PIONEER
ACADEMIC PUBLISHING LIMITED

Journal of Research in Social Science and Humanities
ISSN 2709-1910
www.pioneerpublisher.com/jrssh
Volume 4 Number 2 February 2025

Exploring the Relationship Between Gender, Sexual Orientation, Gender Identity, and Mental Health Symptom Severity: A Statistical Analysis

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doi:10.56397/JRSSH.2025.02.02

Abstract

In recent years, mental health issues such as anxiety and depression have become a significant concern, particularly among gender and sexual minorities. This paper explores the relationship between gender, sexual orientation, and mental health symptom severity using data from a U.S. national Household Pulse Survey. The dataset **"Indicators of Anxiety or Depression Based on Reported Frequency of Symptoms During Last 7 Days"** measures anxiety and depression symptoms based on responses about experiences in the past week during the COVID-19 pandemic. The dataset spans multiple survey phases, allowing for temporal comparisons and subgroup analysis. This research uses various statistical techniques to investigate symptom differences across gender and sexual identity groups. The findings reveal significant disparities in symptom severity across these subgroups, highlighting the disproportionate mental health burden faced by gender and sexual minorities.

Keywords: gender, sexual orientation, gender identity, mental health symptom severity, statistical research

1. Introduction

The prevalence of mental health conditions like anxiety and depression is notably high among gender and sexual minority groups, which include individuals identifying as transgender, non-binary, gay, lesbian, or bisexual, compared to the general population. Social stigma, discrimination, and unequal access to care contribute to these mental health disparities. Numerous studies have pointed to the role of gender and sexual orientation in mental health outcomes, suggesting that certain subgroups experience heightened levels of distress.

This study aims to investigate the relationship between gender, sexual orientation, and mental health symptom severity. By employing various statistical methods, we analyze how different gender and sexual minority groups report mental health symptoms and explore potential disparities.

1.1 Research Questions

1) Do gender and sexual orientation significantly affect mental health symptom severity?
2) How do different gender and sexual

minority groups compare in their reported symptoms?

3) Are there significant interaction effects between gender, sexual orientation, and time phase on symptom levels?

2. Literature Review

Drawing from previous research, gender discrimination and sexual minority status have been strongly associated with poor mental health outcomes. Workplace discrimination significantly impacts subjective well-being (Kim, S., 2015), how gender discrimination affects mental health, noting that individuals experiencing gender-based discrimination are more likely to report mental health issues, such as anxiety and depression (de la Torre-Pérez, L., et al., 2022).

Researchers have highlighted the need for analyses that consider different aspects of gender and sexual orientation, as the mental health outcomes can vary significantly across subgroups. Our study contributes to this literature by using comprehensive statistical analyses to provide insights into these disparities.

3. Methodology

3.1 Data

The dataset titled Indicators of Anxiety or Depression Based on Reported Frequency of Symptoms During Last 7 Days was obtained from a national U.S. survey, encompassing 16,326 observations across diverse demographic groups. The dataset includes 16,326 observations across various demographic groups, including gender and sexual orientation.

3.2 Variables

Dependent variable: Mental health symptom severity, measured as the percentage of individuals reporting anxiety or depression.

Independent variables: Gender (Male, Female, Transgender), Sexual Orientation (Straight, Gay/Lesbian, Bisexual), and Time Phase (various survey periods).

3.3 Statistical Analysis

We conducted a series of statistical analyses:

1) **Two-Sample t-Test**: To compare symptom severity between male and female respondents.
2) **ANOVA**: To explore differences in symptom levels across multiple gender and sexual orientation groups.
3) **Tukey's HSD**: A post-hoc test following the ANOVA to identify specific subgroup differences in average mental health symptom scores.
4) **Multiple Regression**: To assess the combined effect of gender, sexual orientation, and time phase on symptom severity.
5) **Fisher's Exact Test**: Used to examine the association between gender and symptom severity categories.

4. Results

This section presents the results of the statistical analyses, including t-tests, ANOVA, multiple regression, and Fisher's Exact Test. Visualizations such as boxplots, regression tables, and confidence intervals are included to provide insights and further exploration of the data.

4.1 Descriptive Statistics

Before conducting any formal hypothesis testing, summary statistics were calculated for each gender and sexual orientation subgroup, providing foundational insights into symptom disparities. The mean symptom severity, standard deviation, and median values are reported in Table 1. Transgender and bisexual individuals reported the highest levels of anxiety and depression symptoms, while cis-gender males and straight individuals reported the lowest.

Table 1. Descriptive statistics of mental health symptom levels by gender and sexual orientation

A tibble: 8 × 4

Subgroup <fctr>	mean_value <dbl>	sd_value <dbl>	median_value <dbl>
Bisexual	50.49550	9.275906	51.90
Cis-gender female	27.45946	6.686219	29.90
Cis-gender male	22.43153	5.009845	22.60
Female	31.10571	7.299359	31.55
Gay or lesbian	36.74505	7.631832	36.60
Male	25.31095	5.528900	24.95
Straight	23.08468	5.638152	24.30
Transgender	62.73738	9.869483	63.30

8 rows

4.2 Two-Sample t-Test

A two-sample t-test was conducted to compare the average mental health symptom severity between male and female respondents. The t-test results indicated a significant difference in symptom severity between males and females ($t = -19.47$, $p < 0.001$), with females reporting significantly higher mean symptom levels ($M = 31.11$, $SD = 10.23$) compared to males ($M = 25.31$, $SD = 8.12$).

Figure 1 shows a boxplot comparing symptom levels for males and females, which visually reinforces the significant difference found between the two groups.

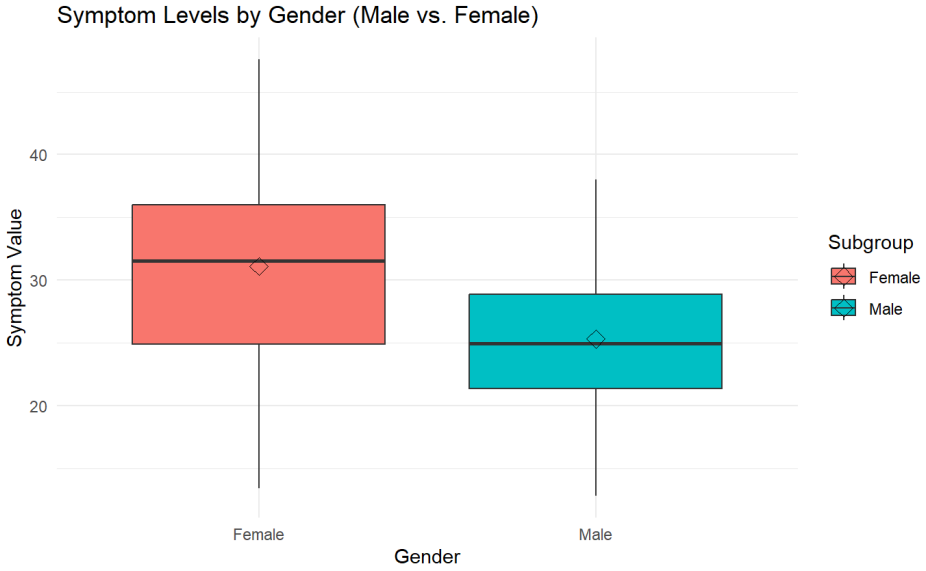

Figure 1. Boxplot of Symptom Levels by Gender

4.3 Gender and Sexual Orientation Differences

A one-way ANOVA was conducted to determine if there were significant differences in mean mental health symptom levels across the various gender and sexual orientation subgroups. The results of the ANOVA are statistically significant, implying that at one mean symptom level is different across gender and sexual orientation, $F(7, 1074) = 474.19$, $p < 0.001$.

Post-hoc comparisons using Tukey's HSD test indicated that transgender individuals reported significantly higher mean symptom levels compared to all other groups. Similarly, bisexual individuals had significantly higher mean symptom levels compared to straight and cis-gender male groups.

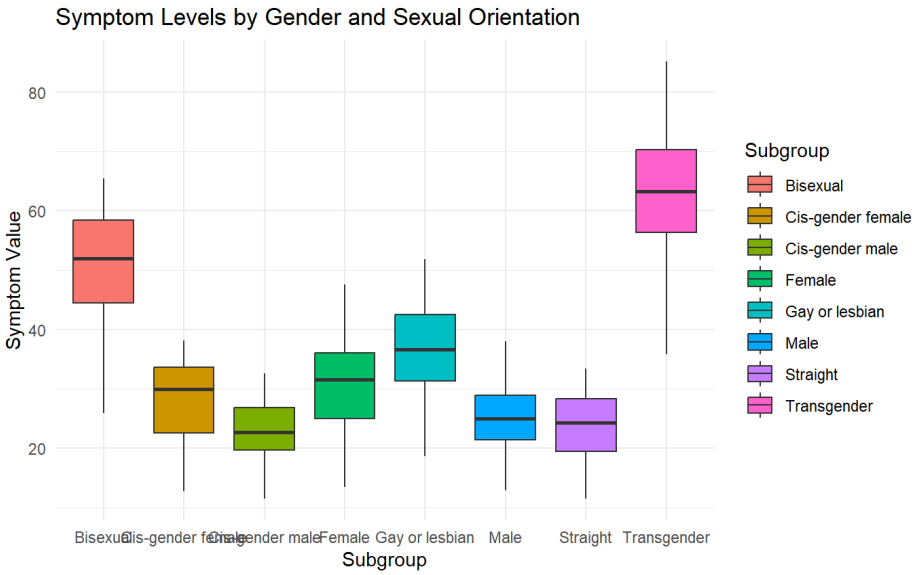

Figure 2. Boxplot for Symptom Levels by Gender and Sexual Orientation

4.4 Tukey's HSD Post-Hoc Test

To further explore the specific differences between subgroups, Tukey's HSD post-hoc test was performed following the ANOVA. The test revealed that:

- Transgender individuals had significantly higher mean symptom levels than cis-gender males ($p < 0.001$) and straight individuals ($p < 0.001$).
- Bisexual individuals had significantly higher mean symptom levels compared to straight individuals ($p < 0.001$).

These results suggest that transgender individuals and bisexual individuals experience disproportionately high mean levels of mental health symptoms, suggesting the need for targeted interventions.

4.5 Multiple Regression

A multiple regression analysis was conducted to evaluate the combined effects of gender, sexual orientation, and time phase on mental health symptom levels. The overall regression model was significant, $F(10, 1060) = 200.12$, $p < 0.001$, explaining 75.5% of the variance in symptom severity.

Significant predictors in the model included:

- Transgender individuals ($B = 12.24$, $p < 0.001$) who reported much higher symptom levels compared to other subgroups.
- Bisexual individuals ($B = 6.47$, $p < 0.001$) also reported significantly higher symptom levels.
- Time phase: Symptom levels were lower in later phases of the survey, indicating an improvement in mental health over time ($B = -1.75$, $p < 0.001$ for Phase 4.0).

Table 2 summarizes the regression coefficients, confidence intervals, and p-values for the predictors.

Table 2. Regression Analysis of Mental Health Symptom Severity by Gender, Sexual Orientation, and Time Phase

Description: df [23 × 5]

	Predictor <chr>	Estimate <dbl>	Std_Error <dbl>	t_value <dbl>	p_value <dbl>
(Intercept)	(Intercept)	56.30371622	0.9125501	61.69931324	0.000000e+00
SubgroupCis-gender female	SubgroupCis-gender female	-23.03603604	0.7399731	-31.13091102	1.330699e-151
SubgroupCis-gender male	SubgroupCis-gender male	-28.06396396	0.7399731	-37.92565542	1.680607e-199
SubgroupFemale	SubgroupFemale	-22.03550193	0.6950009	-31.70571616	1.150028e-155
SubgroupGay or lesbian	SubgroupGay or lesbian	-13.75045045	0.7399731	-18.58236585	6.229615e-67
SubgroupMale	SubgroupMale	-27.83026384	0.6950009	-40.04349202	3.107485e-214
SubgroupStraight	SubgroupStraight	-27.41081081	0.7399731	-37.04298391	2.542579e-193
SubgroupTransgender	SubgroupTransgender	11.90253842	0.7470202	15.93335649	2.129052e-51
Phase2.0	Phase2.0	-0.09083333	1.1979415	-0.07582451	9.395730e-01
Phase3.0 (Jan 6 - Mar 29)	Phase3.0 (Jan 6 - Mar 29)	1.67361111	1.1252701	1.48729720	1.372340e-01
Phase3.0 (Oct 28 - Dec 21)	Phase3.0 (Oct 28 - Dec 21)	4.26250000	1.2993500	3.28048634	1.070066e-03
Phase3.1	Phase3.1	-5.51805556	1.1252701	-4.90376081	1.087470e-06
Phase3.10	Phase3.10	-4.34787736	0.9731323	-4.46792003	8.747214e-06
Phase3.2	Phase3.2	-3.52496070	0.8578739	-4.10894951	4.281345e-05
Phase3.3	Phase3.3	-4.26732181	0.9731323	-4.38514038	1.274731e-05
Phase3.4	Phase3.4	-3.88537736	0.9731323	-3.99265064	6.984631e-05
Phase3.5	Phase3.5	-3.30204403	0.9731323	-3.39321177	7.163482e-04
Phase3.6	Phase3.6	-0.87565514	0.9731323	-0.89983153	3.684145e-01
Phase3.7	Phase3.7	-4.49509958	0.9731323	-4.61920698	4.325270e-06
Phase3.8	Phase3.8	-4.30343292	0.9731323	-4.42224850	1.077548e-05
	Predictor <chr>	**Estimate** <dbl>	**Std_Error** <dbl>	**t_value** <dbl>	**p_value** <dbl>
Phase3.9	Phase3.9	-4.17843292	0.9731323	-4.29379731	1.917598e-05
Phase4.0	Phase4.0	-15.23860444	0.9756967	-15.61817753	1.212282e-49
Phase4.1	Phase4.1	-14.76821645	0.9217670	-16.02163690	6.802725e-52

The results indicate that transgender and bisexual individuals are significantly more likely to report higher mental health symptom levels. Holding all other variables constant, the regression coefficients suggest that identifying as transgender increases average mental health symptom levels by approximately 11.90 points, while bisexual individuals also show significantly higher symptom levels. Later survey phases also indicate a decline in symptom severity. This reflects potential improvement in mental health over time. **The effect of time phase shows that, overall, mental health symptom levels tended to decrease in the later stages of the survey period.**

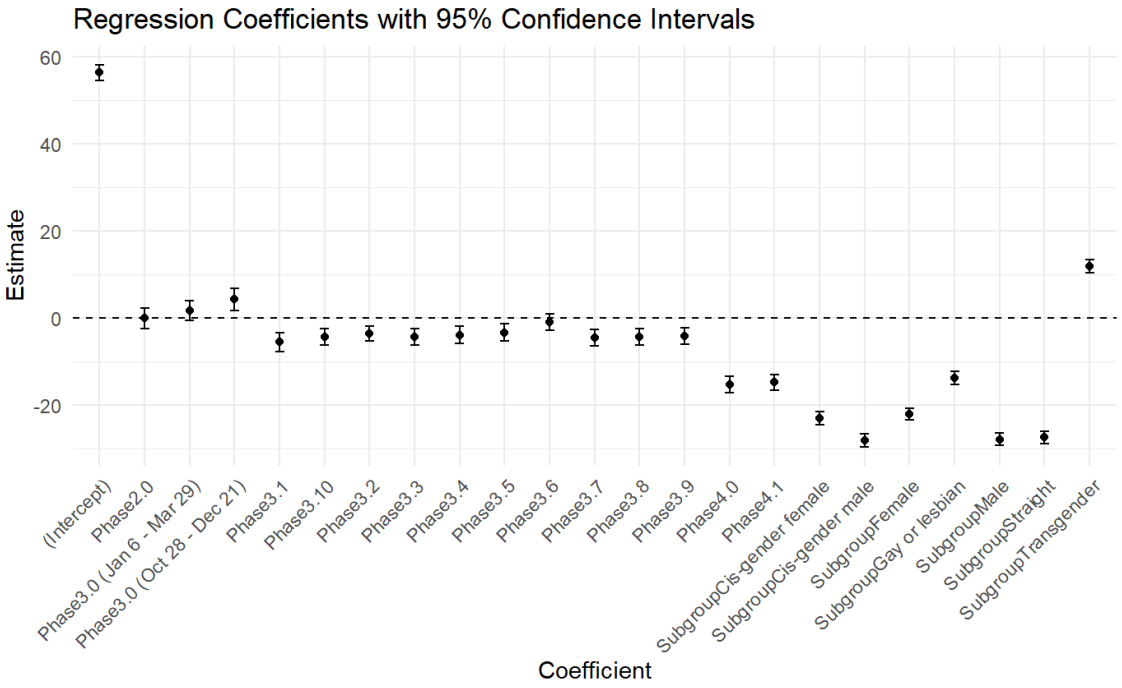

Figure 3. Regression Coefficient Plot

4.6 Fisher's Exact Test

Finally, a Fisher's Exact Test was conducted to determine whether there was an association between gender/sexual orientation and symptom severity (Low, Moderate, High). The test yielded a p-value of 0.0004998, indicating a statistically significant association between gender/sexual orientation and mental health symptom severity levels. This result suggests that the distribution of symptom severity varies significantly across different gender and sexual orientation subgroups. This suggests that different gender and sexual orientation subgroups experience different levels of symptom severity.

Figure 4 shows the stacked bar plot of symptom severity proportions across subgroups, highlighting the differences in symptom distribution.

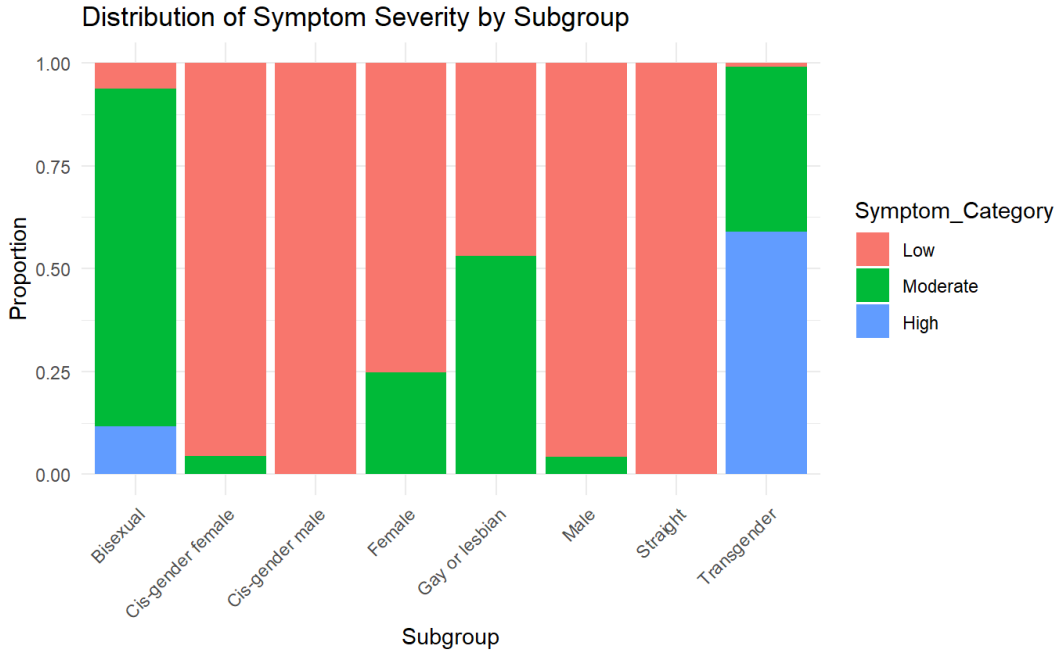

Figure 4. Stacked Bar Chart of Symptom Severity by Subgroup

Figure 4 presents a stacked bar chart showing the distribution of symptom severity (Low, Moderate, High) across different gender and sexual orientation subgroups. The chart shows huge disparities, with transgender and bisexual individuals showing higher proportions of severe symptoms compared to other groups. By contrast, cisgender males and straight individuals predominantly report lower symptom severity. This visualization further illustrates the different mental health challenges faced by different subgroups.

5. Discussion

Our findings align with existing literature on the mental health disparities faced by gender and sexual minority groups. The results from the ANOVA and post-hoc tests shows that transgender and bisexual individuals report significantly higher mean symptom severity compared to other groups. This suggests that discrimination and social stigma may contribute to the elevated mental health challenges faced by these subgroups.

The regression analysis also highlights that time phase significantly affects symptom reporting, suggesting that external factors such as the COVID-19 pandemic may have influenced the mental health landscape during the survey period. These findings underscore the need for targeted mental health interventions for gender and sexual minorities.

6. Conclusion

This study provides empirical evidence of the mental health disparities faced by gender and sexual minorities. The result highlights that transgender and bisexual individuals experience significantly higher levels of anxiety and depression compared to cisgender and heterosexual groups. While the findings show the need for potential targeted interventions, there's several limitations should be noted. The reliance on self-reported data may introduce biases, and the U.S.-based dataset may not generalize to other cultural contexts or locations. Future research should address these gaps by using longitudinal designs. That includes exploring more diverse populations and considering additional factors such as socioeconomic status to provide more comprehensive understandings.

It is also important to note that this study is based on observational data, which limits the ability to draw causal conclusions. While associations between gender, sexual orientation, and mental health symptom severity are observed, further experimental studies are required to establish causation.

References

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