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## US migration history and depressive symptoms among older Mexican adults

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### Abstract

**Objective**—To explore the association between US migration, chronic conditions (diabetes, stroke, heart attack, cancer, and hypertension), and mental health (depressive symptoms, and depression).

**Materials and methods**—We assessed average changes in depressive symptom scores as well as depression over time and their link with migration experience controlling for health and sociodemographic factors among older Mexican adults (50+) using 2012, 2015, and 2018 waves of the Mexican Health and Aging Study (MHAS).

**Results**—Non-migrants had higher average depressive symptom scores and prevalence of depression (5+ score) in 2012 and 2015, but there was no significant difference in either measure in 2018 or on changes over time.

**Conclusion**—Although there were no significant differences in average depressive symptoms and depression over time by migration history, this study highlights some differences in 2012 and 2015. Comparing groups across migration histories allowed the researchers to examine how life course differences impact mental health outcomes.

### Resumen

Explorar la asociación entre la migración, condiciones crónicas (diabetes, embolia cerebral, ataque cardiaco, cáncer e hipertensión), y salud mental (síntomas depresivos y depresión).

Se evaluaron los cambios promedio en las puntuaciones de los síntomas depresivos y depresión a lo largo del tiempo y su relación con condiciones sociodemográficas y de salud entre los adultos mayores (50+) utilizando las olas de estudios 2012, 2015 y 2018 del Estudio Nacional de Salud y Envejecimiento en Mexico (Enasem).

Aquéllos que nunca migraron tuvieron puntajes promedios más altos de síntomas depresivos y prevalencias de depresión (puntuación de 5+) en 2012 y 2015, pero no en 2018 ni tampoco tuvieron incrementos significativos a lo largo del tiempo.

Aunque no hubo diferencias significativas de síntomas depresivos y prevalencia de depresión a lo largo del tiempo, se encontraron algunas diferencias en 2012 y 2015. La comparación a través

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de migrantes y no migrantes permite examinar cómo las diferencias en las experiencias de vida impactan en los indicadores de salud mental como los síntomas depresivos.

### Keywords

depression; migrants; chronic diseases; Mexico

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Elevated depressive symptoms are a leading contributor to poor quality of life as they are associated with decreased cognitive and social functioning and an increased risk of suicide, mortality, and healthcare costs among older adults.<sup>1</sup> Elevated depressive symptoms are a growing problem in low-resource countries with limited economic support for older adults. Mexico, for example, has one of the lowest social security benefit amounts among OECD countries (Organization for Economic Co-operation and Development), and very few older adults possess retirement plans.<sup>2</sup> Evidence indicates that individuals who had not adequately prepared for retirement were from low-income households, had no national pension plan, or had chronic diseases are more susceptible to experiencing elevated depressive symptoms.<sup>3,4</sup> Furthermore, the growing number of people 65 or older in Mexico is expected to triple to about 20.5% by 2050.<sup>2</sup> This rapid demographic shift garners immediate attention to examine depressive symptoms among older adults in Mexico.

While the proportion of older adults is increasing, Mexico is going through an epidemiological shift manifested by an increasing prevalence of chronic disease morbidity. Diabetes, heart disease, and hypertension are some of the leading causes of morbidity and mortality in Mexico.<sup>5</sup> The increase in the proportion of older adults living with chronic diseases is especially concerning because of its association with higher depressive symptoms.<sup>6,7</sup> Chronic diseases are likely associated with elevated depressive symptoms when accompanied by pain or disability.<sup>8</sup> This is especially important in settings with limited resources to treat chronic diseases. As such, it is essential to understand the impact of different chronic diseases on depressive symptoms among growing middle-income countries such as Mexico.

Although the association between chronic diseases and elevated depressive symptoms has been widely studied, little is known about the association between return migration experiences and elevated depressive symptoms among older adults. This is particularly important in a country like Mexico which has had a long history of US-Mexico migration. Large-scale migration from Mexico to the US peaked in the second half of the 20th century. Young individuals who migrated to the US during this period represent a large share of older adults likely to return to Mexico in the next decades.<sup>9</sup> Return migration is an important marker of life course experiences that may have an impact on a migrant's mental health status. For example, return migrants often go back to Mexico due to the feeling of missing their families, poor health, economic reasons, or involuntary reasons, such as deportation that may have detrimental impacts on migrants' mental health.<sup>10</sup> Nonetheless, return migrants often have significantly more economic resources and healthcare access than their Mexican counterparts who never migrated, which may benefit their well-being and mental health.<sup>9</sup> On the other hand, return migrants may experience elevated depressive

symptoms due to years of hardship, changing support systems, and psychosocial stress due to their migration experiences.<sup>11</sup> Therefore, the link between prior migration experience and mental health remains unclear. This paper addresses this research gap by studying the association between prior migration experience to the US and mental health using depressive symptoms and depression as the outcomes.

We study individual-level predictors of depression, depressive symptoms, and their changes over time among older adults (ages 50+) by migration status in Mexico. We control for proximate confounders including sociodemographic characteristics, such as age, gender, marital status, net worth, education, and health conditions (self-reported health, diabetes, stroke, heart attack, cancer, and hypertension).

## Materials and methods

### Data Sources:

The Mexican Health and Aging Study (MHAS) is a national longitudinal study of adults 50 years and older in Mexico.<sup>12</sup> The first wave was collected in 2001, with follow-up interviews in 2003, 2012, 2015, and 2018. This study only included participants aged 50 or older in 2012 (N= 14 872) and their follow-ups in 2015 and 2018 (figure 1). Because the main outcome of interest is based on depressive symptoms, we excluded proxy interviews (N= 1 235), as the respondent did not provide answers related to health outcomes and depressive symptoms. In addition, we excluded respondents with missing values on questions about depressive symptoms at baseline (N= 114), in all chronic disease measures (N= 6), or US migration history (N= 3). The final analytic sample included 13 514 respondents in 2012 and their corresponding follow-ups in 2015 and 2018 (figure 1). Of the 13 514 respondents, 11 398 provided information in the 2012 and 2015 waves, and 8 897 provided information in all three waves.

### Study variables

We constructed the following variables using the MHAS 2012 baseline survey and utilized some variables already constructed by the MHAS team. However, responses from previous waves were used when assessing migration experience. For example, migration questions were asked only during the first interview (2001 for the original sample and 2012 for the refresher sample) and then subsequently in the next wave if the respondent traveled or worked in the US between waves. All respondents were asked during their first interview: “Not counting vacations and short visits, have you ever worked or lived in the US?” Migration status was constructed by the MHAS team and operationalized as never migrant (0) for those born in Mexico that never left and return migrant (1) for those born in Mexico that worked or lived in the US and then returned to Mexico. Return migrants were also asked, “In total, how many years have you worked/lived in the US?” Total years in the US was constructed using the most recent response for individuals with multiple responses across years and those who never migrated were given a value of 0. We coded sociodemographic characteristics as follows. Gender is a binary indicating males (value of 0) and females (value of 1). Marital status at baseline (2012) includes four categories: married or in a civil union (0); separated or divorced (1); widowed (2); or single (3). This variable

was further recorded to represent changes in marital status over time with 4 categories: 0 for those in a union (married or civil union) for the entire study period, 1 for those not in a union during the entire study period (single, widowed, divorced), 2 for those who were not in a union at baseline and got into a union in either 2015 or 2018, and 3 for those who were in a union at baseline and got out of a union in 2015 or 2018. Education includes four categories depending on the years of schooling: none (0), 1-5 years (1), 6 years (2), 7-9 years, (3), or 10+ years (4). We created quartiles of the baseline total net worth (in pesos), this variable was constructed by the MHAS team taking into consideration individual and couple total value of houses, businesses, other properties, capital assets, vehicles, and other assets, and subtracting other debts.<sup>13</sup>

Lastly, health conditions included self-reported physician-diagnosed diabetes, stroke, heart attack, cancer, and hypertension. Self-reported chronic diseases were reported from the question “Has a physician ever told you that you have...?” We categorized each question as a binary: no (0) or yes (1) and further categorized them to represent changes over time as follows: 1 for those that reported a chronic disease at baseline or at any time during follow-up and 0 for those who did not report a chronic disease during the study period. We created a binary category for self-reported health representing poor and fair (0), and excellent, very good, or good (1).

## Outcome

We assessed mental health outcomes by examining the depressive symptom scores based on the Center for Epidemiological Studies Depression continuous scale (CES-D), with higher values indicating worse outcomes. Depressive symptoms were measured in 2012, 2015, and 2018 using a 9-item scale to assess patient experiences in the last week (felt... depressed, everything was an effort, sleep was restless, lonely, enjoyed life, happy, sad, tired, had a lot of energy). Each question had a response code of 1 for “yes” or 0 for “no.” The variables “enjoyed life,” “happy,” and “had a lot of energy” were reverse coded, and all nine responses were summed, leading to our indicator of the number of depressive symptoms (range 0-9). Last, a binary measure for depression in the past week was constructed with a five-point or more cut-off on the CES-D scale based on past studies assessing the validity and reliability using the MHAS.<sup>14</sup>

## Statistical analysis

We used chi-square and t-tests to assess descriptive demographic and health differences stratified across groups of return migrants and non-migrants in each wave. Bivariate tests were used to examine depressive symptoms and depression among individuals with data available at each time point: 2012 (n= 13 514), 2015 (n= 11 398), and 2018 (n= 8 897) (table I). For the longitudinal analysis, we fit a separate mixed-effects model for each outcome: depressive symptom scale as a continuous variable, and depression using a logistic model (yes/ no). We fitted a random intercept and slope model for depressive symptom scores and a random intercept model for the depression outcome. Covariates in the models included time, demographic variables (age, gender, US migration history), SES variables (marital status, education, years in the US, and total net worth), and finally health conditions (stroke,

heart attack, cancer, hypertension, diabetes, and self-reported health). Statistical analysis was conducted using SAS 9.4.

## Results

### Sample description

Table I presents the sociodemographic and health characteristics in the overall sample and stratified across return migrants and non-migrants in each wave. The health characteristics section includes results of average depressive symptom scores and depression prevalence across study years and information on chronic disease and self-reported health. Both in 2012 and 2015, non-migrants had a significantly greater prevalence of depression compared to migrants and a higher average number of depressive symptom scores in 2012 (table I), with neither being significant in 2018. Although the prevalence of depressive symptoms and depression is lower among the migrant group in earlier waves, the change in these outcomes slightly increases over time. For example, the average number of depressive symptoms steadily increased from about 3.1 in 2012 to 3.2 in subsequent waves among migrants, while the prevalence among those who never migrated remained at about the same level (3.4) across waves. In addition, the groups had significant differences in sociodemographic conditions and chronic disease prevalence. For example, those who never migrated had significantly higher proportions of hypertension (44.3 vs. 41%) and diabetes (23.4 vs. 20.8%) at baseline (2012) and continue to do so when one considers chronic disease conditions at any time during the study 2012-2018 (table I). There are some differences in sociodemographic characteristics by migration status. Overall, migrants possessed more economic resources and experienced better health despite their lower educational attainment compared to those that never left Mexico. These differences are essential for understanding the results of depressive symptoms and depression found in the multilevel regression models.

### Number of depressive symptoms

Table II shows coefficient estimates from multilevel models examining average changes in the number of depressive symptoms, and depression, over time, controlling for sociodemographic and health conditions. The model for depressive symptoms shows no significant decrease over time. Return migrants had a slightly higher average rate of increase in the number of depressive symptoms compared to non-migrants over the period of study net of sociodemographic and health conditions, albeit not statistically significant. Similarly, those with more years in the US had a slightly lower average number of depressive symptom scores. It is worth noting that SES indicators except for years in the US were significantly associated with elevated depressive symptoms in the overall sample. These results are consistent with the literature; for example, having higher education, being in a stable union, and being in the upper distribution of net worth were protective factors against elevated depressive symptoms. As expected, having any chronic disease was associated with a higher average number of depressive symptoms over time. In contrast, those who self-reported excellent, very good, or good health had fewer average depressive symptoms over the study period.

## Depression (yes/no)

Table II also shows the results from the model examining changes in depression prevalence over time controlling for sociodemographic and health conditions. This model shows a significant average decline in depression prevalence in the total sample of older adults over time, although the magnitude is very small (about 1%). However, there are no differences by migration status, although return migrants had a slight increase in depression prevalence over the study period and this change is not statistically significant. Similarly, those with more years in the US had lower depression over the study period, on average, although this finding was not significant. Lastly, there were some relevant covariates associated with changes in depression in the overall sample. Being male, in a stable union, having higher education, and having a higher net worth were protective factors associated with lower changes in depression. On the other hand, all chronic diseases and reporting poor or fair health were associated with developing depression in the overall sample.

## Discussion

This study used data from Mexican adults (50 and older) to investigate the association between migration and mental health as proxied by depressive symptoms and depression. Our goal was to assess this link by controlling for proximate demographic factors, socioeconomic conditions, and health between the groups with differing migration histories. Our results suggest that return migrants in Mexico have less average depressive symptoms, a lower prevalence of depression, fewer chronic diseases at baseline, and more economic resources than those who never left Mexico. However, although the number of depressive symptoms increased faster, on average, among migrants than non-migrants over the study period, this is not statistically significant. Moreover, we also found that overall, socioeconomic factors and having fewer chronic conditions were significantly associated with fewer depressive symptoms and a lower prevalence of depression. These findings suggest that having a US migration experience was not significantly associated with average changes in depressive symptoms over time despite differences in SES and demographic characteristics between groups.

Although the present study did not find any significant changes in mental health outcomes across return migrants and non-migrants over time, there were some significant differences when comparing results cross-sectionally. Return migrants had lower average depressive symptom scores and depression prevalence in 2012, and in 2015, they had lower depression prevalence than those who never migrated. However, both groups had similar scores in 2018. Future studies should include more years of observation to better investigate these trends over time. Past studies have suggested that return migrants may lose their physical health advantages over time due to changes in physical health or economic resources.<sup>9</sup> Although we did not find significant differences in changes in depressive symptoms over time between migrants and non-migrants, our results support that having poor health and lower net worth are associated with higher depressive symptoms.

Our findings are consistent with previous studies that found return migrants from the US are wealthier than those who never left Mexico.<sup>8</sup> Migrants are likely to use these resources to improve their health outcomes. Our results indicate that SES indicators were important

in predicting lower depressive symptom scores and depression. However, there were also key differences in sociodemographic characteristics between groups. There were slightly more migrants who were males, wealthier, and in a stable union, which our study and past evidence suggest are associated with lower depressive symptoms.<sup>3,15</sup> As such, the accumulated wealth and marital support of migrants could serve as protective factors as they age.

Similarly, to past studies, our findings suggest that all chronic diseases were associated with elevated depressive symptoms and depression.<sup>7,16</sup> Additionally, our results are consistent with data suggesting diabetes, heart disease, and hypertension are the leading cause of morbidity in Mexico.<sup>5-7</sup> Overall, it appears that migrants are physically healthier than those who never left at baseline. However, chronic disease prevalence were similar between groups when examined over the entire period of study. A strength of our study is that it uniquely focuses on those 50 and older, which coincides with the age at that most chronic diseases develop. More importantly, our findings suggest that future work targeting chronic disease prevention and management in Mexico could improve mental health among older adults.

Despite our valuable findings, there are some important limitations to consider. Migrants who return to Mexico may differ from those who do not, as some studies have suggested that those who return to Mexico might be in poorer health and have lower SES compared to those who remain in the US.<sup>17</sup> Unfortunately, our study did not include data on those who remained in the US which limits our understanding of selectivity. Lastly, doctor-diagnosed chronic diseases could produce underestimations due to limited access to medical care in Mexico.<sup>18</sup> This is especially true among Mexicans who have never migrated, given that they have fewer resources to seek medical care.

Despite such limitations, our study provides an overview of the characteristics and predictors of depressive symptoms and depression across those with differing migration experiences. The unique focus on return migration among older adults in Mexico provides information on an understudied population. We found that SES conditions and chronic diseases are important predictors of depressive symptoms and depression in the overall sample. Furthermore, return migrants had a lower prevalence of depression across the initial years of the study. Future studies should expand the comparison to Mexican migrants in the US. Lastly, our results suggest that immediate attention to preventing and addressing chronic conditions and socioeconomic disparities in Mexico is essential for improving the well-being of older adults.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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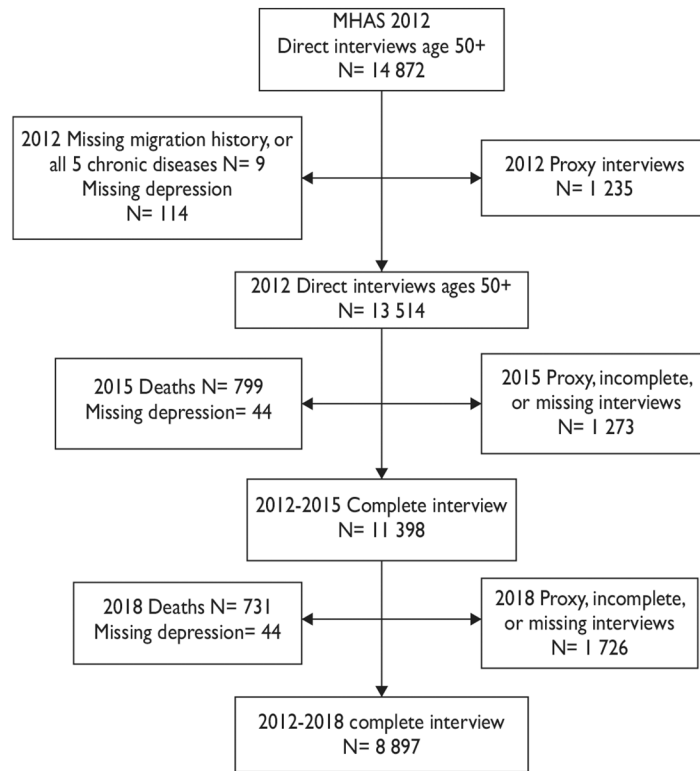


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**Figure 1.** Sample selection chart. Mexican Health and Aging Study (MHAS). Mexico, October-December 2012, 2015 and 2018

Sample characteristics overall and stratified by US migration experience. Mexico, Mexican Health and Aging Study, October–December 2012, 2015, and 2018

**Table 1**

Variables	N= 13 514	US migration experience		p-value
		No N= 12 167	Yes N= 1 347	
Depressive symptom score (mean ± SD)	3.37 ± 2.64	3.40 ± 2.65	3.11 ± 2.55	<.001
Depression (defined as 5+ score), n (%)	4 368	4 009 (32.9)	359 (26.6)	<.001
2012 average score	3.35 ± 2.64	3.37 ± 2.65	3.21 ± 2.52	0.058
Depression n (%)	3 554	3 250 (31.5)	304 (27.8)	0.011
2018 average score	3.36 ± 2.61	3.37 ± 2.61	3.24 ± 2.56	0.157
Depression n (%)	2 740	2 503 (30.9)	237 (28.8)	0.208
Age in 2012 (mean ± SD)	64 ± 9	64 ± 9	67 ± 10	<.001
Years in USA			4.59 ± 7.21	
Sex, n (%)				
Male	5 779	4 761 (39.1)	1 018 (75.6)	<.001
Female	7 735	7 406 (60.9)	329 (24.4)	<.001
Marital status baseline, n (%)				
Married or civil union	9 337	8 353 (68.6)	984 (73.0)	<.001
Separated or divorced	1 090	991 (8.1)	99 (7.3)	0.309
Widowed	2 458	2 241 (18.4)	217 (16.1)	0.037
Single	629	582 (4.8)	47 (3.5)	0.032
Union change, n (%)				
Remained in a union over study period	8 311	7 407 (60.8)	904 (67.1)	<.001
No union over study period	4 025	3 680 (30.3)	345 (25.6)	<.001
Got into union over study period	152	134 (1.1)	18 (1.34)	0.437
Got out of a union over study period	1 026	946 (7.8)	80 (5.9)	0.015
Education (years)				
None	2 308	2 062 (17.0)	246 (18.3)	0.222

Variables	N= 13 514	US migration experience		p-value
		No N= 12 167	Yes N= 1 347	
1-5	4 150	3 680 (30.4)	470 (35.0)	<.001
6	2 864	2 584 (21.3)	280 (20.8)	0.703
7-10	2 269	2 090 (17.2)	179 (13.3)	<.001
10+	1 865	1 699 (14)	166 (12.4)	0.10
Net assets in pesos 2012				
1 <sup>st</sup> Quartile (<170 000)	3 390	3 088 (25.3)	302 (22.4)	0.017
2 <sup>nd</sup> Quartile (170 000-507 398)	3 367	3 029 (24.9)	338 (25.0)	0.873
3 <sup>rd</sup> Quartile (507 398-1 100 000)	3 397	3 064 (25.1)	333 (24.7)	0.711
4 <sup>th</sup> Quartile (1 100 000-24 050 000)	3 360	2 986 (24.5)	374 (27.8)	0.009
Self-reported health				
Poor or fair	8 634	7 801 (64.1)	833 (61.9)	0.104
Excellent, very good, or good	4 877	4 364 (35.9)	513 (38.1)	0.104
Chronic conditions in 2012				
Stroke	277	245 (2.0)	32 (2.4)	0.375
Hypertension	5 947	5 395 (44.4)	552 (41.1)	0.020
Diabetes	3 128	2 848 (23.4)	280 (20.8)	0.029
Cancer	290	256 (2.1)	34 (2.5)	0.312
Heart attack	482	424 (3.5)	58 (4.3)	0.123
Chronic conditions ever (2012, 2015, or 2018)				
Stroke	523	473 (3.9)	50 (3.7)	0.750
Hypertension	7 819	7 072 (58.1)	747 (55.5)	0.062
Diabetes	4 033	3 674 (30.2)	359 (26.7)	0.007
Cancer	540	479 (3.9)	61 (4.5)	0.290
Heart attack	928	822 (6.8)	106 (7.8)	0.125

**Table II**

Coefficient estimates from models predicting average number of depressive symptoms (CESD score) and depression (yes/no). Mexico, Mexican Health and Aging Study, October-December 2012, 2015 and 2018

Variable	CESD coefficient	Depression (Yes/No) coefficient
Intercept	2.68 <sup>*</sup>	0.20 <sup>*</sup>
Time	0.001	-0.01 <sup>‡</sup>
Migrated USA	0.12	0.01
Years in USA	-0.01	-0.001
Sex	0.70 <sup>*</sup>	0.11 <sup>*</sup>
Baseline age	0.004 <sup>‡</sup>	0.001 <sup>‡</sup>
Education (reference: no education) (years)		
1-5	-0.27 <sup>*</sup>	-0.04 <sup>*</sup>
6	-0.58 <sup>*</sup>	-0.09 <sup>*</sup>
7-9	-0.87 <sup>*</sup>	-0.13 <sup>*</sup>
10+	-1.00 <sup>*</sup>	-0.14 <sup>*</sup>
Union (reference)		
Not in a union	0.31 <sup>*</sup>	0.05 <sup>*</sup>
Fell into a union over study period	0.41 <sup>§</sup>	0.07 <sup>§</sup>
Fell out of a union over study period	0.50 <sup>*</sup>	0.08 <sup>*</sup>
Net assets in quartiles (Reference: Q1)		
Q2	-0.21 <sup>*</sup>	-0.03 <sup>*</sup>
Q3	-0.25 <sup>*</sup>	-0.04 <sup>*</sup>
Q4	-0.32 <sup>*</sup>	-0.04 <sup>*</sup>
Hypertension	0.34 <sup>*</sup>	0.05 <sup>*</sup>
Diabetes	0.15 <sup>*</sup>	0.02 <sup>*</sup>
Heart disease	0.43 <sup>*</sup>	0.07 <sup>*</sup>
Cancer	0.24 <sup>§</sup>	0.05 <sup>§</sup>
Stroke	0.48 <sup>*</sup>	0.08 <sup>*</sup>
Self-reported health (ref= fair/poor)		
Excellent, very good, or good	-1.29 <sup>*</sup>	-0.18 <sup>*</sup>
Fit (N= 13 514)		
-2 Log likelihood	152 430.1	38 290.7
AIC	152 438.1	38 294.7
BIC	152 468.2	38 309.7
Covariance		
Random intercept variance	2.7925	0.0551
Slope variance	0.1771	

\*  $p < .001$

†  $p = < .05$

§  $p < .01$

AIC: Akaike's information criteria

BIC: Bayesian information criteria

CESD: Center for Epidemiological Studies Depression

Note: Depression is defined as a score of 5 or more in depressive symptoms. The Appendix shows similar models for the subsample of respondents with complete information in all waves (N= 8 897). Results are substantially similar to this table

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