

Association Between Nativity Status and Depression Symptom Severity Among U.S. Adults

Tajrian Amad

BIST0615: Applied Categorical Analysis Fall 2025

December 10, 2025

Abstract

Background: As foreign-born population continues to grow in the United States, understanding how nativity relates to experiencing different levels of depressive symptoms has become increasingly important. Prior research suggests that foreign-born adults may experience lower levels of depression than their U.S.-born counterparts; therefore, this study aims to contribute to this growing literature to examine the association between nativity status and depressive symptom severity among U.S. adults.

Methods: A cross-sectional analysis was conducted using data from the 2022 National Health Interview Survey (NHIS). The primary outcome was depression symptom severity, measured by the PHQ-8 and categorized into none/minimal, mild, and moderate/severe. Descriptive statistics were reported to summarize sample characteristics, and bivariate associations were assessed using Chi-square and trend tests. A multivariable proportional odds model was used to estimate the independent association between nativity and depressive symptom severity, adjusting for age and family income-to-poverty ratio level.

Results: Majority of the sample consisted of U.S.-born (83.9%) and foreign-born individuals comprised of 16.1% of the study population. 7.8% of U.S.-born adults and 3.9% of foreign-born adults reported moderate to severe depressive symptoms. In unadjusted analyses, nativity status was not significantly associated with depressive symptom severity (OR: 0.67; 95% CI: 0.42, 1.06). After adjusting for confounders, foreign-born adults had 43% lower odds of reporting high depressive symptom severity compared with U.S.-born adults (aOR: 0.71; 95% CI: 0.60, 0.84).

Discussion/Conclusion: Foreign-born adults showed lower adjusted odds of higher depressive symptom severity, which may suggest cultural and social factors that buffer against the risk. Future research should examine how this protective effect may change with duration of U.S. residence and acculturation.

Introduction

Depression is a prevalent mental health disorder characterized by persistent low mood, loss of interest in usual activities, and associated changes in sleep, appetite, and concentration that can substantially impair daily functioning. In the United States, depression is a significant public health concern, affecting millions of adults every year and contributing to morbidity and disability. As the foreign-born or immigrant population in the US continues to grow, nativity status has been identified as an important factor within this context. Previous studies have suggested that foreign-born adults often exhibit lower levels of depression compared with U.S.-born adults (Tillman et al., 2009; Mamudu et al., 2024). This is further supported by the “Healthy Immigrant Effect” or “Healthy Migrant Hypothesis,” a theoretical framework that posits that foreign-born individuals tend to have more favorable physical and mental health outcomes than their U.S.-born counterparts, despite often facing greater socioeconomic disadvantage (Kennedy et al., 2006). A nationally representative study by Salas-Wright and colleagues (2018) found that immigrants were less likely than U.S.-born individuals to meet criteria for lifetime mood or anxiety disorders.

This apparent health advantage, however, does not appear to be constant over time. A systematic review by Elshahat et al. (2022) indicates that while immigrants may arrive with an initial mental health advantage, it can diminish with longer residence in the country, driven by factors such as acculturative stress, discrimination, and incorporation of less healthy behaviors prevalent in the new environment. Nonetheless, the relatively low prevalence of depression reported among this population could also suggest protective factors, such as social support or cultural practices, that may buffer against risk (Cariello et al., 2022). The relationship between nativity status and depression is therefore complex and may be confounded by socioeconomic factors, such as income, education, and employment, which differ between native- and foreign-born populations.

The present study seeks to extend and contribute to this growing literature by exploring the following research question: Among U.S. adults, what is the association between nativity (U.S.-born vs. foreign-born) and the severity of depression? Using nationally representative data, this cross-sectional study seeks to investigate whether the mental health advantage observed among the immigrant population in the context of mental health is evident across varying levels of depressive severity. This design is well-suited for assessing the burden of disease across a large, nationally representative population at a specific point in time, allowing for identification of differences in prevalence and severity of depression between nativity groups.

Methods

Study Population, Source, and Measures

This study uses data from the 2022 National Health Interview Survey (NHIS), a nationally representative, cross-sectional household survey conducted annually by the Centers for Disease Control and Prevention (CDC) to collect health-related information from the general, non-institutionalized U.S. adult population. The study population in the current research includes all sample adults aged 18 years and older who participated in the survey. To ensure a consistent sample size across the statistical analyses, respondents with missing data (including “Unknown,” “Refused,” or “Not Ascertained”) for the outcome, predictor, or confounding variables were excluded from the analysis.

The primary outcome is the severity of depressive symptoms, measured by the ordinal variable derived from the eight-item Patient Health Questionnaire (PHQ-8) depression scale. Respondents were categorized into four ordered levels of symptom severity, including “None/Minimal,” “Mild,” “Moderate,” or “Severe.” Due to very small cell counts in “Moderate” and “Severe” categories, these were combined into a single category, “Moderate/Severe.” Therefore, the severity of depressive symptoms was recoded into a three-level ordinal variable: “None/Minimal,” “Mild,” and “Moderate/Severe.” The predictor of interest is nativity status, a nominal variable that indicates whether the participant was born in the United States or in a U.S. territory.

Some potential confounding variables are selected for adjustment, which include the respondent’s age, sex, educational attainment, and family income-to-poverty ratio level. Age is a continuous variable that is measured in years. Sex is a nominal variable with categories for “Male” and “Female.” Educational attainment is an ordinal variable with eleven categories ranging from “Grade 1-11” to “Professional School or Doctoral degree.” For simplicity and better interpretation of results, this variable is recoded into a six-level ordinal variable, with categories including “Less than high school,” “High school diploma or GED equivalent,” “Some college, no degree,” “Associate degree,” “Bachelor’s degree,” and “Postgraduate degree.” Similarly, the 12-level ordinal variable for the ratio of family income-to-poverty is also recoded into a four-level ordinal variable. The recoded categories are defined as: Below Poverty (less than 100% of the Federal Poverty Level), Low Income (100% to less than 200% of the FPL), Middle Income (200% to less than 400% of the FPL), and High Income (400% or more of the FPL). These categories were based on thresholds or cut-offs frequently applied in public health research, corresponding to eligibility criteria for certain federal programs (Wang et al., 2022; Gensheimer et al., 2022; Jeon et al., 2024).

Statistical Methods

All statistical analyses were performed using SAS version 9.4. Descriptive statistics were reported for study participants. Bivariate analyses were conducted to assess the unadjusted associations between all variables and the predictor of interest using Pearson's Chi-square test and the Cochran-Armitage trend test. The Mantel-Haenszel chi-square test was used to examine the associations between selected variables and depressive symptom severity. Potential confounders were identified based on a priori knowledge as well as statistically determined using bivariate associations (Tables 1 and 2). Covariates associated with both the predictor of interest and outcome were included in the multivariate model to adjust for potential confounding. To investigate the association between nativity status and the severity of depressive symptoms, a multivariable ordinal logistic regression model was used, controlling for selected confounders. Prior to finalizing the model, the proportional odds assumption was evaluated using the score test to confirm whether the predictors have a consistent effect across all response levels. Additionally, the linearity assumption for ordinal covariates was evaluated using likelihood ratio tests, which compared models treating these variables as categorical vs. continuous. A two-sided p-value of <0.05 was considered statistically significant for all statistical tests performed.

Results

The final analytic sample included 951 US adults. Table 1 presents the demographic and socioeconomic characteristics of the study population stratified by nativity status. The majority of the sample was U.S.-born (83.9%), while 16.1% identified as foreign-born. The age distribution differed significantly by nativity status ($p = 0.0049$); the U.S.-born population tended to be older, with the largest proportion in the 65+ age group, whereas the foreign-born population was relatively younger. As for the gender distribution, females comprised approximately 55% of both the U.S.-born and foreign-born populations, although this association was not statistically significant ($p = 0.9069$). In terms of education, attainment was similar across both groups; however, foreign-born individuals had a higher prevalence of having less than a high school education compared to U.S.-born individuals (16.3% vs. 5.9%). However, foreign-born adults were more likely to have a postgraduate degree than the U.S.-born group (21.6% vs. 14.9%). Although not statistically significant, differences appeared to be slightly pronounced in the family income-to-poverty ratio levels, where foreign-born adults were more represented in the low-income level (22.2% vs. 15.3%) and less represented in the high-income category (39.9% vs. 46%) relative to U.S. native adults.

Table 1. Distribution of Sample Characteristics by Nativity Status, National Health Interview Survey, 2022 (N = 951)

Characteristic	Overall n (%)	Nativity Status: U.S.-Born n (%)	Nativity Status: Foreign-Born n (%)	P-value*
Overall	951 (100)	798 (83.9)	153 (16.1)	
Age Group				
18-34	188 (19.8)	150 (18.8)	38 (24.8)	0.0049*
35-49	230 (24.2)	192 (24.0)	38 (24.8)	
50-64	220 (23.1)	174 (21.8)	46 (30.1)	
65+	313 (32.9)	282 (35.3)	31 (20.3)	
Gender				
Male	431 (45.3)	361 (45.2)	70 (44.8)	0.9069
Female	520 (54.7)	437 (54.8)	83 (54.3)	
Education level				
Less than high school	72 (7.6)	47 (5.9)	25 (16.3)	0.5919
High school diploma or GED equivalent	246 (25.9)	212 (26.6)	34 (22.2)	
Some college, no degree	123 (12.9)	110 (13.8)	13 (8.5)	
Associate's degree	124 (13.0)	109 (13.7)	15 (9.8)	
Bachelor's degree	234 (24.6)	201 (25.2)	33 (21.6)	
Postgraduate degree	152 (16.0)	119 (14.9)	33 (21.6)	
Family income-to-poverty ratio levels				
Below Poverty (<100% FPL)	94 (9.9)	77 (9.7)	17 (11.1)	0.0705
Low income (100% to <200% FPL)	156 (16.4)	122 (15.3)	34 (22.2)	
Middle income (200% to <400% FPL)	273 (28.7)	232 (29.1)	41 (26.8)	
High income (≥400% FPL)	428 (45)	367 (46)	61 (39.9)	

*P-values determined using the Pearson's chi-square test for the association between sex and nativity status; the Cochran-Armitage trend test for age group, education level, and ratio to family income to poverty level. P-value <0.05 is statistically significant.

The bivariate associations between selected characteristics and the severity of depressive symptoms are shown in Table 2. Depressive symptom severity varied across several characteristics. The prevalence of moderate/severe depressive symptoms was 7.8% among

U.S.-born adults and 3.9% among foreign-born individuals; however, this relationship did not reach statistical significance ($p = 0.0605$). All covariates, including age, sex, education level, and income, were significantly associated with depressive symptom severity. Adults in the 35-49 age group had higher proportions of mild depressive symptoms than younger and older respondents, while the oldest group were more likely than younger and middle-aged adults to experience moderate to severe depressive symptoms. Additionally, males had a lower prevalence of moderate to severe symptoms of depression than females (5.8% vs. 8.3%; $p = 0.0044$).

In terms of socioeconomic characteristics, the severity of depressive symptom appear to decrease with higher educational attainment ($p = 0.0004$). Individuals with less than a high school education had the highest proportion of moderate to severe depressive symptoms (11.1%), while those with postgraduate degrees had the lowest (4%). This pattern also emerged similarly in the relationship between depressive symptom severity and family income-to-poverty ratio, which appeared to be statistically significant ($p = <0.0001$). Respondents in lower income groups reported a higher prevalence of moderate to severe symptoms of depression. 14.9% of adults living below the poverty level reported moderate to severe symptoms, compared to 10.9% of those with low income, 7.3% in the middle-income group, and only 4% in the high-income group. On the contrary, the proportion of adults reporting no or minimal symptoms increased with each sequential income level, from 66% among those below the poverty line to 84.8% among those in the high-income group.

Table 2. Depressive Symptom Severity Prevalence by Selected Characteristics, National Health Interview Survey, 2022 (N = 951)

Predictor	Overall n (%)	None/Minimal Depressive Symptoms n (%)	Mild Depressive Symptoms n (%)	Moderate/ Severe Depressive Symptoms n (%)	P-value*
US Nativity Status					
US-Born	798 (83.9)	626 (78.5)	110 (13.8)	62 (7.8)	0.0605
Foreign-born	153 (16.1)	129 (84.3)	18 (11.8)	6 (3.9)	
Age Group					
18-34	188 (19.8)	143 (76.1)	26 (13.8)	19 (10.1)	0.0282*
35-49	230 (24.2)	177 (79.1)	38 (16.5)	15 (6.5)	
50-64	220 (23.1)	174 (79.1)	30 (13.6)	16 (7.3)	
65+	313 (32.9)	261 (83.4)	34 (10.9)	18 (26.5)	
Sex					
Male	431 (45.3)	362 (84)	44 (10.2)	25 (5.8)	0.0044*
Female	520 (54.7)	393 (75.6)	84 (16.2)	43 (8.3)	

Predictor	Overall n (%)	None/Minimal Depressive Symptoms n (%)	Mild Depressive Symptoms n (%)	Moderate/ Severe Depressive Symptoms n (%)	P-value*
Education level					
Less than high school	72 (7.6)	53 (73.6)	11 (15.3)	8 (11.1)	0.0004*
High school diploma or GED equivalent	246 (25.9)	188 (76.4)	33 (13.4)	25 (10.2)	
Some college, no degree	123 (12.9)	96 (78.4)	16 (13)	11 (8.9)	
Associate's degree	124 (13)	91 (73.4)	25 (20.2)	8 (6.5)	
Bachelor's degree	234 (24.6)	194 (82.9)	30 (12.8)	10 (4.3)	
Postgraduate degree	152 (16)	133 (87.5)	13 (8.6)	6 (4)	
Family income-to-poverty ratio levels					
Below Poverty (<100% FPL)	94 (9.9)	62 (66)	18 (19.2)	14 (14.9)	<0.0001*
Low income (100% to <200% FPL)	156 (16.4)	112 (71.8)	27 (17.3)	17 (10.9)	
Middle income (200% to <400% FPL)	273 (28.7)	218 (79.9)	35 (12.8)	20 (7.3)	
High income (≥400% FPL)	428 (45)	363 (84.8)	48 (11.2)	17 (25)	

*P-values determined using the Mantel-Haenszel chi-square test. P-value <0.05 is statistically significant.

Table 3 displays the association between nativity status and the severity of depressive symptoms using the proportional odds model, adjusting for age and family income-to-poverty ratio levels. Age was associated with both nativity status and depressive symptom severity; hence, it was identified as a confounder. While family income-to-poverty ratio was not statistically associated with nativity status, it was included in the adjusted model due to its strong association with the response variable as well as its conceptual importance as a socioeconomic determinant. The proportional odds assumption was evaluated and met for all predictors, which confirms that the relationship is consistent across response categories. Additionally, the linearity assumption held for ordinal variables, such as age group, education level, and income/poverty levels. Therefore, these variables were treated as continuous to achieve a simple model.

When investigating the association between nativity status and the severity of depressive symptoms, the unadjusted model shows that it is not statistically significant (OR: 0.67; 95% CI: 0.42, 1.06). However, when adjusting for selected confounders, age, and family

income-to-poverty ratio level, the relationship trended towards statistical significance. In the adjusted model, foreign-born adults had 43% lower odds of reporting moderate to severe depressive symptoms compared to U.S.-born adults (aOR: 0.57; 95% CI: 0.35, 0.92). Age and family income-to-poverty ratio were also significant predictors in the adjusted model. Regarding age, for every one unit increase in the age group, the odds of moderate to severe depressive symptoms decreased by 19% (aOR: 0.82; 95% CI: 0.71, 0.94). Furthermore, for each increase in family income-to-poverty ratio, the odds of higher depressive symptom severity decreased by 33% (aOR: 0.67; 95% CI: 0.57, 0.77).

Table 3. Association Between Nativity Status and Depressive Symptom Severity Among US Adults, National Health Interview Survey, 2022 (N = 951)

	Unadjusted Odds Ratio (95% CI)	Adjusted Odds Ratio* (95% CI)
Nativity status		
Foreign-born (ref: U.S.-born)	0.67 (0.42, 1.06)	0.57 (0.35, 0.92)
Age	-	0.82 (0.71, 0.94)
Family income to poverty ratio level	-	0.67 (0.57, 0.77)

*Adjusted for age and ratio of family income-to-poverty level.

Discussion

The current study examined the association between nativity status and the severity of depressive symptoms among U.S. adults. Depressive symptom severity varied significantly across demographic and socioeconomic characteristics, including age, sex, education, and family income-to-poverty ratio level. Although nativity status was not found to be associated with depressive symptom severity in unadjusted analyses, the adjusted proportional odds model indicated that foreign-born adults have significantly lower odds of experiencing higher severity of depressive symptoms compared to U.S.-born adults. Age and the family income-to-poverty ratio were adjusted for in the model and both appeared to be associated with lower odds of moderate to severe symptoms. These findings are consistent with prior research describing a mental health advantage among immigrant populations (Tillman et al., 2009; Kennedy et al., 2006).

This study had several strengths. The use of nationally representative NHIS data allowed for generalizability and investigation of nativity differences in depressive symptom severity across several sociodemographic characteristics. The use of rigorous analytical methods, including appropriate statistical tests and evaluations of proportional odds and linearity assumptions, supported the validity of our findings. However, there are some limitations to consider. The cross-sectional study design does not allow for establishing temporality and causality. For foreign-born individuals, the length of U.S. residency may be an important factor to consider when assessing the prevalence of depressive symptoms or potential changes in symptoms over time. The current study suggests the presence of a relationship between nativity status and depressive symptom severity; however, future research could incorporate the length of U.S. residency among foreign-born populations when examining this association thoroughly. Additionally, the outcome was measured based on a self-reported questionnaire, which could introduce misclassification due to recall bias or underreporting of depressive symptoms. It is likely that individuals may not be comfortable with disclosing their depressive symptoms or may not entirely recognize the symptoms they experience. This may partly explain the small cell counts in both the moderate and severe depressive symptom categories. Collapsing these categories due to small cell sizes may have reduced sensitivity to find differences at the highest levels of symptom severity. Although mental health stigma varies across cultural groups, this study did not account for race/ethnicity and therefore no assumptions about these differences are made; however, this remains an important area for future research.

These findings are supported by the “Healthy Immigrant Effect” theory, identifying that foreign-born status is linked to experiences of lower depressive symptoms than their U.S. counterparts despite facing social disadvantages, as was also observed in our study. The primary association observed in this study suggests that cultural or social factors may buffer depressive symptom severity among foreign-born adults. Future research can build on these results to further investigate whether this association remains stable over time, while accounting for other psychosocial variables not explored here, such as acculturative stress or discrimination. These insights would be imperative for public health practitioners or policymakers seeking to develop culturally responsive interventions that address both protective and risk factors influencing depressive symptom severity among diverse populations.

References

- Tillman, K. H., & Weiss, U. K. (2009). Nativity Status and Depressive Symptoms among Hispanic Young Adults: The Role of Stress Exposure. *Social Science Quarterly*, 90(5), 1228–1250. <https://doi.org/10.1111/j.1540-6237.2009.00655.x>
- Mamudu, L., Chiangong, J., Curry, M., McEligot, A. J., Mamudu, H. M., & Williams, F. (2024). The influence of nativity/birthplace, neighborhood cohesion, and duration lived in the neighborhood on psychological distress. *Journal of Affective Disorders Reports*, 17, 100798. <https://doi.org/10.1016/j.jadr.2024.100798>
- Kennedy, S. (2006, December). The Healthy Immigrant Effect and Immigrant Selection: Evidence from Four Countries. *Social and Economic Dimensions of an Aging Population Research Papers*; McMaster University. <https://ideas.repec.org/p/mcm/sedapp/164.html>
- Salas-Wright, C. P., Vaughn, M. G., Goings, T. C., Miller, D. P., & Schwartz, S. J. (2018). Immigrants and mental disorders in the united states: New evidence on the healthy migrant hypothesis. *Psychiatry research*, 267, 438–445. <https://doi.org/10.1016/j.psychres.2018.06.039>
- Elshahat, S., Moffat, T., & Newbold, K. B. (2022). Understanding the Healthy Immigrant Effect in the Context of Mental Health Challenges: A Systematic Critical Review. *Journal of Immigrant and Minority Health*, 24(6), 1564–1579. <https://doi.org/10.1007/s10903-021-01313-5>
- Cariello, A. N., Perrin, P. B., Williams, C. D., Espinoza, G. A., Paredes, A. M., & Moreno, O. A. (2022). Moderating Influence of Social Support on the Relations between Discrimination and Health via Depression in Latinx Immigrants. *Journal of Latina/o psychology*, 10(2), 98–111. <https://doi.org/10.1037/lat0000200>
- Wang, S. Y., Yeh, H.-C., Stein, A. A., & Miller, E. R. (2022). Use of Health Information Technology by Adults With Diabetes in the United States: Cross-sectional Analysis of National Health Interview Survey Data (2016-2018). *JMIR Diabetes*, 7(1), e27220–e27220. <https://doi.org/10.2196/27220>
- Gensheimer, S. G., Eisenberg, M. D., Hindman, D., Wu, A. W., & Pollack, C. E. (2022). Examining Health Care Access And Health Of Children Living In Homes Subsidized By The Low-Income Housing Tax Credit. *Health affairs (Project Hope)*, 41(6), 883–892. <https://doi.org/10.1377/hlthaff.2021.01806>

Jeon, J., Cao, P., Fleischer, N. L., Levy, D. T., Holford, T. R., Meza, R., & Tam, J. (2023). Birth Cohort–Specific Smoking Patterns by Family Income in the U.S. *American journal of preventive medicine*, 64(4 Suppl 1), S32–S41. <https://doi.org/10.1016/j.amepre.2022.07.019>

Appendices

Appendix 1: SAS Code and Results from Proportional Odds Model

```
/*
Selected variables for analysis:
NATUSBORN_A: Born in U.S. or U.S. territory
PHQCAT_A: Severity of depressive symptoms - PHQ scale
categorization
EDUCP_A: Educational level of the sample adult
RATCAT_A: The ratio of the family's income to the poverty
threshold, grouped into 14 ordered categories
AGEP_A: The age of the sample adult
SEX_A: The sex of the sample adult
*/

/* Bivariate associations */
* NATUSBORN_A and independent variables;
proc freq data = proj.nhisproj_subset;
    tables (AGE_GROUP SEX_A EDUCP_A RATCAT_A) * NATUSBORN_A /
norow chisq trend measures cl;
run;
* PHQCAT_A and predictors;
proc freq data = proj.nhisproj_subset;
    table (NATUSBORN_A SEX_A AGE_GROUP EDUCP_A RATCAT_A) *
PHQCAT_A_3LVL / chisq cmh measures cl;
run;

/* Proportional odds model: checking for proportional odds
assumption */

* Unadjusted model with predictor of interest;
proc logistic data = proj.nhisproj_subset descending;
    model PHQCAT_A_3LVL = NATUSBORN_A;
    oddsratio NATUSBORN_A;
run;
* Proportional odds assumption met for nativity status (p-value:
0.3822);

* Unadjusted model with covariates (confounders only: AGE_GROUP
and RATCAT_A);
```

```

* Model with all covariates (without predictor of interest);
proc logistic data = proj.nhisproj_subset descending;
    class AGE_GROUP RATCAT_A;
    model PHQCAT_A_3LVL = AGE_GROUP RATCAT_A;
run;
* Proportional odds assumption met for all covariates (p-value:
0.7111)

```

```

* Now, run models with each covariate by itself to check for
proportional odds assumption;
* Age group - ordinal categorical variable;
proc logistic data = proj.nhisproj_subset descending;
    class AGE_GROUP;
    model PHQCAT_A_3LVL = AGE_GROUP;
run;
* Proportional odds assumption met for age group (p-value:
0.5734);

```

```

* Compare models to check if age group should be treated as
categorical or continuous;
proc logistic data = proj.nhisproj_subset descending;
    model PHQCAT_A_3LVL = AGE_GROUP;
run;

```

```

/*

```

Predictor	-2 Log L	DF	Difference	P-value
Age - continuous	1215.749	1	0.398	
	0.819549893			
Age - categorical	1215.351	3		

```


```

```

Linearity assumption holds. Age should be treated as a
continuous variable.
*/

```

```

* Federal poverty level;
proc logistic data = proj.nhisproj_subset descending;
    class RATCAT_A;
    model PHQCAT_A_3LVL = RATCAT_A;
run;
* Proportion odds assumption holds for federal poverty level
(p-value: 0.6177);

```

```

* Compare models to check if federal poverty level should be
treated as categorical or continuous;
proc logistic data = proj.nhisproj_subset descending;
    model PHQCAT_A_3LVL = RATCAT_A;
run;

/*
Predictor          -2 Log L      DF          Difference      P-value
FPL - continuous    1196.474    1              0.124          0.939882887
FPL - categorical    1196.35          3
Linearity assumption holds. Federal poverty level should be
treated as a continuous variable.
*/

* Proportional odds assumption holds for all predictor of
interest and covariates;

* Adjusted proportional odds model: PHQCAT_A_3LVL and predictor
of interest and confounders;
proc logistic data = proj.nhisproj_subset descending;
    class NATUSBORN_A (ref = '1');
    model PHQCAT_A_3LVL = NATUSBORN_A AGE_GROUP RATCAT_A/
clodds = wald;
    oddsratio NATUSBORN_A;
run;

```

The LOGISTIC Procedure

Model Information	
Data Set	PROJ.NHISPROJ_SUBSET
Response Variable	PHQCAT_A_3LVL
Number of Response Levels	3
Model	cumulative logit
Optimization Technique	Fisher's scoring

Number of Observations Read	951
Number of Observations Used	951

Response Profile		
Ordered Value	PHQCAT_A_3LVL	Total Frequency
1	3	68
2	2	128
3	1	755

Probabilities modeled are cumulated over the lower Ordered Values.

Class Level Information		
Class	Value	Design Variables
NATUSBORN_A	1	-1
	2	1

Model Convergence Status
Convergence criterion (GCONV=1E-8) satisfied.

Score Test for the Proportional Odds Assumption		
Chi-Square	DF	Pr > ChiSq
2.6371	3	0.4510

Model Fit Statistics		
Criterion	Intercept Only	Intercept and Covariates
AIC	1224.675	1194.100
SC	1234.390	1218.388
-2 Log L	1220.675	1184.100

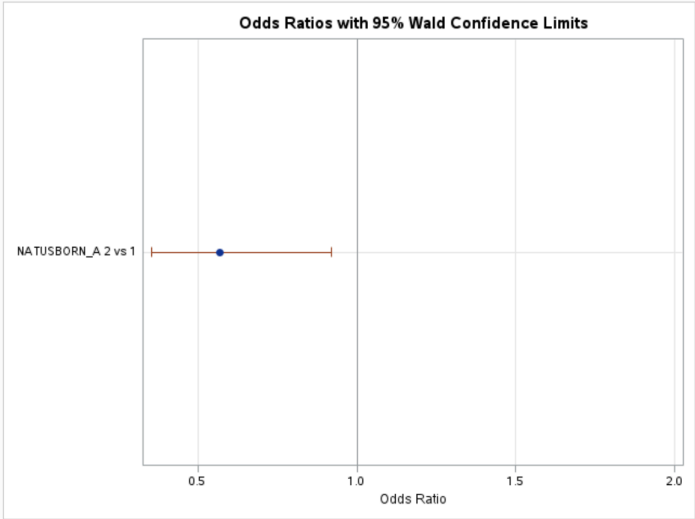
Testing Global Null Hypothesis: BETA=0			
Test	Chi-Square	DF	Pr > ChiSq
Likelihood Ratio	36.5748	3	<.0001
Score	36.9435	3	<.0001
Wald	36.6795	3	<.0001

Type 3 Analysis of Effects			
Effect	DF	Wald Chi-Square	Pr > ChiSq
NATUSBORN_A	1	5.3092	0.0212
AGE_GROUP	1	7.6962	0.0055
RATCAT_A	1	28.4818	<.0001

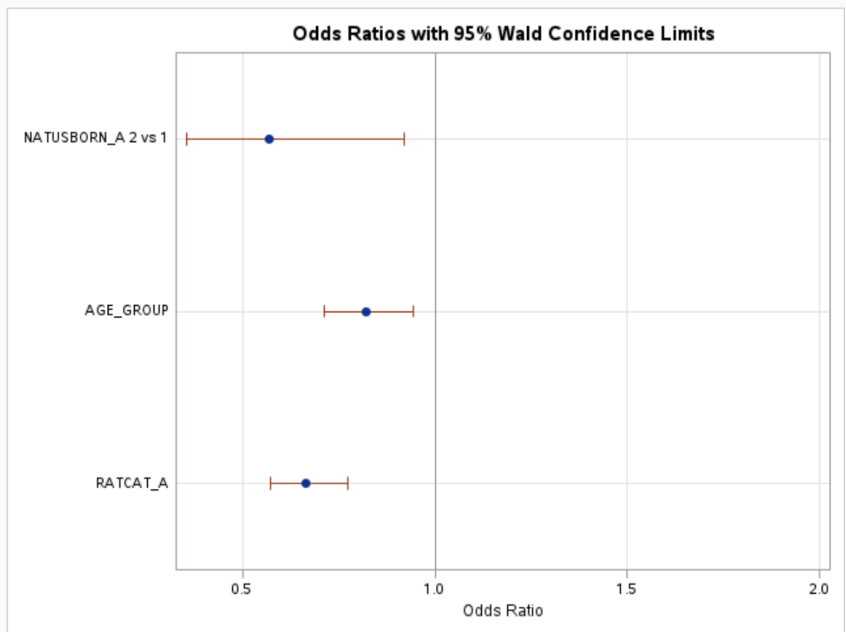
Analysis of Maximum Likelihood Estimates						
Parameter		DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq
Intercept	3	1	-1.0526	0.3216	10.7162	0.0011
Intercept	2	1	0.1974	0.3128	0.3983	0.5280
NATUSBORN_A	2	1	-0.2813	0.1221	5.3092	0.0212
AGE_GROUP		1	-0.1984	0.0715	7.6962	0.0055
RATCAT_A		1	-0.4086	0.0766	28.4818	<.0001

Association of Predicted Probabilities and Observed Responses			
Percent Concordant	60.1	Somers' D	0.259
Percent Discordant	34.2	Gamma	0.275
Percent Tied	5.7	Tau-a	0.090
Pairs	156684	c	0.630

Odds Ratio Estimates and Wald Confidence Intervals			
Odds Ratio	Estimate	95% Confidence Limits	
NATUSBORN_A 2 vs 1	0.570	0.353	0.919



Odds Ratio Estimates and Wald Confidence Intervals				
Effect	Unit	Estimate	95% Confidence Limits	
NATUSBORN_A 2 vs 1	1.0000	0.570	0.353	0.919
AGE_GROUP	1.0000	0.820	0.713	0.943
RATCAT_A	1.0000	0.665	0.572	0.772



Appendix 2: Project Proposal Plan

Research Question: Among U.S. adults, what is the association between nativity (U.S.-born vs. foreign-born) and the severity of depressive symptoms?

Variables:

Predictor: Nativity Status (NATUSBORN_A)

Values:

1 = Yes

2 = No

Response:

Depressive Symptom Severity (PHQCAT_A) - Original

Values:

1 = None/Minimal

2 = Mild

3 = Moderate

4 = Severe

Depressive Symptom Severity - 3 Levels (PHQCAT_A_LVL) - RECODED

Values:

1 = None/Minimal

2 = Mild

3 = Moderate/Severe

Confounders:

Age (AGEP_A) - Original

Values: Top coded at 85. 97 = Refused; 98 = Not ascertained; 99 = Don't know.

Age group (AGE_GROUP) - RECODED into categorical

Values:

1 = 18-34

2 = 35-49

3 = 50-64

4 = 65+

Sex (SEX_A)

Values:

1 = Male

2 = Female

Education level (EDUCP_A)

Values:

Code	Description
00	Never attended/kindergarten only
01	Grade 1-11
02	12th grade, no diploma
03	GED or equivalent
04	High School Graduate
05	Some college, no degree
06	Associate degree: occupational, technical, or vocational program
07	Associate degree: academic program
08	Bachelor's degree (Example: BA, AB, BS, BBA)
09	Master's degree (Example: MA, MS, MEng, MEd, MBA)
10	Professional School or Doctoral degree (Example: MD, DDS, DVM, JD, PhD, EdD)
97	Refused
98	Not Ascertained
99	Don't Know

Education level - RECODED

Values:

1 = Less than high school

2 = High school diploma or GED equivalent

3 = Some college, no degree

4 = Associate's degree

5 = Bachelor's degree

6 = Postgraduate degree

Ratio of family income-to-poverty ratio (RATCAT_A)

Values:

Code	Description
01	0.00 - 0.49
02	0.50 - 0.74
03	0.75 - 0.99
04	1.00 - 1.24
05	1.25 - 1.49
06	1.50 - 1.74
07	1.75 - 1.99
08	2.00 - 2.49
09	2.50 - 2.99
10	3.00 - 3.49
11	3.50 - 3.99
12	4.00 - 4.49
13	4.50 - 4.99
14	5.00 or greater
98	Not Ascertained

Recoded:

1 = Below Poverty (<100% FPL)

2 = Low income (100% to <200% FPL)

3 = Middle income (200% to <400% FPL)

4 = High income (\geq 400% FPL)