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Depressive symptoms and weight status among women recently immigrating to the US

ABSTRACT

Objective

Depressive symptoms have been associated with obesity. Little is known about this relationship among immigrants. We examined relationships between depressive symptoms and weight status in immigrant women from three ethnic groups.

Methods

Participants were Brazilian, Haitian, and Latina women (n=345) enrolled in Live Well, a community-based, randomized intervention designed to prevent weight gain in recent immigrants. Study data are from baseline when participants completed the Center for Epidemiological Studies Depression Scale (CES-D), Perceived Stress Scale, a physical activity questionnaire, and socio-demographic questions; BMI was calculated from measured height and weight.

Results

Forty-four percent of participants (36% of Brazilians, 66% of Haitians, 30% of Latinas) had high depressive symptoms (CES-D ≥ 16), and 38% (26% of Brazilians, 49% of Haitians, 42% of Latinas) were obese (BMI ≥ 30.0). Those reporting more depressive symptoms were more likely to be obese (Wald chi-square = 4.82, $p < .05$). An interaction between depressive symptoms, ethnic group, and income was revealed ($F(4,340)=2.91$, $p < .05$), such that higher depressive symptoms were associated with higher BMI among Brazilians earning $\geq \$30,000$ per year and with lower BMI among Brazilians earning $< \$30,000$. The relationship between depressive symptoms and obesity did not differ by income among Haitians or Latinas.

Conclusions

Depressive symptoms and obesity were highly prevalent among these recently-immigrated women. Positive relationships between these variables were consistent across ethnic and income groups, with the exception of lower-income Brazilians. While these findings suggest similar patterns and health needs across several groups of immigrants, cultural differences should be considered when addressing these health conditions.

Keywords: depressive symptoms, obesity, immigrants, women

SIGNIFICANCE

What is Already Known on this Subject?

Immigrants to the US are at increased risk of both depressive symptoms and obesity as time in the US increases. Most research on this subject, however, has focused on Latinos. Less is known about the prevalence of and relationship between depressive symptoms and obesity in immigrants from other ethnic groups.

What this Study Adds?

Depressive symptoms and obesity were prevalent and positively associated in this sample of Brazilian, Haitian, and Latina immigrant women, providing rationale for intervention and policy efforts to address these comorbid health conditions.

Word count: 3,469

INTRODUCTION

Both obesity and depression have been identified as public health priorities due to their widespread nature, associated disease burden, and economic costs (de Wit et al., 2010). Given that immigrants are estimated to comprise nearly one-fifth of the US population by 2050 (Passel, Cohn, & Pew Research Center, 2008), and that they are at increased risk for both obesity and depression as time in the US increases (Argeseanu Cunningham, Ruben, & Venkat Narayan, 2008), a better understanding of these problems among immigrant populations is important. Health-related research among immigrants has focused predominantly on Latinos, a major and growing immigrant group (Passel et al., 2008), but similar trends have been observed among other immigrant groups, in which many aspects of health decline with increased time in the US (Argeseanu Cunningham et al., 2008). To elucidate the relationship between depression and obesity in the context of immigration to the US, more information about depression-obesity associations in multiethnic samples of recent immigrants is needed.

Depression is one of the most prevalent diseases globally and a leading cause of disability (World Health Organization, 2005), with symptoms that include changes in mood, cognitive functioning, sleep, appetite, and energy level. Many individuals suffering from depression receive no treatment, and disparities exist in both the prevalence of depression and the likelihood of receiving treatment. In the US, depressive symptoms have been shown to be higher among women, racial/ethnic minorities, and lower-income individuals (Pratt & Brody, 2008). In general, immigrants arrive to the US with lower levels of depressive symptoms than their US-born counterparts, but this advantage decreases with time in the US (Argeseanu Cunningham et al., 2008). For example, Latina immigrants who had lived in the US for at least 15 years had higher depressive symptoms than US-born Latinas (Sternberg & Lee, 2013). In contrast, research with Haitian immigrants has yielded mixed results (Cohen, Magai, Yaffee, & Walcott-Brown, 2005; Martinez et al., 2013), possibly due to cohort effects; high rates of depressive symptoms among Haitian immigrants were attributed to the 2010 Haitian earthquake

in one recent study (Martinez et al., 2013). Although it appears that depressive symptoms among immigrants are prevalent overall, information about potential differences between ethnic groups, for whom the process of transitioning to a new culture may differ, is limited.

Acculturation is defined as the bidirectional process of cultural and psychological change that results when two cultures meet (Sam & Berry, 2010). For new immigrants to the US, the major force is towards assimilation to the dominant culture. Increases in depressive symptoms with increased time in the US have been attributed in part to acculturative stress, or psychological, physical, and social difficulties related to the transition to a new culture (Berry & Annis, 1974). Difficulties can stem from various aspects of the acculturation process, including discrimination, new family responsibilities, economic hardship, and a lack of understanding of the new cultural system's values, language, and beliefs. Furthermore, the working conditions of many new immigrants can be hazardous to their health and can include physical stressors, abuse, and exploitation (Benach, Muntaner, Chung, & Benavides, 2010). These stressors may contribute to the emergence of depressive symptoms.

Additionally, as immigrants transition to living in the US, they are exposed to obesogenic environments characterized by ubiquitous, relatively affordable convenience foods and sedentary lifestyles. Initially, immigrants in the US are less likely to be obese than US-born individuals, but after more than a decade in the US, their obesity rates are comparable to US-born individuals' (Argeseanu Cunningham et al., 2008), likely reflecting the obesity-promoting changes in dietary and physical activity patterns that come with the transition to an American lifestyle (Tovar et al., 2013). Stress can also lead to adverse changes in sleep quality, physical activity, and dietary intake, which may contribute to weight gain (American Psychological Association, 2013). While research about acculturation effects on both mental and physical health is growing, interrelationships between these processes remains poorly understood.

Studies in the general population (i.e. not focused on immigrants specifically) have shown a bidirectional relationship between depression and obesity (Luppino et al., 2010), such

that depressive symptoms predict the development of obesity and vice versa; further, these relationships appear to be stronger among women (de Wit et al., 2010). There were similar findings in a small study of Latina immigrants, in which higher depressive symptoms were positively associated with BMI (Sternberg & Lee, 2013). The relationship between obesity and depressive symptoms across different immigrant groups remains largely unexplored. Given that the risk for depressive symptoms and obesity both increase with time in the US, and potential differences in the acculturation process for immigrants from different ethnic groups, it is important to examine these health outcomes in tandem within multiethnic immigrant samples. Additionally, given evidence that stress may contribute to both depressive symptoms and weight outcomes, such examinations should test whether depressive symptoms and obesity are related beyond their shared relationships with stress. We explored the prevalence of and relationship between depressive symptoms and obesity in a cross-sectional sample of immigrants from three ethnic groups. We hypothesized that depressive symptoms and obesity would be positively related across ethnic groups, after adjusting for perceived stress and other relevant characteristics described herein, and also explored whether these covariates modified the relationship between depressive symptoms and weight status.

METHODS

Participants

Participants were 345 women (39.7% Brazilian, 31.6% Haitian, 28.7% Latina) enrolled in Live Well, a community-based, participatory, randomized controlled lifestyle intervention designed to prevent weight gain in recent immigrant women. Recruitment materials focused on healthy living as opposed to weight. Data for the current analysis were from baseline (pre-intervention) assessments. Detailed demographic information from the Live Well study has been published previously (Tovar et al., 2013). Given the overarching study's goal to prevent weight gain in recent immigrants, residence in the US for <10 years was an inclusion criterion, along

with: 20-55 years of age; not pregnant or ≤ 6 months postpartum; having a child between 3 and 12 years old; residence in the Greater Boston area; and willingness to be randomized to intervention or wait-list control groups. Participants were of Brazilian, Haitian, or Spanish-speaking Latina descent, representing three of the largest immigrant groups in Greater Boston. Latinas in this study were primarily from El Salvador, Colombia, Guatemala, Dominican Republic and Honduras. For inclusion in the current analysis, participants needed to have data on the study's key variables. Ninety percent of 383 women enrolled in Live Well met these criteria; their demographics appear in Table 1. Informed consent was obtained from all participants. The study was approved by the Institutional Review Board of Tufts University. All survey measures were available in Portuguese, Haitian-Creole, and Spanish. Measures that lacked existing versions in any of these languages were translated and back-translated into English by a native speaker. Trained interpreters were available to assist participants with survey completion.

Measures

Depressive Symptoms

Depressive symptoms were measured using the Center for Epidemiological Studies Depression Scale (CES-D), a reliable and valid screening tool for assessing depressive symptoms in non-clinical samples (Radloff, 1977). The CES-D is a non-diagnostic measure and examines health correlates of depressive symptoms based on responses about feelings and behaviors over the past week. This measure has been widely used, including with Haitian (Martsolf, 2004) and Hispanic (Moscicki, Locke, Rae, & Boyd, 1989) populations. Scores range from 0 to 60, with scores ≥ 16 indicating high depressive symptoms (Radloff, 1977). Scores were coded as missing if participants lacked data on ≥ 4 items (Radloff, 1977).

Weight Status

Height and weight were measured in triplicate by trained researchers following standard procedures (Lohman, Roche, & Matorell, 1988). Height was measured without shoes to the nearest eighth of an inch using a portable vertical stadiometer (Shorr Production, LLC, Olney, MD). Weight was measured to the nearest 0.5 pound on a digital quadruple strain gauge technology platform scale (Befour Model PS-6600, Befour Inc., Saukville, WI) without shoes and in light clothing. Body mass index (BMI) was calculated from average height and weight measurements. Participants were categorized as obese (BMI ≥ 30.0) or non-obese (BMI < 30.0) as recommended based on associations with disease risk (National Institutes of Health, 1998). Both continuous BMI and this clinically-relevant dichotomous variable were examined in statistical analyses.

Covariates

A number of covariates were considered based on relevant literature (e.g., Wong & Miles, 2014), including annual family income, education, living with a spouse or partner, number of children in the household, household size, use of food assistance, days per week of family dinner, years in the US, total activity from the Pregnancy Physical Activity Questionnaire (PPAQ; Chasan-Taber et al., 2004), and perceived stress. As described below, income and perceived stress were included in final models. Annual family income was operationalized as a categorical variable, with three categories: $\geq \$30,000$; $< \$30,000$; missing income data (15%). The cut-off of \$30,000 corresponds to about 125% of the federal poverty line for a family of four in the state in which the study was conducted. Perceived stress was operationalized as the total perceived stress score from the Perceived Stress Scale (PSS; Cohen, Kamarck, & Mermelstein, 1983), which gauges the respondent's perception of stress over the last month. In previous studies, this scale was translated and validated in a Spanish-speaking population (Ramírez & Hernández, 2007) and in Portuguese-speaking Brazilians (Reis, Hino, & Añez, 2010). As stated

above, the scale was translated and back-translated into Haitian-Creole for the current study. A short version consisting of ten items was used (Roberti, Harrington, & Storch, 2006).

Statistical Analyses

Analyses were conducted using SAS 9.4 (Cary, NC). We calculated the percentage of women in each ethnic group with high depressive symptoms and obesity and assessed group differences using logistic regression. We conducted multivariable analyses to examine relationships between depressive symptoms and weight status. Models were tested with obesity (dichotomous) and BMI (continuous) as outcomes using logistic regression and general linear models, respectively. In each model, predictors included depressive symptoms (continuous), ethnic group, their interaction, and two covariates: perceived stress and family income. These covariates changed the coefficient representing the relationship between depressive symptoms and obesity by more than 10%; the other covariates examined did not meet this criterion. We also examined relationships between these two covariates using a general linear model with income as a categorical predictor. Finally, in exploratory analyses, we examined both covariates as moderators, introducing each of the following interaction terms into the model predicting BMI: depressive symptoms \times covariate, ethnic group \times covariate, and depressive symptoms \times ethnic group \times covariate. Results from all linear and logistic models reported herein remained the same when removing the one participant who was underweight (BMI <18.5).

RESULTS

Descriptive Statistics

As shown in Figure 1, 44% of participants (36% of Brazilians, 66% of Haitians, 30% of Latinas) had high depressive symptoms, with a significantly higher prevalence in Haitians, compared to Brazilians (OR = 3.50, 95% CI: 2.06, 5.93) and Latinas (OR = 4.48, 95% CI: 2.50, 8.02). Thirty-eight percent of participants (26% of Brazilians, 49% of Haitians, 42% of Latinas)

were obese, with a relatively lower prevalence in Brazilians, compared to Haitians (OR = 0.38, 95% CI: 0.22, 0.64) and Latinas (OR = 0.48, 95% CI: 0.28, 0.84).

Relationship between Depressive Symptoms and Obesity

There was a significant main effect, such that participants with higher depressive symptoms were more likely to be obese (Wald chi-square=4.82, $p<.05$). Results were similar with BMI as the outcome. There was no statistical interaction between depressive symptoms and ethnic group in the context of either of these models, indicating that the overall positive relationship between depressive symptoms and obesity did not differ by ethnic group. Test statistics and p-values corresponding to each term of these models appear in Table 2.

Exploring Interactions with Covariates

Perceived stress did not modify the relationship between depressive symptoms, ethnic group, and weight outcomes, nor were any of the subordinate two-way interactions in this model significant (depressive symptoms \times ethnic group, depressive symptoms \times perceived stress, ethnic group \times perceived stress). There was, however, a significant three-way interaction between ethnic group, depressive symptoms, and income ($F(4,340)=2.91$, $p<.05$): higher depressive symptoms were associated with higher BMI among Brazilians earning \geq \$30,000 per year and with lower BMI among Brazilians earning less ($p=.01$; Figure 2). The relationship between depressive symptoms and obesity did not differ by income group among Haitians or Latinas. The two covariates of interest, the categorical income variable and perceived stress score, were not significantly related, but there was a trend ($p=.07$) in the direction of lower-income women reporting higher stress.

DISCUSSION

This study identified a high prevalence of depressive symptoms and obesity among immigrant women from three ethnic groups. Findings from our primary model showed a

relationship between depressive symptoms and weight status, such that higher depressive symptoms were significantly associated with obesity, and this did not vary by ethnic group. A subsequent exploratory model revealed a three-way interaction, such that the overall positive association between depressive symptoms and weight status was reversed among lower-income Brazilians, for whom higher depressive symptoms were associated with a lower BMI. For all other groups, the overall association was robust, with positive relationships between depressive symptoms and weight status for Brazilians earning \geq \$30,000 per year and for Haitians and Latinas across income subgroups.

While both high depressive symptoms and obesity were prevalent overall, ethnic group differences were apparent, with Brazilians having a lower prevalence of obesity and Haitians having a higher prevalence of high depressive symptoms, compared to the other groups. The lower obesity prevalence among Brazilians may reflect thinner body size ideals in this ethnic group (Forbes et al., 2012), in contrast to the acceptance of larger body sizes among immigrants from many other ethnic groups (Lopez, Blix, & Blix, 1995). In a population-based study conducted in Brazil, the majority of women showed body image dissatisfaction, reporting that their body was heavier than the ideal (Silva, Nahas, de Sousa, Del Duca, & Peres, 2011). While thin body size ideals may mitigate the risk of obesity upon immigrating into the US, this factor may not be adaptive, as body dissatisfaction has been associated with unhealthy weight loss behaviors among Brazilians (Siqueira, Appolinário, & Sichieri, 2005), and lower BMI was positively associated with depressive symptoms in lower-income Brazilians in our sample. More research is needed to understand the behaviors associated with maintaining a healthy weight upon immigrating to the US in order to promote healthier behaviors and decrease unhealthy ones in a culturally-sensitive manner.

Compared to other studies of immigrants from the same ethnic groups, depressive symptoms in the current sample appear to be higher in Haitians (Martinez et al., 2013), slightly lower in Latinas (Sternberg & Lee, 2013), and lower in Brazilians (Sánchez et al., 2014). The

ethnic group differences in depressive symptoms identified should be interpreted with caution as it may not be appropriate to compare CES-D scores across populations (Perreira, Deeb-Sossa, Harris, & Bollen, 2005). Furthermore, different cultural views may impact the extent to which depressive symptoms are disclosed, and additional differences between Haitians and the other ethnic groups in our study could have contributed to observed differences (Tovar et al., 2013). The Haitian immigrants in our study had been in the US for a shorter amount of time compared to women in the other groups (Tovar et al., 2013). This overlap between ethnicity and time in the US could explain why the latter did not emerge as a covariate of influence in our study. Based on the literature, shorter time in the US would be expected to be associated with *lower* depressive symptoms, but it is possible that the acculturative process is experienced differently in Haitian immigrants, for whom the existing data about depressive symptoms are mixed (Cohen et al., 2005; Martinez et al., 2013). Other potential contributing factors include the 2010 Haitian earthquake: many Haitians in our study had come to the US in its aftermath, with more than half of 26 Haitian participants who selected an “other” reason for emigrating specifying the earthquake as the reason, and others had close relatives who were affected by it. Stress and depressive symptoms have been shown to be elevated in other studies of Haitian immigrants post-earthquake (Martinez et al., 2013). The extent to which the experiences of this cohort of Haitian immigrants will generalize to other cohorts is unknown, but the observation that the overall relationship between depressive symptoms and obesity was largely consistent across ethnic groups, in spite of these differences and independent of other factors examined, suggests that this finding is robust.

The confirmation of the depressive symptoms-obesity relationship in the Latina group has widespread public health implications, given that this ethnic group is the largest immigrant group in the US (Passel et al., 2008). Cultural factors to consider when designing interventions addressing these outcomes among Latina immigrants include traditional gender role expectations (Raffaelli & Ontai, 2004). In addition to gender role expectations, body shape

ideals, and the extent to which depressive symptoms are disclosed and mental health services are accessible, another possible factor in the development of depressive symptoms and obesity that may differ across ethnic groups is racism. Connections between racism and health have been documented among African-American and Black individuals (Krieger, Chen, Coull, Beckfield, Kiang, & Waterman, 2014) and may have impacted the Haitian immigrants in particular. Group differences in the acculturation process and challenges encountered therein highlight that the nature of interventions addressing depressive symptoms and obesity should be tailored to fit differing cultural contexts.

While there was a positive relationship between depressive symptoms and obesity in this multiethnic sample of immigrant women overall, a possible exception is the lower-income Brazilians, for whom depressive symptoms were inversely related to weight status in exploratory analyses. This latter finding could reflect issues with food access in the lower-income Brazilians and/or that lower-income Brazilian women tend to have occupations that involve substantial physical activity (Siquiera & Jansen, 2008). In interpreting the current findings, several caveats should be considered: first, participants in this study were low-income overall, with the majority of the sample reporting annual household earnings less than \$30,000 per year. The observed income differences may be capturing other unmeasured characteristics associated with lower earnings. Additionally, Brazilians had the most income variability, and income data overall were self-reported with 15% missing data, each of which could have affected the findings. Future research should further explore differences by ethnicity and income.

Limitations of the current study include the aforementioned measurement considerations, as well as the possibility of social desirability biasing responses and the cross-sectional design, which precludes inferences about directionality. Also, descriptive statistics presented may not be representative of all immigrants from these ethnic groups, and selection bias is possible as a result of recruitment through well-established community organizations.

Additional research, including investigations in other regions of the United States with sizeable immigrant populations, should be conducted to establish generalizability of the findings. Strengths of the current study include the inclusion of three different ethnic groups, objective assessments of height and weight, and survey measures that have been used across multiple ethnic groups, with translation into each group's native language (although the CES-D and PSS have not been validated in every ethnic group studied). Another strength of this study is its community-based participatory approach, which was guided by a steering committee composed of academic researchers and community representatives from each ethnic group, facilitating culturally-appropriate study protocols and interpretations of findings.

The current findings suggest several avenues for future research. Longitudinal analyses can provide additional information about directionality, which will have implications for intervention efforts among immigrant women with a high prevalence of both depressive symptoms and obesity. Previous research in other samples suggests that relationships between depressive symptoms and obesity are likely bidirectional. If depressive symptoms predict increased weight status prospectively, this suggests that interventions targeting depression through mental health counseling or preventive approaches (e.g., social support; Valdez, Abegglen, & Hauser, 2013) may also decrease obesity risk. Such processes could also bolster intervention compliance: for example, lowering depressive symptoms may boost participation in intervention activities and adherence. Further research on directionality and modifiability of these outcomes could inform the development of interventions, including which variables to target. It may be possible to identify intervention targets that could impact both depressive symptoms and obesity (e.g., physical activity, social support), which are applicable and acceptable across ethnic groups.

In sum, high depressive symptoms and obesity were prevalent in a multiethnic sample of women who were new immigrants to the US. Positive relationships between depressive

symptoms and weight status were consistent across groups, with the exception of lower-income Brazilians. These findings suggest similar health patterns and needs across several groups of recently-immigrated women although varying levels of high depressive symptoms and obesity and variations in the acculturation process should be considered in addressing these needs. Additional research to establish directionality and modifiability is needed to inform the development and implementation of culturally-sensitive efforts to address these critical public health concerns in new immigrants.

REFERENCES

- American Psychological Association. (2013). *Stress in America: Missing the Health Care Connection*. Washington, DC.
- Argeseanu Cunningham, S., Ruben, J.D., & Venkat Narayan, K. (2008). Health of foreign-born people in the United States: a review. *Health & Place, 14*(4), 623-635.
- Benach, J., Muntaner, C., Chung, H., & Benavides, F.G. (2010). Immigration, employment relations, and health: Developing a research agenda. *American Journal of Industrial Medicine, 53*(4), 338-343.
- Berry, J.W., & Annis, R.C. (1974). Acculturative stress: The role of ecology, culture and differentiation. *Journal of Cross-cultural Psychology, 5*(4), 382-406.
- Chasan-Taber, L., Schmidt, M. D., Roberts, D. E., Hosmer, D., Markenson, G., & Freedson, P. S. (2004). Development and validation of a pregnancy physical activity questionnaire. *Medicine and Science in Sports and Exercise, 36*, 1750-1760.
- Cohen, C.I., Magai, C., Yaffee, R., & Walcott-Brown, L. (2005). Racial differences in syndromal and subsyndromal depression in an older urban population. *Psychiatric Services, 56*(12), 1556-1563.
- Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior, 24*(4), 385-396.
- de Wit, L., Luppino, F., van Straten, A., Penninx, B., Zitman, F., & Cuijpers, P. (2010). Depression and obesity: a meta-analysis of community-based studies. *Psychiatry Research, 178*(2), 230-235.
- Forbes, G.B., Jung, J., Vaamonde, J.D., Omar, A., Paris, L., & Formiga, N.S. (2012). Body dissatisfaction and disordered eating in three cultures: Argentina, Brazil, and the US. *Sex Roles, 66*(9-10), 677-694.
- Krieger, N., Chen, J.T., Coull, B.A., Beckfield, J., Kiang, M.V., Waterman, P.D. (2014). Jim Crow and premature mortality among the US Black and White population, 1960–2009: An age–period–cohort analysis. *Epidemiology, 25*(4), 494-504.
- Lohman T.G., Roche, A.F., & Matorell, R. (1988). *Anthropometric Standardization Reference Manual*. Champaign, Illinois: Human Kinetics Book.
- Lopez, E., Blix, G.G., & Blix, A.G. (1995). Body image of Latinas compared to body image of non-Latina White women. *Health Values: The Journal of Health Behavior, Education & Promotion, 19*(6), 3-10.
- Luppino, F.S., de Wit, L.M., Bouvy, P.F., Stijnen, T., Cuijpers, P., Penninx, B.W., & Zitman, F. G. (2010). Overweight, obesity, and depression: a systematic review and meta-analysis of longitudinal studies. *Archives of General Psychiatry, 67*(3), 220-229.
- Martinez, L.S., Reich, A.J., Ndulue, U.J., Dalembert, F., Gute, D.M., & Peréa, F.C. (2013). Employing a community based participatory research approach to bear witness: Psychosocial impact of the 2010 earthquake on Haitians in Somerville, MA. *Journal of Immigrant and Minority Health, 16*(6), 1-7.
- Martsof, D.S. (2004). Childhood maltreatment and mental and physical health in Haitian adults. *Journal of Nursing Scholarship, 36*(4), 293-299.
- Moscicki, E.K., Locke, B.Z., Rae, D.S., & Boyd, J.H. (1989). Depressive symptoms among Mexican Americans: The Hispanic health and nutrition examination survey. *American Journal of Epidemiology, 130*(2), 348-360.
- National Heart, Lung, and Blood Institute, National Institutes of Health. (1998). *Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults*. Washington, DC.
- Passel, J.S., Cohn, D., & Pew Research Center. (2008). Immigration to play lead role in future US growth. US population projections: 2005-2050. Washington DC.

- Perreira, K.M., Deeb-Sossa, N., Harris, K.M., & Bollen, K. (2005). What are we measuring? An evaluation of the CES-D across race/ethnicity and immigrant generation. *Social Forces*, 83(4), 1567-1601.
- Pratt, L.A., & Brody, D.J. (2008). Depression in the United States household population. *NCHS Data Brief*, 7, 1-8.
- Radloff, L.S. (1977). The CES-D scale a self-report depression scale for research in the general population. *Applied Psychological Measurement*, 1(3), 385-401.
- Raffaelli, M., & Ontai, L.L. (2004) Gender socialization in Latina/a families: Results from two retrospective studies. *Sex Roles*, 50(5-6), 287-99.
- Ramírez, M.T.G., & Hernández, R.L. (2007). Factor structure of the Perceived Stress Scale (PSS) in a sample from Mexico. *The Spanish Journal of Psychology*, 10(01), 199-206.
- Reis, R.S., Hino, A.A.F., & Añez, C.R.R. (2010). Perceived Stress Scale reliability and validity study in Brazil. *Journal of Health Psychology*, 15(1), 107-114.
- Roberti, J.W., Harrington, L.N., & Storch, E.A. (2006). Further psychometric support for the 10-item version of the perceived stress scale. *Journal of College Counseling*, 9(2), 135-147.
- Sam, D.L., & Berry, J.W. (2010). Acculturation when individuals and groups of different cultural backgrounds meet. *Perspectives on Psychological Science*, 5(4), 472-481.
- Sánchez, M., Cardemil, E., Adams, S.T., Calista, J.L., Connell, J., DePalo, A., . . . Kaminow, P. (2014). Brave new world: Mental health experiences of Puerto Ricans, immigrant Latinas, and Brazilians in Massachusetts. *Cultural Diversity and Ethnic Minority Psychology*, 20(1), 16-26.
- Silva, D.A.S., Nahas, M.V., de Sousa, T.F., Del Duca, G.F., & Peres, K.G. (2011). Prevalence and associated factors with body image dissatisfaction among adults in southern Brazil: a population-based study. *Body Image*, 8(4), 427-431.
- Siqueira, C.E., & Jansen, T. (2008). Updating demographic, geographic, and occupational information on Brazilian immigration to the United States: the case of Massachusetts. Jouët-Pastré C, Braga L, Eds., *Becoming Brazuca: Brazilian Immigration to the United States*. Cambridge, MA: Harvard University Press: 105–124.
- Siqueira, K.S., Appolinário, J.C., & Sichieri, R. (2005). Relationship between binge-eating episodes and self-perception of body weight in a nonclinical sample of five Brazilian cities. *Revista Brasileira de Psiquiatria*, 27(4), 290-294.
- Sternberg, R.M., & Lee, K.A. (2013). Depressive symptoms of midlife Latinas: effect of immigration and sociodemographic factors. *International Journal of Women's Health*, 5, 301-308.
- Tovar, A., Boulos, R., Sliwa, S., Must, A., Gute, DM., Metayer, N., . . . Economos, C.D. (2013). Baseline socio-demographic characteristics and self-reported diet and physical activity shifts among recent immigrants participating in the randomized controlled lifestyle intervention “Live Well”. *Journal of Immigrant and Minority Health*, 16(3), 457-465.
- Valdez, C.R., Abegglen, J., & Hauser, C.T. (2013). Fortalezas familiares program: Building sociocultural and family strengths in latina women with depression and their families. *Family Process*, 52(3), 378-393.
- Wong, E., & Miles, J.V. (2014). Prevalence and correlates of depression among new U.S. immigrants. *Journal of Immigrant and Minority Health*, 16(3), 422-428.
- World Health Organization. (2005). Depression. Available at: http://www.who.int/mental_health/management/depression/en/. Accessed March 27, 2015.

Table 1: Demographic Characteristics of Women by Ethnic Group

	<i>Mean \pm SD or Frequency for:</i>		
	Brazilians	Haitians	Latinas
% of sample (n= 345)	39.7	31.6	28.7
% living with partner (n=341)	86.8	50.9	70.1
Education (n=343)			
% < high school	24.8	34.6	34.4
% high school/trade school	52.6	40.2	40.4
% some college	22.6	25.2	25.3
% earning <\$30,000 per year (n=294)	62.2	93.8	76.7
Age in years (n=341)	34.1 \pm 5.7	38.5 \pm 6.2	35.5 \pm 6.6
Years in the US (n=338)	7.4 \pm 2.5	3.3 \pm 3.1	7.0 \pm 2.5

Note: Frequencies above reflect percentages among those providing data on the corresponding variable. For income, a categorical indicator of missing data was created and used in statistical analyses due to the large number of missing cases.

Table 2: Results from Hypothesized Models Examining Depressive Symptoms, Ethnic Group, and their Interaction as Predictors of Weight Status

	Test statistic	p-value
<i>Outcome: Obesity (logistic model)</i>		
	<i>Wald chi-square</i>	
Depressive symptoms	4.82	.03*
Ethnic group ¹	3.72	.16
Interaction	1.67	.43
Income ²	.94	.62
Perceived stress	4.76	.03*
<i>Outcome: BMI (general linear model)</i>		
	<i>F-value</i>	
Depressive symptoms	3.23	.07#
Ethnic group ¹	.91	.41
Interaction	.81	.45
Income ²	1.91	.15
Perceived stress	2.12	.15

* $p < .05$; # $p < .10$. For the two statistically significant terms depicted, standardized point estimates are as follows: depressive symptoms, $B = 0.26$; perceived stress, $B = -0.17$.

¹ categorical variable: Haitian, Latina, Brazilian; ² categorical variable: $\geq \$30,000$, $< \$30,000$, missing; All other predictors were continuous variables.

For the logistic model depicted above, reference coding of the two categorical variables was used, with Haitians and higher-income ($\geq \$30,000$) women as reference groups. Findings were consistent when using GLM coding instead, which allows non-full-rank parameterization as in the general linear model procedure, and were also consistent using effect coding, which is the default in SAS.

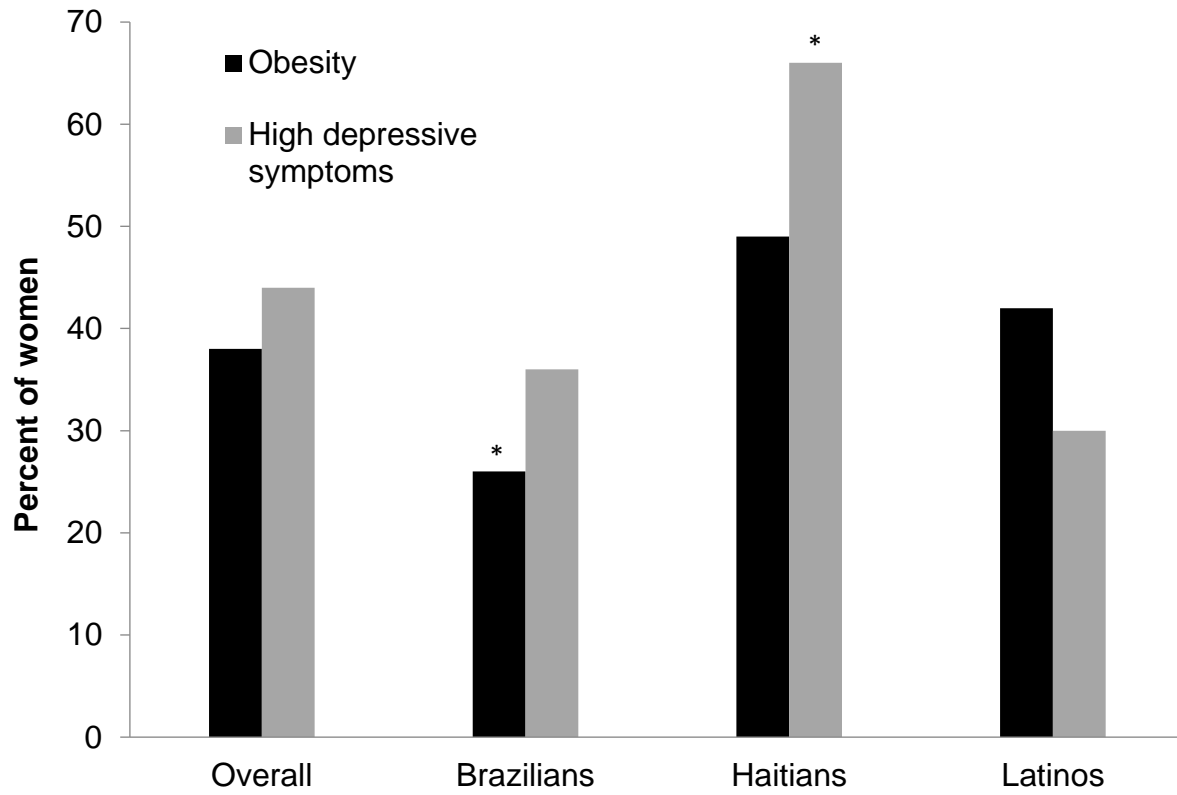


Figure 1. Prevalence of Obesity and High Depressive Symptoms.

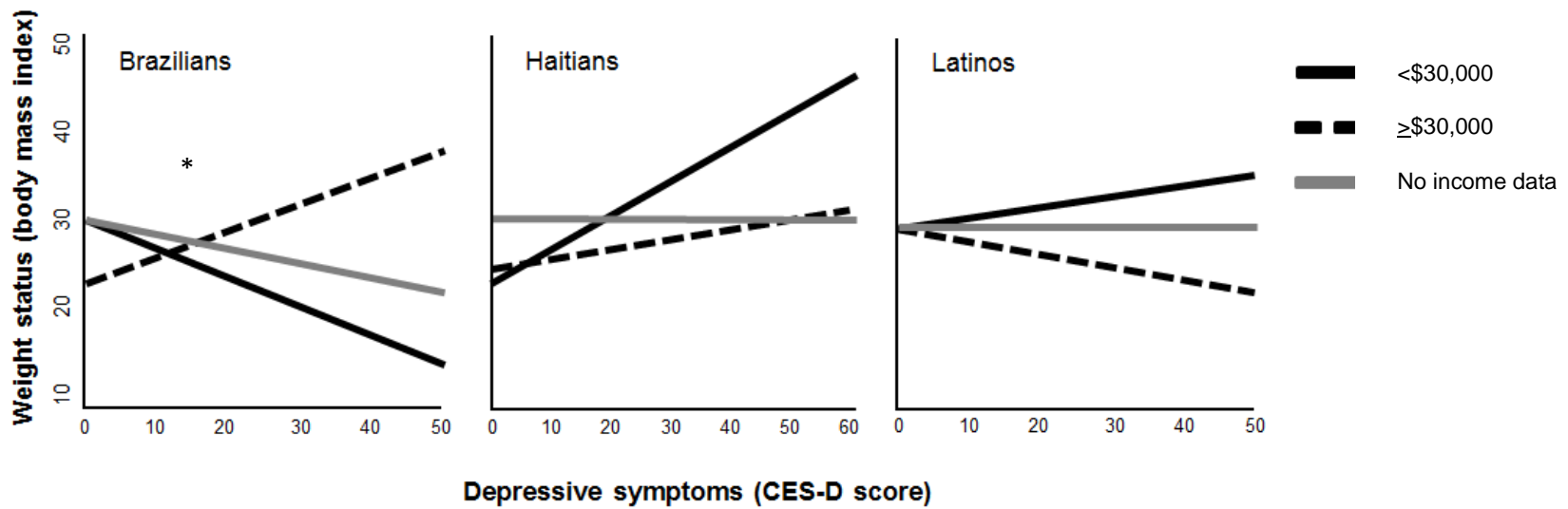


Figure 2. Relationship between Depressive Symptoms and BMI Differed by Income for Brazilians.

FIGURE CAPTIONS

Figure 1. Prevalence of Obesity and High Depressive Symptoms. The percentage of participants in the sample with obesity (BMI \geq 30.0) and with high depressive symptoms (CES-D score \geq 16) are depicted overall and by ethnic group. Asterisks identify ethnic groups for whom the prevalence of the respective outcome was significantly different compared to the other ethnic groups. Brazilians had a lower prevalence of obesity, and Haitians had a higher prevalence of high depressive symptoms, compared to each of the other groups.

Figure 2. Relationship between Depressive Symptoms and BMI Differed by Income for Brazilians. Higher depressive symptoms predicted higher BMI among Brazilians earning \geq \$30,000 per year but predicted lower BMI among Brazilians earning less. Income differences in the depressive symptoms-BMI relationship were non-significant in the other two ethnic groups.