

Predicting Depression in the United States: Are Sexual Orientation, Race, and Income Related to Taking Depression Medication?

Abstract

Depression is a highly prevalent mental health condition affecting people's quality of life across the world, and is caused by both biological and social factors. This study aims to understand how sexual orientation can play a role in depression, and, secondarily, how race and income do as well. To do so, we fit a multiple regression model to predict the odds of taking medication based on sexual orientation, income, and race, and adjusting for other demographic factors. Our results show that all non-heterosexual identities have greater odds of taking medication for depression compared to those identifying as straight, non-white racial backgrounds have lower odds of taking medication for depression compared to the white background, and lower income groups show higher odds of taking medication for depression than higher income groups. These differences highlight the impact of social determinants of health, and show the need for equitable diagnosis and treatment of depression.

Introduction

Depression is the most common mental health condition,¹ affecting about 264 million people across the globe.² Symptoms, including feelings of hopelessness and loss of interest in activities, can be life-altering.³ Since there are many implicit biases and stigmas against sexual orientations, understanding the relationship between sexual orientation and depression is key, as experiencing discrimination can have consequences at the psychological level. Past work has found that identifying as lesbian, bisexual, or gay is associated with higher odds of having a mood disorder,⁴ and with higher prevalence of suicidal behavior.⁵ Broadly, our research question asks whether or not sexual orientation plays a role in depression.

Our primary hypothesis focuses on the nature of the relationship between sexual orientation and odds of taking medication for depression in the non-institutionalized population of the United States. Taking medication for depression is informative to study because it indicates the individual had depression that warranted pharmacological intervention and had access to the needed medication, which provides insight beyond diagnosis alone. We hypothesize that among the sexual orientation categories, each non-heterosexual category will have higher odds of taking medication for depression than the straight category. Additionally, we look into how race and income may predict the odds of taking medication for depression. Based upon data collected by the CDC between 2013 and 2016⁶, our secondary hypothesis is that the odds of taking depression medication will be lower in more wealthy income brackets. Lastly, we hypothesize that the odds of taking depression medication will differ by race.

To address these hypotheses, we construct a multiple regression model predicting the odds of taking depression medication based on sexual orientation, income, and race, while accounting for sex, age, and educational attainment. This allows us to assess how factors beyond biology are associated with the development of depression and access to treatment.

Methods

Data Collection

All data used were from the National Health Interview Survey⁷, accessed through IPUMS. This survey is a voluntary survey conducted by the U.S. Census Bureau a sample of the the non-institutionalized U.S. population. Approximately 35,000 households are sampled each year, and all survey responses were self-reported through interviews. Only adults who responded within 2018 were included in this analysis.

Variables

Our primary response variable, whether or not an individual takes medication for depression, is a binary categorical variable delineated as “Yes” or “No.” We included three explanatory variables that relate to our three hypotheses. Our primary explanatory variable, sexual orientation, is a categorical variable consisting of five non-ordinal levels: “Straight,” “Lesbian or Gay,” “Bisexual,” “Something Else,” and “I Don’t Know.” The second explanatory variable, annual household income in USD, is grouped into four categories: \$0-\$34,999, \$35,000-\$74,999, \$75,000-\$99,999, and \$100,000+. Our third explanatory variable, race, is categorized as “White,” “Black/African-American,” “Alaskan Native/Native American,” “Chinese,” “Filipino,” “Asian Indian,” “Other Asian,” and “Multiple Races.”

In addition to our explanatory variables, we included three covariates: age, level of educational attainment, and sex. Age was transformed to age⁻³, as it had a linear relationship with the logit of taking depression medication (Appendix, Part 1). We chose to simplify educational attainment into five categories, based upon whether an individual reached or completed major educational steps: “Less than High School,” “High School Diploma or GED,” “Some College,” “Bachelor’s Degree,” and “Higher Degree.” Sex is a binary categorical variable separated into “Male” and “Female”, which, while it is not representative of the gender spectrum, was included to account for different rates of depressive disorders between men and women.⁸ We coded any unknown values as missing and excluded all missing values from our analysis. The one exception is for the sexual orientation category ‘I don’t know,’ as individuals who are questioning or exploring their sexual orientation are commonly included in the LGBTQ+ community.

Statistical Analysis

All analyses were performed in R (v4.0.3). To analyze our hypotheses, we fit a generalized linear model including all covariates and explanatory variables. We performed z-tests on each individual coefficient to assess significance. Additionally, to test the importance of each variable in the model, we performed a nested likelihood ratio for each variable, comparing the full model to the model lacking that particular variable.

Results

In total, 22,577 individuals were included in our sample. See **Table 1** for exact CIs, coefficient estimates, and p-values. The model adjusted for covariates age⁻³, sex, and educational attainment, and contained all explanatory variables. Individual z-tests for all LGBTQ+ categories in reference to heterosexual individuals had significantly higher odds of taking depression medication at the $\alpha = 0.05$ level (Table 1). The bisexual category had the highest adjusted odds ratio (OR = 3.060, 95% Confidence interval: [2.32, 4.035], Table 1). For total family income, in reference to the income group \$0-\$34,999, all the other categories had significantly lower odds of taking medication at the $\alpha = 0.05$ level. The highest income group (\$100,000+) had the lowest adjusted odds ratio (OR = 0.399, 95% CI: [0.348, 0.456], Table 1). Compared to the White category, Alaskan Native/Native American and Multiple Races did not have significantly different odds for taking depression medication. However, all other races had significantly lower odds of taking depression medication at $\alpha = 0.05$. All explanatory variables were important to keep within the model (nested likelihood ratio tests, $p < 0.001$; Appendix, Part 2).

Table 1: *Adjusted Odds Ratios of Taking Medication for Depression.* Total sample size: N = 22,577. Adjusted OR: adjusted odds ratio. CI: 95% confidence intervals for the adjusted OR. LRT: Likelihood Ratio Test. P-values calculated from z-tests. Data provided by IPUMS-NHIS.⁷

Variable	Adjusted OR	P-Value	CI	N
Sexual Orientation				
(Nested LRT, p < 0.001)				
Straight (Reference)				21561
Lesbian/Gay	2.194	<0.001	(1.707, 2.82)	433
Bisexual	3.060	<0.001	(2.32, 4.035)	286
Something Else	2.256	0.001	(1.397, 3.643)	104
I don't know	1.839	0.002	(1.256, 2.691)	193
Family Income				
(Nested LRT, p < 0.001)				
<34.9k (Reference)				7302
35k-74.9k	0.627	<0.001	(0.564, 0.698)	6670
75k-99.9k	0.561	<0.001	(0.485, 0.649)	3030
>100k	0.399	<0.001	(0.348, 0.456)	5575
Race				
(Nested LRT, p < 0.001)				
White (Reference)				18273
Black/African-American	0.513	<0.001	(0.441, 0.598)	2702
Alaskan Native/Native American	0.713	0.08	(0.488, 1.041)	323
Chinese	0.204	<0.001	(0.091, 0.462)	250
Filipino	0.380	0.001	(0.217, 0.668)	281
Asian Indian	0.293	<0.001	(0.15, 0.572)	294
Other Asian	0.333	<0.001	(0.201, 0.553)	385
Multiple Races	0.531	0.179	(0.211, 1.335)	69

Although each non-heterosexual sexual orientation category had a significantly higher odds of taking depression medication than the straight group, the largest effect size was observed for the bisexual category, as has been observed previously.⁹ As we see in Table 1, we are 95% confident that the odds of taking depression medication for those identifying as bisexual are between 2.32 and 4.035 times higher than the odds for those who identify as straight when adjusting for age, sex, race, education, and income. We also have sufficient evidence to say the odds of taking depression for those identifying as bisexual are signifi-

cantly higher than for the 'I don't know' category. No significant differences were observed for any of the other pairs of sexual orientation categories. See Appendix part 3 for visualizations.

When changing the reference category, we observe that the Black/African-American category has significantly higher predicted odds of taking depression medication than Chinese, Asian Indian, or Other Asian category. Additionally, the predicted odds of taking depression medication are significantly less among those within the Chinese category compared to the Alaskan Native/Native American category. None of the other category pairs are significantly different from one another.

With regards to income, we see that the highest and lowest income groups show significant differences with each of the middle income groups, while the middle income groups are not significantly different from each other. To be specific, all the income categories greater than the \$0-\$34,999 category have a lower predicted odds of taking depression medication than the \$0-\$34,999 category. Meanwhile, all the categories below the \$100,000+ category have higher odds of taking depression medication than the \$100,000+ category. We did not observe a significant difference between the \$35,000-\$74,999, \$75,000-\$99,999 categories.

Discussion

We used multiple logistic regression to examine whether or not non-heterosexual individuals have higher odds of taking medication for depression. Our results indicate that non-heterosexual individuals have higher odds of taking medication for depression compared to heterosexual individuals, the majority of non-white races have lower odds of taking medication compared to white individuals, and higher income brackets have lower odds of taking depression medication than individuals within households making less than \$34,999 annually. All models adjusted for covariates age⁻³, sex, and educational attainment.

Although our results found a significant difference between each non-heterosexual category and the straight category, and between the bisexual category and 'I don't know' category, no other significant relationships between sexual orientations were observed. This may suggest that all non-heterosexual sexual orientations are impacted similarly, or it could be a result of the smaller sample sizes for each of the non-heterosexual categories.

In general, we must consider that our outcome variable is not equivalent to a diagnosis of depression; it implies that the individual had depressive symptoms that necessitated medication, and that this individual had access to that medication. This is particularly relevant in regard to our findings on differences in odds of taking medication between racial groups. We cannot conclude then, that minority groups are less likely to have depression, only that they are less likely to have depression and be treated for that depression with medication. Depression often goes undiagnosed in minority populations, which can be due to a combination of factors, including clinician bias and the presentation of chronic rather than acute symptoms.¹⁰

By contrast, when considering the effects observed of sexual orientation categories and income brackets, we must note that our results are in accordance with the documented occurrence of depression in these populations. Thus, it is more likely here that the prevalence of depression drives the differences we observe rather than the access to medication or diagnosis. Still, an additional factor that may contribute to the differences we see in income groups is the access to treatments for depression other than medication – most notably psychotherapy. There are disparities in the use of psychotherapy depending on income, with lower use reported among lower income individuals.¹¹ These disparities may contribute to the higher odds of taking depression medication observed here, as medication could be the only treatment option for those who cannot access psychotherapy.

It is important to note that our study does contain limitations. Primarily, the data are self-reported, which will inherently include self-reporting bias. Additionally, we could not differentiate an individual's income from the total family income; however, examining a household's income could potentially more insight into an individual's lifestyle. For example, a person living in a middle-income household making minimum wage could have a better quality of life than someone in a low-income household making a higher wage. Lastly, the data set only contains two genders, and only four defined sexual orientations (straight, lesbian, gay, bisexual), two of which are grouped together. Because of this, we cannot extend our results to examine persons outside of the gender binary, nor can we parse out finer subtleties between sexual orientations.

Ultimately, our results provide insight to factors contributing to the odds of taking depression medication in the non-institutionalized United States, highlighting the importance of targeted mental health care for these populations.

References

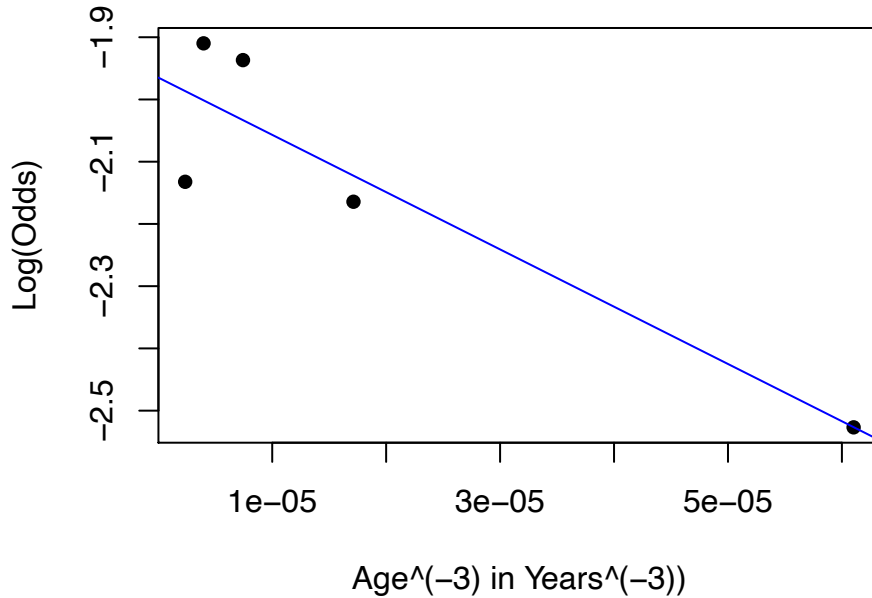
1. Lim, G. Y., Tam, W. W., Lu, Y., Ho, C. S., Zhang, M. W., & Ho, R. C. (2018). Prevalence of Depression in the Community from 30 Countries between 1994 and 2014. *Scientific Reports*, 8(1), 2861. <https://doi.org/10.1038/s41598-018-21243-x>
2. Depression. (2020, January 30). World Health Organization. <https://www.who.int/news-room/fact-sheets/detail/depression>
3. Kanter, J. W., Busch, A. M., Weeks, C. E., & Landes, S. J. (2008). The nature of clinical depression: Symptoms, syndromes, and behavior analysis. *The Behavior Analyst*, 31(1), 1–21. <https://doi.org/10.1007/BF03392158>
4. Bostwick, W. B., Boyd, C. J., Hughes, T. L., & McCabe, S. E. (2010). Dimensions of Sexual Orientation and the Prevalence of Mood and Anxiety Disorders in the United States. *American Journal of Public Health*, 100(3), 468–475. <https://doi.org/10.2105/AJPH.2008.152942>[https://doi.org/10.1016/S0140-6736\(18\)31948-2](https://doi.org/10.1016/S0140-6736(18)31948-2)
5. Haas, A. P., Eliason, M., Mays, V. M., Mathy, R. M., Cochran, S. D., D'Augelli, A. R., Silverman, M. M., Fisher, P. W., Hughes, T., Rosario, M., Russell, S. T., Malley, E., Reed, J., Litts, D. A., Haller, E., Sell, R. L., Remafedi, G., Bradford, J., Beautrais, A. L., ... Clayton, P. J. (2010). Suicide and Suicide Risk in Lesbian, Gay, Bisexual, and Transgender Populations: Review and Recommendations. *Journal of Homosexuality*, 58(1), 10–51. <https://doi.org/10.1080/00918369.2011.534038>
6. Brody, D. J., Pratt, L. A., Hughes, J. P. (2018). Prevalence of Depression Among Adults Aged 20 and Over: United States, 2013–2016. CDC <https://www.cdc.gov/nchs/data/databriefs/db303.pdf>
7. Lynn A. Blewett, Julia A. Rivera Drew, Miriam L. King and Kari C.W. Williams. IPUMS Health Surveys: National Health Interview Survey, Version 6.4 [dataset]. Minneapolis, MN: IPUMS, 2019. <https://doi.org/10.18128/D070.V6.4>
8. Ferrari, A. J., Charlson, F. J., Norman, R. E., Patten, S. B., Freedman, G., Murray, C. J. L., Vos, T., & Whiteford, H. A. (2013). Burden of Depressive Disorders by Country, Sex, Age, and Year: Findings from the Global Burden of Disease Study 2010. *PLoS Medicine*, 10(11), e1001547. <https://doi.org/10.1371/journal.pmed.1001547>
9. Russell, S. T., & Fish, J. N. (2016). Mental Health in Lesbian, Gay, Bisexual, and Transgender (LGBT) Youth. *Annual Review of Clinical Psychology*, 12(1), 465–487. <https://doi.org/10.1146/annurev-clinpsy-021815-093153>
10. Bailey, R., Mokonogho, J., & Kumar, A. (2019). Racial and ethnic differences in depression: Current perspectives. *Neuropsychiatric Disease and Treatment*, Volume 15, 603–609. <https://doi.org/10.2147/NDT.S128584>
11. Krupnick, J. L., & Melnikoff, S. E. (2012). Psychotherapy with Low-Income Patients: Lessons Learned from Treatment Studies. *Journal of Contemporary Psychotherapy*, 42(1), 7–15. <https://doi.org/10.1007/s10879-011-9182-4>

Appendix

1. Assumptions for Logistic Regression

Linearity

Figure 1: Empirical logit plot of age^{-3} vs $\log(\text{odds taking medication for depression})$.



The figure above shows a linear relationship between the $\log(\text{Odds})$ of taking medication for depression and age^{-3} . Thus, the linearity assumption is satisfied.

Randomness & Independence

With the central aim to form a sample representative of the non-institutionalized population of the United States, the sample for the National Health Interview Survey is selected from clusters of addresses from defined areas. To keep the sampling plan as up to date as possible, the sampling plan is revised after every decennial census. For the purpose of our work, this sampling strategy provides a reasonable approximation of randomness. With regards to independence, we are only studying the year 2018, so time should not create any clustering. Additionally, because shared demographic features likely to impact taking medication for depression are accounted for in the model - age, sex, income, education - we do not have reason to believe the errors would not be independent.

2. Likelihood Ratio Test

Table 2: Full Likelihood Ratio Tests for models. The model “Full” contains all variables explanatory variables: Sexual Orientation, Income, Race, Age^{-3} , Sex, and Education. Df: degrees of freedom. $\log(\text{Likelihood})$: logarithm of the likelihood of taking depression medication. Chi Sq: value compared against χ^2 distribution. P-values were calculated against a χ^2 distribution.

Model	Df	Log(Likelihood)	Chi Sq	P-Value
Full	20	14729.99		
W/o Sexual Orientation	4	14890.25	160.26	<0.001
W/o Income	3	15827.35	1097.37	<0.001
W/o Race	7	14912.12	182.14	<0.001
W/o Age	1	14812.15	14729.99	<0.001
W/o Sex	1	14947.28	217.30	<0.001
W/o Education	4	14800.34	70.35	<0.001

3. Confidence Intervals for Each Variable of Interest

Figure 2A-C. Top left to bottom figure: *A: Adjusted Odds Ratio Estimates by Sexual Orientation.* Reference category: Straight. *B: Adjusted Odds Ratio Estimates by Income.* Reference category: income group \$0-\$34,999. *C: Adjusted Odds Ratio Estimate by Race* Reference category: White racial group. For all figures, the black bars represent the 95% Confidence Interval.

