.numeric(data$`Community connectedn_2`) -1
data$`Community connectedn_3` <- as.numeric(data$`Community connectedn_3`) -1
data$`Community connectedn_4` <- 6- as.numeric(data$`Community connectedn_4`) -1
#reversed scoring
data$`Community connectedn_5` <- 6- as.numeric(data$`Community connectedn_5`) -1 #here
too
data$community_connectedness_score <- data$`Community connectedn_1`+ data$`Community
connectedn_2`+ data$`Community connectedn_3`+ data$`Community connectedn_4`+
data$`Community connectedn_5` #I am leaving this for later matching with the results from the
PROMIS tool
data$community_connectedness_score %>% mean()
data$community_connectedness_score %>% sd()
data_community_connectedness <- data[,c(30:34)]
alpha_results <- alpha(data_community_connectedness)
print(alpha_results)
community_connectedness_histogram <- ggplot(data, aes(x =
community_connectedness_score)) +
  geom_histogram(binwidth = 1, fill = "white", color = "purple") +
  labs(title = "", x = "Score", y = "Frequency")

```

```

ggsave("community_connectedness_histogram.png", plot =
community_connectedness_histogram, width = 8, height = 6)
data_high_cc <- data %>%
  filter(community_connectedness_score > 10)
view(data_high_cc)
(46*100)/60 #participants reporting high to very high community connectedness
#clearing leftover columns
data <- data %>%
  dplyr::select(1:4,12,35:66)

###CALCULATE SCORE SLEEP QUESTIONNAIRE###
#reverse scoring
data$`Sleep Questionnaire_1` <- 6 - as.numeric(data$`Sleep Questionnaire_1`)
data$`Sleep Questionnaire_3` <- 6 - as.numeric(data$`Sleep Questionnaire_3`)
data$`Sleep Questionnaire_5` <- 6 - as.numeric(data$`Sleep Questionnaire_5`)
data$`Sleep Questionnaire_6` <- 6 - as.numeric(data$`Sleep Questionnaire_6`)
data$`Sleep Quest3_1` <- 6 - as.numeric(data$`Sleep Quest3_1`)
data$`Sleep Quest3_2` <- 6 - as.numeric(data$`Sleep Quest3_2`)
data$`Sleep Quest4_1` <- 6 - as.numeric(data$`Sleep Quest4_1`)
data <- data %>% mutate_at(c(5:32), as.numeric)

#####
#####
#####
#create document to add into PROMIS scoring tool
data1 <- data[,c(1,6:32)]
data1$Assmnt <- 1
data1 <- data1[,c(1,29, 5:7,10,21,25,26,28)]
write.csv(data1,"data_sleep.csv") #required changes were made to the titles (ex: removing
quotation marks) and question names

#alpha for sleep questionnaire:
data_sleep_alpha <- data1[,c(3:10)]
alpha_results <- alpha(data_sleep_alpha)
print(alpha_results)

#working with data generated by the PROMIS tool
data_PROMIS <- read_csv("sleep_tscores_version3.csv")
data_PROMIS <- data_PROMIS[-c(1:4),-c(2,3,5,8,9)]
colnames(data_PROMIS)[colnames(data_PROMIS) == 'Report Generated: 5/27/2024 2:56:39
PM'] <- 'PIN'
colnames(data_PROMIS)[colnames(data_PROMIS) == '...4'] <- 'sleep_raw_score'
colnames(data_PROMIS)[colnames(data_PROMIS) == '...6'] <- '_sleep_T_score'
colnames(data_PROMIS)[colnames(data_PROMIS) == '...7'] <- 'sleep_SE'
data_PROMIS <- data_PROMIS %>% mutate_at(c(1:4), as.numeric)

```

```

mean_t_score <- mean(data_PROMIS$_sleep_T_score`)
se_t_score <- sd(data_PROMIS$_sleep_T_score`) /
sqrt(length(data_PROMIS$_sleep_T_score`))
n <- length(data_PROMIS$_sleep_T_score`)
print(mean_t_score)
print(se_t_score)
print(n)
sleep_histogram <- ggplot(data_PROMIS, aes(x = `_sleep_T_score`)) +
  geom_histogram(binwidth = 1, fill = "white", color = "purple") +
  labs(title = "", x = "Score", y = "Frequency")
ggsave("sleep_histogram.png", plot = sleep_histogram, width = 8, height = 6)
lower_boundary <- mean_t_score - 1.96*se_t_score
upper_boundary <- mean_t_score + 1.96*se_t_score
print(lower_boundary)
print(upper_boundary)
summary(data$sleep_tscore)#adding results to main dataset for handling & cleaning the dataset
data <- data[,-c(6:32)] #I intentionally left the sleep raw score in to check for matching
data$pin_match <- data_PROMIS$PIN
data$sleep_tscore <- data_PROMIS$_sleep_T_score`
data$sleep_SE <- data_PROMIS$sleep_SE
data <- data[,-c(11)]

#####
#####
#####data analysis
#####
#####
#####
data$B_sex_dummy <- as.numeric(data$sex) - 1 # = born male
data_analysis <- data
#####linear models for the 3
hypotheses#####
#Hypotheses:
#TGD individuals who are also LGB minorities as well as TGD show higher prevalence of SDs
than individuals who are uniquely TGD minorities or LGB minorities.
#The relationship between the distal stressor discrimination and sleep disturbance outcomes is
moderated by community connectedness for all SGM subgroups.
#The relationship between the proximal stressor negative expectations and sleep disturbance
outcomes is moderated by community connectedness for all SGM subgroups.
#general correlation:
data_correlation <- data_analysis[,c(7:11)]
data_correlation$Minority_status <- data_correlation$SM_nonGM
data_correlation$Discrimination <- data_correlation$discrimination_score
data_correlation$Negative_expectations <- data_correlation$negative_expectations_score
data_correlation$Community_connectedness <-
data_correlation$community_connectedness_score

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data_correlation$Sleep_disturbance <- data_correlation$sleep_tscore
data_correlation <- data_correlation[,c(6:10)]
correlation_matrix <- cor(data_correlation)
print(correlation_matrix)
png("correlation_plot.png", width = 800, height = 600)
corrplot(correlation_matrix, method = "circle", type = "upper",
          tl.col = "black", tl.srt = 45, addCoef.col = "red", tl.cex = 1)
dev.off()
correlation_results <- rcorr(as.matrix(data_correlation))
correlation_matrix <- correlation_results$r
p_values <- correlation_results$P
print(p_values)
#main effects:
#H1:
model_1a <- data_analysis %>%
  lm(sleep_tscore ~ SM_nonGM, data = .) #every respondent was SM
model_1a %>% tidy()
confint(model_1a)
#assumptions:
runs.test(model_1a$residuals) #independence
crPlots(model_1a) #linearity
residuals1a <- residuals(model_1a)
shapiro.test(residuals1a) #normality of residuals
bptest(model_1a) #homoscedasticity
#vif_values <- vif(model_1a) #multicollinearity
#print(vif_values)
t.test(sleep_tscore ~ SM_nonGM, var.equal=TRUE, data = data_analysis)

model_1b <- data_analysis %>%
  lm(sleep_tscore ~ discrimination_score, data = .)
tidy(model_1b)
confint(model_1b)
runs.test(model_1b$residuals) #independence
crPlots(model_1b) #linearity
residuals1b <- residuals(model_1b)
shapiro.test(residuals1b) #normality of residuals
bptest(model_1b) #homoscedasticity
#vif_values <- vif(model_1b) #multicollinearity
#print(vif_values)

model_1c <- lm(sleep_tscore ~ negative_expectations_score, data = data_analysis)
#model_1c <- lm(log(sleep_tscore) ~ negative_expectations_score, data = data_analysis)
#model_1c <- lm(sqrt(sleep_tscore) ~ negative_expectations_score, data = data_analysis)
#model_1c <- lm(1/sleep_tscore ~ negative_expectations_score, data = data_analysis)
#model_1c <- lm(sleep_tscore ~ sqrt(negative_expectations_score), data = data_analysis)
summary(model_1c)

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confint(model_1c)
runs.test(model_1c$residuals) #independence
crPlots(model_1c) #linearity
residuals1c <- residuals(model_1c)
shapiro.test(residuals1c) #normality of residuals
bptest(model_1c) #homoscedasticity #not met !!!
#vif_values <- vif(model_1c) #multicollinearity
#print(vif_values)

model_1d <- lm(sleep_tscore ~ community_connectedness_score, data = data_analysis)
#model_1d <- lm(log(sleep_tscore) ~ community_connectedness_score, data = data_analysis)
#model_1d <- lm(sqrt(sleep_tscore) ~ community_connectedness_score, data = data_analysis)
#model_1d <- lm(1/sleep_tscore ~ community_connectedness_score, data = data_analysis)
#model_1d <- lm(sleep_tscore ~ sqrt(community_connectedness_score), data = data_analysis)
summary(model_1d)
confint(model_1d)
runs.test(model_1d$residuals) #independence
crPlots(model_1d) #linearity
residuals1d <- residuals(model_1d)
shapiro.test(residuals1d) #normality of residuals
bptest(model_1d) #homoscedasticity
#vif_values <- vif(model_1d) #multicollinearity
#print(vif_values)

#interaction effects:
#H2:
data_analysis$transformed_sleep <- log(data_analysis$sleep_tscore)
#data_analysis$transformed_sleep <- sqrt(data_analysis$sleep_tscore)
#data_analysis$transformed_sleep <- exp(data_analysis$sleep_tscore)
#data_analysis$trans_com <- log(data_analysis$community_connectedness_score + 1)
#data_analysis$trans_com <- sqrt(data_analysis$community_connectedness_score)

model_22 <- data_analysis %>%
  lm(sleep_tscore ~ discrimination_score + community_connectedness_score +
discrimination_score*community_connectedness_score + SM_nonGM, data = .)
summary(model_22)
confint(model_22)
runs.test(model_22$residuals) #independence
#linearity: <- not met
par(mfrow = c(1, 2)) # Arrange plots in a grid
plot(data_analysis$discrimination_score, residuals(model_22),
  xlab = "Discrimination Score", ylab = "Residuals",
  main = "Residuals vs. Discrimination Score")
lines(lowess(data_analysis$discrimination_score, residuals(model_22)), col = "red")
plot(data_analysis$community_connectedness_score, residuals(model_22),

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    xlab = "Community Connectedness Score", ylab = "Residuals",
    main = "Residuals vs. Community Connectedness Score")
lines(lowess(data_analysis$community_connectedness_score, residuals(model_22)), col =
"blue")
residuals22 <- residuals(model_22)
shapiro.test(residuals22) #normality of residuals
bptest(model_22) #homoscedasticity
vif_values <- vif(model_22, type = "predictor") #multicollinearity
print(vif_values)

#trying transformations:
#data_analysis$transformed_sleep <- log(data_analysis$sleep_tscore)
data_analysis$transformed_sleep <- sqrt(data_analysis$sleep_tscore)
#data_analysis$transformed_sleep <- 1/(data_analysis$sleep_tscore)

model_23 <- lm(transformed_sleep ~ discrimination_score + community_connectedness_score +
discrimination_score:community_connectedness_score + SM_nonGM, data = data_analysis)
summary(model_23)
runs.test(model_23$residuals) #independence
#linearity: <- not met
par(mfrow = c(1, 2)) # Arrange plots in a grid
plot(data_analysis$discrimination_score, residuals(model_23),
    xlab = "Discrimination Score", ylab = "Residuals",
    main = "Residuals vs. Discrimination Score")
lines(lowess(data_analysis$discrimination_score, residuals(model_23)), col = "red")
plot(data_analysis$community_connectedness_score, residuals(model_23),
    xlab = "Community Connectedness Score", ylab = "Residuals",
    main = "Residuals vs. Community Connectedness Score")
lines(lowess(data_analysis$community_connectedness_score, residuals(model_23)), col =
"blue")
residuals23 <- residuals(model_23)
shapiro.test(residuals23) #normality of residuals
bptest(model_23) #homoscedasticity
vif_values <- vif(model_23, type = "predictor") #multicollinearity
print(vif_values)

#H3:

model_3a <- data_analysis %>%
  lm(sleep_tscore ~ negative_expectations_score + community_connectedness_score +
    negative_expectations_score*community_connectedness_score, data = .)
model_3a %>% summary()
confint(model_3a)

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runs.test(model_3a$residuals) #independence
#linearity: <- not met
par(mfrow = c(1, 2)) # Arrange plots in a grid
plot(data_analysis$negative_expectations_score, residuals(model_3a),
      xlab = "Negative expectations Score", ylab = "Residuals",
      main = "Residuals vs. Neg. Ex. Score")
lines(lowess(data_analysis$negative_expectations_score, residuals(model_3a)), col = "red")
plot(data_analysis$community_connectedness_score, residuals(model_3a),
      xlab = "Community Connectedness Score", ylab = "Residuals",
      main = "Residuals vs. Community Connectedness Score")
lines(lowess(data_analysis$community_connectedness_score, residuals(model_3a)), col =
"blue")
residuals3a <- residuals(model_3a)
shapiro.test(residuals3a) #normality of residuals
bptest(model_3a) #homoscedasticity
vif_values <- vif(model_3a, type = "predictor") #multicollinearity
print(vif_values)

#transformations:
#data_analysis$transformed_cc <- log(data_analysis$community_connectedness_score +1)
#data_analysis$transformed_cc <- sqrt(data_analysis$community_connectedness_score)
data_analysis$transformed_cc <- 1/(data_analysis$community_connectedness_score +1)
model_3b <- lm(sleep_tscore ~ negative_expectations_score +transformed_cc +
negative_expectations_score*transformed_cc, data = data_analysis)
summary(model_3b)
par(mfrow = c(1, 2)) # Arrange plots in a grid
plot(data_analysis$negative_expectations_score, residuals(model_3b),
      xlab = "Negative expectations Score", ylab = "Residuals",
      main = "Residuals vs. Neg. Ex. Score")
lines(lowess(data_analysis$negative_expectations_score, residuals(model_3b)), col = "red")
plot(data_analysis$community_connectedness_score, residuals(model_3b),
      xlab = "Community Connectedness Score", ylab = "Residuals",
      main = "Residuals vs. Community Connectedness Score")
lines(lowess(data_analysis$community_connectedness_score, residuals(model_3b)), col =
"blue")
residuals3b <- residuals(model_3b)
shapiro.test(residuals3b) #normality of residuals
bptest(model_3b) #homoscedasticity
vif_values <- vif(model_3b, type = "predictor") #multicollinearity
print(vif_values)

# updates for resit
#descriptives
data_SM_nonGM <- data %>%
  dplyr::filter(SM_nonGM == 1)
data_SM_nonGM$discrimination_score %>% mean()

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data_SM_nonGM$discrimination_score %>% sd()
data_SM_nonGM$negative_expectations_score %>% mean()
data_SM_nonGM$negative_expectations_score %>% sd()
data_SM_nonGM$community_connectedness_score %>% mean()
data_SM_nonGM$community_connectedness_score %>% sd()
data_SM_nonGM$sleep_tscore %>% mean()
data_SM_nonGM$sleep_tscore %>% sd()
#
data_SMGM <- data %>%
  dplyr::filter(SM_nonGM == 0)
data_SMGM$discrimination_score %>% mean()
data_SMGM$discrimination_score %>% sd()
data_SMGM$negative_expectations_score %>% mean()
data_SMGM$negative_expectations_score %>% sd()
data_SMGM$community_connectedness_score %>% mean()
data_SMGM$community_connectedness_score %>% sd()
data_SMGM$sleep_tscore %>% mean()
data_SMGM$sleep_tscore %>% sd()
```