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Assessing Social Support and Nativity as Modifiers of the Effect of Parenting Stress on Obesity in Hispanic Mothers

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Bachelor of Science

The Pennsylvania State University

2017

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Abstract

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By Abigail K. Ruths

Psychological stress has often but inconsistently been shown to be a risk factor for increased adiposity. Mothers, especially those who lack social support systems, may be under considerable stress, which may in turn affect their likelihood of developing obesity. Additionally, Hispanic mothers may face unique challenges that cause further stress and affect their likelihood of developing obesity. The present study utilized log-binomial regression to assess the relationship between parenting stress and obesity while separately considering social support measures and nativity as potential effect modifiers, controlling for other potential confounders.

An inverse but not statistically significant relationship was found between parenting stress and maternal obesity ($PR_{\text{1-unit increase in parenting stress}} = 0.90$, 95% CI = 0.81, 1.01). None of the four types of social support examined nor nativity were shown to be significant modifiers of the relationship between parenting stress and obesity.

This study highlights the complexity and inconsistently predictable relationship between psychological stress and obesity in specific populations—in this case, Hispanic mothers. Further investigations should closely examine the complex roles Hispanic mothers' social networks play in their parenting responsibilities, including how the immigration experience may disrupt social networks, and whether strong social support networks reduce parenting stress that may contribute to other health problems like increased adiposity.

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Abstract

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mothers. Further investigations should closely examine the complex roles Hispanic mothers' social networks play in their parenting responsibilities, including how the immigration experience may disrupt social networks, and whether strong social support networks reduce parenting stress that may contribute to other health problems like increased adiposity.

Introduction

Overweight and obesity, defined by the World Health Organization as "abnormal or excessive fat accumulation that may impair health" (1) affect 39% of the world's population (2). In the United States, being middle-aged, being Hispanic, having low income, and having low education are the greatest risk factors for obesity (3, 4). The causes of obesity are multifactorial and include diet, physical activity, genetics, socio-environmental factors (5). Obesity has been associated with death and disability from related conditions including cardiovascular disease, diabetes, chronic kidney disease, and cancer (6, 7).

The health, nutritional status, and income of mothers have been shown to be some of the greatest determinants of her children's health and wellbeing (8). Both under and overnutrition of the mother increase her offspring's likelihood of developing obesity in their lifetime (8), which means preventing and treating obesity in mothers is essential to lowering the risk of obesity in a population. However, overweight and obesity affect half of all women of child-bearing age in the United States (9). Hispanic mothers, and therefore their children, may be particularly at risk since Hispanics are already a high-risk group for obesity in the United States.

Psychological stress has been proposed as a risk factor for obesity, though previous findings have been inconsistent. A systematic review and meta-analysis by Tenk and colleagues found that perceived stress among adults was associated with both increased waist circumference and increased BMI, among other metabolic outcomes (10). Wardle and colleagues likewise conducted a meta-analysis examining the effect of psychosocial stress on objective adiposity measures and found many null associations—although those that were statistically significant showed a positive relationship between stress and obesity (11). Another study showed differences in the relationship between stress and obesity by sex, showing a negative association among men and a null association among women (12). About half of the 80% of people whose eating habits are affected by stress will overeat and the other half will under-eat (13), which may also contribute to observed sex differences. Stress and obesity may also be locked in a positive feedback loop, wherein obesity is psychologically and physically stressful for an individual and is related to widespread inflammation and therefore increased cortisol, which has been associated with weight gain (14).

Though many studies have examined the effect of stress on obesity, few have focused specifically on Hispanic women or Hispanic mothers who have a high prevalence of obesity. Using data from the Hispanic Community Health Study/Study of Latinos (HCHS/SOL), Isasi and colleagues used found an association between high chronic stressors and obesity, greater waist circumference, and body fat percentage, but found no interaction by sex (15). Richardson and colleagues also found an association between perceived stress and severe obesity in a convenience sample of low-income women, though the sample was only 16% non-White Hispanic (16).

Chasan-Taber and colleagues examined a variety of risk factors for excessive gestational weight gain during pregnancy in a sample of largely Puerto Rican Hispanic women and found no consistent association between maternal stress (using the Perceived Stress Scale) and weight gain (17).

Social support has been shown to positively affect health, including improvements in reported stress, anxiety, depression, and well-being (18, 19). Social support may buffer perception of stress by supporting an individual's emotional, informational, and instrumental needs (20). Motherhood can be a high stress time; having a strong support network may help mothers lower their stress and spend a little more time focusing on their own needs and wellbeing.

When examining stress and obesity in Hispanic mothers, it is important to consider socio-cultural factors, including the immigration experience (which affects a third of all Hispanics in the United States). Like many developing regions, Latin America is experiencing an increase in obesity. However, the immigrant paradox—in which recent immigrants are healthier than both well-established immigrants and non-immigrants—may mean that foreign-born Hispanic mothers are healthier than US-born Hispanic mothers. However, this idea may not be generalizable across all Hispanic ethnic groups (21). To further complicate matters, the immigration experience may be both stressful and disruptive to important social networks that are usually quite strong among Hispanics (22). If social support buffers stress, immigrant women who lack strong social networks may be more stressed than non-immigrant women who have well-established social support systems.

Clearly, the relationship between stress, obesity, social support, and nativity (foreign-born status) has not been fully elucidated. The present study aims to assess how social support and nativity in Hispanic mothers residing in US cities may buffer (or exacerbate) the effect of parenting stress on obesity.

Methods

Sample

Data for this cohort study was obtained from the Fragile Families and Child Wellbeing Study ("Fragile Families") at Princeton University. Data are publicly available for download from the Office of Population Research data archive. Fragile Families is a nationally representative cohort of children, mothers, fathers, and other caregivers oversampled for unwed parents. Surveys and interviews were conducted at baseline (birth) and years 1, 3, 5, 9, and 15. Data are available for approximately 4700 births and were obtained from 75 hospitals in 20 US cities with populations of 200,000 or greater (23). Cities were stratified by labor market conditions and policy environments and then randomly selected (23). Family exclusion criteria included: families who planned to put their baby up for adoption, families in which the father was not alive at the time of the birth, those who did not speak English nor Spanish, ill mothers or babies, those whose babies passed away before the time of the interview, and, in many hospitals, families with one or more parents under the age of 18 (23).

One of the goals of the overarching study was to determine the capabilities of "fragile families" in which the parents of the child exist in non-traditional arrangements (unmarried, non-cohabiting, or one parent absent), with particular interest in the contributions and roles of the father. Two additional areas of interest were welfare reform and non-marital childbearing. Topics addressed by the survey questions include parenting, marriage and relationships, social support, health, community resources, education, employment, income, and child health and well-being (23).

Data

Due to the wide availability of measures, this data is useful for examining relationships outside of the main aims of the study. The present study utilized data from wave 5 (year 9) based on availability of variables of interest. The data were restricted to the population of interest, Hispanic mothers of both foreign- and US-born status (1333 Hispanic mothers at baseline, 877 in year 9), and those with data for the outcome of interest, obesity (n=721).

Outcome

The outcome, maternal obesity, was dichotomized using a constructed Body Mass Index measure at the standard cut-point of greater than or equal to 30. BMI was constructed from height and weight measures. Weight was measured in year 9 by researchers during home visits. The mother was asked to provide her weight if she refused to be weighted or if she weighed over 300 pounds; she provided her pre-pregnancy weight if she was currently pregnant. Height was previously measured in

waves 3 and 4 and BMI was constructed one of these measurements. One biologically implausible outlier (126.2) was set to missing.

Exposure

The main exposure of interest, maternal parenting stress, was constructed using four parenting stress-related questions that the mother answered on a four-level scale of strongly agree to strongly disagree: 1) Being a parent is harder than I thought it would be, 2) I feel trapped in my responsibilities as a parent, 3) I find that taking care of my child(ren) is much more work than pleasure, and 4) I often feel tired, worn out, or exhausted from raising a family. These questions were derived from the Child Development Supplement of the Panel Study of Income Dynamics (PSID) (24). Scores from these four questions were averaged to create an overall parenting stress continuous composite measure.

For part of the interaction assessment described below, parenting stress was also recoded into a 3-level categorical measure. With an original range of 1.0-4.0, parenting stress was coded as low stress when stress was equal to 1-1.75 (average answer was equal to mostly disagreeing), medium stress when stress was equal to 2.0-2.75 (average answer represented some disagreement and some agreement), and high stress when stress was equal to 3.0-4.0 (average answer was equal to mostly agreement).

Effect Modifiers

The first effect modifier of interest was the mother's social support. Four different types of social support were examined: 1) Friends and kin support, 2) emotional support from the father, 3) household support from the father, and 4) parenting appraisal support

from the father. These continuous measures, which were first reverse coded to indicate higher social support with a higher score before being constructed, were then used to construct additional 3-level categorical social support measures of each type of social support.

The friends and kin support measure was constructed by totaling the number of positive responses to three questions related to the mother's access to financial, housing, and childcare support. Emotional support from the father was constructed by averaging the responses to five questions about the mother's emotional relationship with her child's father. Household support from the father was constructed by averaging the responses to four questions about the father's contribution to household and childcare tasks. Parenting appraisal support from the father was constructed by averaging the responses to four questions about the father's and mother's agreement on parenting and the father's availability to look after the child when needed. The aforementioned methods were informed by two previous studies that used the same set of questions and similar methods of variable construction (25, 26).

All four types of social support were also considered as effect modifiers by first recoding the continuous measures into 3-level categorical measures. Low, medium, and high support cut offs were determined by examining the possible responses to the questions originally asked. A complete list of questions is available in the appendix.

Friend and kin support, originally 0-3, was coded as low support when support was equal to 0 or 1 (answered "yes" 0-1 times), medium support when support was equal to 2 (answered "yes" two times), and high support when support was equal to 3 (answered "yes" all three times). Father emotional support, originally 1.0-3.0, was coded

as low support when support was equal to 1.0-1.6 (equal to mostly “never”), medium support when support was equal to 1.8-2.4 (equal to mostly “sometimes”), and high support when support was equal to 2.6-3.0 (equal to mostly “often”).

Father household support and father parenting appraisal support had the same range (1.0-4.0) and nearly identical response options and were therefore coded the same way. Household support and parenting appraisal support were coded as low support when support was equal to 1.0-2.25 (equal to most “never” or “rarely”), medium support when support was equal to 2.5-3.25 (equal to mostly “sometimes”), and high support when support was equal to 3.5-4.0 (equal to mostly “always/often”).

The second effect modifier of interest was nativity. Mothers were asked “Were you born in the United States?” It is worth noting that mothers born in Puerto Rico are US-born, though may share some (though not all) similar experiences to mothers who emigrated from other countries when moving to the mainland United States. None of the sample was taken directly from the island; therefore, any mothers who were born in Puerto Rico moved to the mainland at some point before the birth of their child.

Other Covariates

Additional variables of interest included whether the mother was married to the father at baseline, smoking, age, education, poverty, and language preference. Mothers were considered smokers if they had smoked cigarettes in the past month. Age was continuous. Education was categorized as less than high school, high school or equivalent, some college or technical school, and college or graduate studies. Poverty was a 5-level categorical variable based on percentage of poverty line: 0-49%, 50-99%,

100-199%, 200-299%, and 300% and up. Language preference (Spanish or English) was based off of the mother's preference for language of interview.

Analysis

Log binomial regression models were used to assess the relationship between parenting stress and obesity in Hispanic mothers and to examine potential effect modifiers. Interaction assessments were conducted individually for the four types of social support while adjusting for potential confounders (nativity, age, education, smoking, language preference, married to father at baseline, and poverty) both as continuous measures and 3-level categorical measures. For continuous measures, interaction term coefficients were assessed for statistical significance.

Interaction by social support was examined again by assessing interaction term coefficients for statistical significance. Prevalence ratios were additionally calculated for each combination of stress and social support.

Interaction by nativity (US-born or foreign-born) was also separately assessed both with parenting stress as a continuous measure and as a 3-level categorical measure. Interaction term coefficients were assessed for statistical significance. Prevalence ratios were calculated for US-born and foreign-born mothers with parenting stress as a continuous measure.

A confounding assessment was conducted by comparing prevalence ratios of fully parameterized and reduced models. Any measure that was previously identified as an

important effect modifier remained in the model for the confounding assessment. For any model which dropped a variable and produced a prevalence ratio not within 10% of the gold standard (fully parameterized) model, that variable was considered to be an important confounder to the relationship between parenting stress and obesity in Hispanic mothers. All analyses were conducted in SAS 9.4 statistical software (SAS Institute, Cary, NC).

Results

Study population characteristics can be found in Table 1 and are shown by total sample, obese and non-obese. A majority of mothers were not married to the father at baseline (76%), as was expected based on the sampling method. About two-thirds (62%) of the sample was US-born, 59% were of Mexican decent, 58% had a high school diploma or less, 83% were non-smokers, 37% lived below the poverty line, and 70% preferred English over Spanish. Education, nativity, and language preference were all significantly associated with obesity. None of the social support measures examined for effect modification were associated with obesity. US-born mothers and mothers who preferred English were more likely to be obese.

The interaction assessment considering parenting stress and four types of social support as continuous measures found no evidence of effect modification by friend/kin support ($\beta = 0.02$, $p = 0.81$), father emotional support ($\beta = 0.17$, $p = 0.33$), father household support ($\beta = 0.04$, $p = 0.48$), nor father parenting appraisal support ($\beta = 0.01$, $p = 0.91$), adjusting for other covariates (Table 2). When considering parenting stress and

types of social support as 3-level categorical measures, the coefficients for the combination of low parenting stress and low father emotional support and of medium parenting stress and low parenting appraisal support were statistically significant (Appendix Table 1). However, given the overwhelming lack of statistical significance in other combinations and the results of the previous interaction assessment, none of the four types of social support examined were found to be significant effect modifiers to the relationship between parenting stress and obesity.

The interaction assessment considering nativity and continuous parenting stress found no evidence of effect modification of the relationship between parenting stress and obesity adjusting for other covariates (Table 3). In models stratified by nativity status, the prevalence ratio of obesity was 0.92 (95% CI: 0.81, 1.04) among US-born mothers and 0.82 (95% CI: 0.65, 1.03) among foreign-born mothers (Table 4). Similarly, when considering parenting stress as a 3-level categorical variable, no evidence of effect modification was found (Appendix Table 2).

Several log-binomial regression models were examined to assess potential confounding by six covariates: nativity, poverty, age, smoking, marriage to father at birth, education, and language preference (Appendix Table 3). None of the covariates were found to be confounders of the relationship between parenting stress and obesity in Hispanic mothers, and none of the prevalence ratios were statistically significant, though the coefficients for nativity and poverty were significantly associated with obesity in the fully parameterized model and reduced models shown in Table 5. The fully parameterized model and reduced models produced nearly identical prevalence ratios. A 1-unit increase in parenting stress was associated with a 10% decrease in obesity

prevalence among Hispanic mothers (though not statistically significant), whether or not adjusting for covariates.

Discussion

Using data from a nationally representative sample of largely unwed Hispanic mothers, the relationship between parenting stress and obesity was found to be inverse, though not statistically significant. Furthermore, neither social support nor nativity were found to significantly modify the effect of parenting stress on maternal obesity.

Stress has often been proposed as a risk factor for obesity as there are many logical pathways by which stress would cause an increase in adiposity (27). Yet, findings from previous studies examining stress as a risk factor for obesity have been mixed. Two meta-analyses (10, 11) found positive associations between stress and obesity, though the latter of these also found many studies with null results. Other studies have found a positive relationship between general stress, parenting stress, and perceived stress and BMI (28, 29) while Suglia and colleagues found an inverse relationship between perceived stress and adiposity in men but no association in women (12). Isasi and colleagues found associations between exposure to chronic stressors and obesity, but no interaction by sex (15). Richardson and colleagues also found an association between perceived stress and severe obesity in a convenience sample of low income women (16) while Chasan-Taber and colleagues found no association between maternal stress and weight gain in pregnant Hispanic women (17).

The literature on the relationship between psychological stress/stressors and obesity is abundant. There are studies to support or contradict nearly every hypothesis, though the majority published tend to support the idea that psychological stress increases the likelihood of obesity. The present study adds to the literature by reporting an inverse relationship between parenting stress and maternal obesity in Hispanic mothers, suggesting that the dominant paradigm holding that stress increases likelihood of obesity may not be applicable to all subgroups nor all types of stress. These results shed light on the complicated nature of the relationship between stress and obesity. Additionally, in this sample, none of the combinations of covariates appreciably accounted for the relationship, and neither social support nor nativity modified the effect.

Though the findings of this study are not aligned with the majority of previous findings examining stress and obesity, there are potential explanations for this contradiction. First, it is equally likely for a stressed person to eat less than usual as it is for a stressed person to eat more (13), though this has not been specifically examined in the context of motherhood and parenting stress. Still, it is possible that the mothers in this sample tend to eat less when they are stressed instead of more. Additionally, mothers who reported more parenting stress may also be busier, which could mean more time on her feet, more time running errands, or more time tending to her children, leading to overall increased physical activity and lower BMI. Some mothers may try to reduce stress by participating in additional physical activity. It is also possible that some mothers underreport the parenting stress they feel (most mothers reported low to medium stress) because they feel it is part of the parenting experience and otherwise find parenting very rewarding, but this is unlikely to explain the inverse relationship observed between

parenting stress and obesity. Finally, there could be unmeasured factors related to motherhood, being Hispanic, or both that confound the relationship between stress and obesity.

Though social support has previously been shown to both directly affect health outcomes and also buffer the effect of stress on health outcomes (18-20), the present study found no substantial evidence of modification of the effect of parenting stress on obesity by friend and kin support, father emotional support, father household support, nor father parenting appraisal support. One explanation for this is that the nature of the questions asked about social support could have little relation to the questions asked about parenting stress. For example, a mother who feels strong emotional support from the father could still report feeling "trapped in [her] responsibilities as a parent." It is possible that effect modification would have been present had the main exposure been overall psychological or perceived stress, as the literature has related these to social support more than parenting stress. There was additionally no evidence of statistically significant effect modification by nativity. This could be because mothers, regardless of origin, experienced similar levels of parenting stress. The slight difference in effect estimates between US-born Hispanic mothers and foreign-born Hispanic mothers, however, warrants further investigation.

A secondary finding outside of the main aims of this study was a significantly lower prevalence in obesity among foreign-born Hispanic mothers compared to US-born Hispanic mothers. This finding is consistent with the disputed "immigrant health paradox" in which immigrants, especially those who have more recently immigrated, have better health outcomes than both their US-born same-ethnicity counterparts and

other US-born groups. Further research should be conducted to investigate whether factors including social support and acculturation (via English language acquisition and other measures) could explain this relationship.

The outcome of this study was maternal obesity dichotomized at the standard cutoff of BMI greater than or equal to 30. This dichotomization leaves a lot of room for variation within the two groups, especially in a sample where around half of participants were obese. It is possible that examining the relationship between parenting stress and BMI with BMI continuous would capture more of the nuance of the relationship. Additionally, it is important to note that log binomial regression may overestimate the precision of the calculated prevalence ratios. Though none were shown to be statistically significant, it is possible that the true relationship between stress and obesity in Hispanic mothers is even less predictable.

A strength of this study is that, after an extensive literature review, it appears to be the only one of its kind to have investigated both social support and nativity in Hispanic mothers as modifiers of the effect of parenting stress on obesity. Though having a secondary comparison group such as Black or White mothers would allow for better conclusions to be drawn about the unique experiences of Hispanic mothers, the study was designed with Hispanic origin as a central component instead of just as a covariate for which to control. Racial and ethnic disparities should be investigated as often as for which they are adjusted.

This study found an association between stress and obesity contrary to the dominant paradigm in the literature and in the field of public health and health

promotion. While most studies which have found positive relationships between stress and obesity have been in non-Hispanic locations, this inverse relationship may also be unique to mothers or, more specifically, Hispanic mothers. Therefore, further research should investigate the effect of stress on obesity in Hispanic and non-Hispanic women with and without children. Though this study found no modification by social support nor nativity, there is significant literature and evidence to support the continued investigation of the effects of these two factors on stress, obesity, and other health outcomes, especially in immigrant populations.

Additionally, future studies would benefit from utilizing a variety of stress and social support measures and testing effect modification by each type individually instead of as composite measures. This may help to identify key aspects of social support to target in public health interventions. Likewise, gathering information on mothers' stress unrelated to the parenting experience will give a more complete picture of overall psychological stress.

Future investigations should closely examine how the social support networks of Hispanic mothers may or may not share parenting responsibilities and alleviate parenting stress. This is especially important in immigrant mothers who may experience a disruption in social networks due to the immigration experience. The findings of such investigations will inform the public health community of how to best serve Hispanic mothers with regards to parenting, stress reduction, and overall health improvement.

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Tables

Table 1. Demographic Characteristics, Parenting Stress, Social Support, and Obesity in Hispanic Mothers: The Fragile Families and Child Wellbeing Study (n = 721)

Characteristic	Total sample n (%)	Obese n (%)	Non-obese n (%)	Statistically significant[+]
Parenting Stress (1-4)*[a]	1.92 (0.68)	1.87 (0.67)	1.96 (0.68)	
Social Support*[b]				
Friends/kin support (0-3)	2.63 (0.75)	2.60 (0.77)	2.65 (0.73)	
Father emotional support (1-3)	2.54 (0.47)	2.53 (0.46)	2.55 (0.49)	
Father household support (1-4)	2.76 (1.12)	2.74 (1.11)	2.78 (1.13)	
Father parenting appraisal support (1-4)	3.40 (0.83)	3.40 (0.80)	3.40 (0.86)	
Married to father at baseline				
Yes	170 (23.58)	78 (45.88)	92 (54.12)	
No	551 (76.42)	283 (51.36)	268 (48.64)	
Age*	34.16 (5.88)	33.85 (5.64)	34.46 (6.10)	
Nativity				
US-born	447 (62.00)	253 (56.60)	194 (43.40)	Yes
Foreign-born	274 (38.00)	108 (39.42)	166 (60.58)	
Origin				
Mexican, Mexican-American	411 (59.39)	222 (54.01)	189 (45.99)	
Puerto Rican	100 (14.45)	51 (51.00)	49 (49.00)	
Cuban	8 (1.16)	3 (37.50)	5 (62.50)	
Central American/Caribbean	26 (3.76)	9 (34.62)	17 (65.38)	
South American	18 (2.60)	6 (33.33)	12 (66.67)	
Other Hispanic/Latino, not specified	121 (17.49)	51 (42.15)	70 (57.85)	
Don’t know/refused	8 (1.15)	3 (37.50)	5 (62.50)	
Education				
Less than high school	261 (36.20)	123 (47.13)	138 (62.87)	Yes
High school or equivalent	156 (21.64)	88 (56.41)	68 (43.59)	
Some college, tech	244 (33.84)	128 (62.46)	116 (47.54)	
College, graduate	60 (8.32)	22 (36.67)	38 (63.33)	

Smoke				
Yes	123 (17.06)	69 (56.10)	54 (43.90)	
No	598 (82.94)	292 (48.83)	306 (51.17)	
Percent Poverty Line				
0-49%	115 (16.08)	70 (60.87)	45 (39.13)	
50-99%	153 (21.40)	75 (49.02)	78 (50.98)	
100-199%	230 (32.17)	115 (50.00)	115 (50.00)	
200-299%	114 (15.94)	55 (48.25)	59 (51.75)	
300%+	103 (14.41)	44 (42.72)	59 (57.28)	
Language Preference				
English	502 (69.63)	270 (53.78)	232 (46.22)	Yes
Spanish	219 (30.37)	91 (41.55)	129 (58.45)	

**Reported as means and standard deviations*
[a]Highest value in the given range indicates highest parenting stress
[b]Highest value in the given range indicates highest social support
[+]Statistical significance reached at α =0.05.

Table 2. Interaction Assessment of Social Support Measures on Relationship between Parenting Stress and Obesity in Hispanic Mothers, with Social Support and Parenting Stress as Continuous Measures: The Fragile Families and Child Wellbeing Study (n = 721)

	Model 1:		Model 2:		Model 3:		Model 4:	
	β	Standard Error	β	Standard Error	β	Standard Error	β	Standard Error
Parent Stress	-0.15	0.19	-0.58	0.46	-0.21	0.16	-0.12	0.25
Nativity	-0.40*	0.14	-0.32	0.17	-0.43*	0.15	-0.45*	0.15
Poverty	-0.09*	0.03	-0.05	0.05	-0.10*	0.03	-0.10*	0.03
Age	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.01
Education	-0.01	0.04	0.01	0.06	-0.01	0.05	-0.01	0.05
Smoking	-0.02	0.09	-0.09	0.15	0.00	0.11	-0.02	0.11
Language	0.00	0.15	0.10	0.18	0.09	0.16	0.09	0.15
Married at Baseline	0.03	0.10	0.03	0.13	0.08	0.10	0.09	0.11
Friend/Kin Support	-0.04	0.14						
Father Emotional Support			-0.43	0.13				
Father Household Support					-0.07	0.10		
Father Parenting Appraisal Support							0.02	0.14
Stress*Friend/Kin Support	0.02	0.07						
Stress*Father Emotional Support			0.17	0.18				
Stress*Father Household Support					0.04	0.05		
Stress*Father Parenting Appraisal Support							0.01	0.07

**Coefficient statistically significant at $\alpha = 0.05$.*

Table 3. Interaction Assessment of Nativity on the Relationship between Parenting Stress and Obesity in Hispanic Mothers, with Social Support as Continuous Measure: The Fragile Families and Child Wellbeing Study (n = 721)

	β	Standard Error
Parent Stress	0.04	0.17
Nativity	-0.19	0.29
Poverty	-0.09*	0.03
Age	0.00	0.01
Education	-0.01	0.04
Smoking	-0.01	0.09
Language	0.00	0.15
Married at Baseline	0.03	0.10
Stress*Nativity	-0.11	0.13

**Coefficient statistically significant at $\alpha = 0.05$.*

Table 4. Regression Model Estimating the Association of 1-Unit Increase in Parenting Stress and Obesity Stratified by Maternal Nativity Status in Hispanic Mothers: The Fragile Families and Child Wellbeing Study (n = 721)

	US-Born		Foreign-Born	
	β	Standard Error	β	Standard Error
Parent Stress	-0.08	0.06	-0.20	0.12
Poverty	-0.10*	0.03	-0.05	0.07
Age	0.00	0.01	0.00	0.01
Education	0.01	0.04	-0.12	0.09
Smoking	-0.07	0.09	0.78	0.52
Language	0.17	0.18	-0.19	0.19
Married at Baseline	0.04	0.11	-0.07	0.16

Coefficient statistically significant at $\alpha = 0.05$

Table 5. Log Binomial Regression Analyses of Parenting Stress and Obesity, Selected Models: The Fragile Families and Child Wellbeing Study (n = 721)

	Fully parameterized model		Partially reduced model 1		Partially reduced model 2	
	β	Standard Error	β	Standard Error	β	Standard Error
Parenting Stress	-0.10	0.06	-0.10	0.06	-0.11	0.06
Nativity	-0.41*	0.14	-0.39*	0.09	-0.38*	0.09
Poverty	-0.09*	0.03	-0.09*	0.03	-0.09*	0.03
Age	0.002	0.01	0.01	0.01		
Smoking	-0.02	0.09	-0.02	0.09		
Married to father at baseline	0.03	0.10	0.03	0.09	0.03	0.09
Education	-0.01	0.03				
Language	0.01	0.15				

**Denotes a coefficient statistically significant at alpha = 0.05*

Appendices

Additional Analysis Tables

Appendix Table 1. Prevalence Ratios of Obesity in Hispanic Mothers Stratified by Differing Levels of Parenting Stress and Social Support: The Fragile Families and Child Wellbeing Study (n = 721)

Friend/Kin Support:	High support		Medium Support		Low Support	
Parenting Stress	PR	95% CI	PR	95% CI	PR	95% CI
Medium stress v. low stress	0.82	0.68, 0.98	0.77	0.53, 1.13	0.69	0.41, 1.14
High stress v. low stress	0.86	0.62, 1.21	1.27	0.82, 1.97	0.55	0.22, 1.37
High stress v. medium stress	1.06	0.74, 1.50	1.65	1.02, 2.66	0.80	0.30, 2.13

Father Emotional Support:	High support		Medium Support		Low Support	
Parenting Stress	PR	95% CI	PR	95% CI	PR	95% CI
Medium stress v. low stress	0.85	0.62, 1.17	0.74	0.52, 1.06	0.41	0.13, 1.22
High stress v. low stress	0.65	0.31, 1.34	1.14	0.69, 1.88	0.00	0.00, 0.00
High stress v. medium stress	0.76	0.35, 1.63	1.538	0.90, 2.62	0.00	0.00, 0.00

Father Household Support:	High support		Medium Support		Low Support	
Parenting Stress	PR	95% CI	PR	95% CI	PR	95% CI
Medium stress v. low stress	0.83	0.63, 1.10	0.94	0.64, 1.37	0.67	0.49, 0.91
High stress v. low stress	1.01	0.64, 1.61	0.75	0.34, 1.66	0.93	0.61, 1.43
High stress v. medium stress	1.22	0.74, 2.01	0.80	0.35, 1.79	1.39	0.87, 2.23

Father Parenting Appraisal Support:	High support		Medium Support		Low Support	
Parenting Stress	PR	95% CI	PR	95% CI	PR	95% CI
Medium stress v. low stress	0.84	0.68, 1.05	0.74	0.52, 1.05	0.62	0.34, 1.15
High stress v. low stress	0.89	0.59, 1.34	0.77	0.41, 1.48	1.42	0.89, 2.27
High stress v. medium stress	1.05	0.68, 1.62	1.05	0.54, 2.04	2.28	1.20, 4.34

Adjusted for nativity, age, education, smoking, language preference, married to father at baseline, and poverty

Appendix Table 2. Regression Model Estimating Interaction Between Nativity and Parenting Stress and Obesity in Hispanic Mothers, with Three-Level Categorical Stress: The Fragile Families and Child Wellbeing Study (n = 721)

	β	Standard Error
Low Stress	-0.17	0.39
Medium Stress	-0.33	0.42
High Stress	0.00	0.00
Nativity	-0.57	0.31
Poverty	-0.10*	0.03
Age	0.003	0.01
Education	-0.01	0.04
Smoking	-0.002	0.09
Language	-0.02	0.15
Married at Baseline	0.02	0.10
Nativity*Low Stress	0.21	0.30
Nativity*Medium Stress	0.15	0.33
Nativity*High Stress	0.00	0.00

**Coefficient is statistically significant at $\alpha = 0.05$.*

Appendix Table 3. Prevalence Ratios Estimating the Association of Parenting Stress on Obesity in Hispanic Mothers (Selected Models): The Fragile Families and Child Wellbeing Study (n = 721)

Covariates	PR	95% CI
nativity, poverty, age, smoking, married to father at baseline, education, language *(fully parameterized model)*	0.90	0.81, 1.01
nativity, poverty, age, smoking, married to father at baseline, education	0.90	0.81, 1.01
nativity, poverty, age, smoking, married to father at baseline, language	0.90	0.81, 1.01
nativity, poverty, age, smoking, married to father at baseline	0.90	0.81, 1.01
nativity, poverty, age, smoking	0.90	0.81, 1.01
nativity, poverty, age, married to father at baseline	0.90	0.81, 1.01
nativity, poverty, married to father at baseline	0.90	0.81, 1.00
nativity, age, married to father at baseline	0.91	0.82, 1.02
nativity, married to father at baseline	0.90	0.81, 1.02
married to father at baseline	0.90	0.80, 1.01
none *(crude model)*	0.90	0.81, 1.01

All models contained main exposure, parenting stress, as a continuous measure

Social Support composite measures construction

Based on Driver and Amin, 2019, informed by Sampson et al, 2015

Type of support	Question description	Responses
Friends/kin support	Mother could count on someone to loan her $200 during the next year	Yes, no
	Mother could count on someone to provide her with a place to live	
	Mother could count on someone to help her with emergency child care	
Father emotional support	He is fair and willing to compromise when you have a disagreement	Often, sometimes, never
	He expresses affection or love for you	
	He encourages or helps you to do things that are important to you	
	He listens to you when you need someone to talk to	
	He really understands your hurts and joys	
Father household support	How often he looks after child when you need to do things	Often, sometimes, rarely, never
	How often he runs errands for you like picking things up from the store	
	How often he fixes things around your home	
	How often he takes child places he/she needs to go	
Parenting appraisal support (from father)	He respects the schedules and rules you make for child	Always true, sometimes true, rarely true, never true
	He supports you in the way you want to raise child	
	You and father talk about problems that come up with raising child	
	You can count on father to look after child for a few hours	

Literature Review

Social support, stress, and obesity in US Hispanic mothers

Obesity – prevalence

The World Health Organization (WHO) defines overweight and obesity as "abnormal or excessive fat accumulation that may impair health" (1). Overweight and obesity affect populations around the world. An estimated 39% of the world's population was overweight or obese in 2015 with 1.9 billion overweight and 609 million obese (2). These figures reflect a 50% increase in overweight prevalence and an 80% increase in obesity prevalence since 1980 (2). The WHO estimated a similar prevalence of overweight in 2016, among whom they estimated 650 million to be obese, meaning 39% and 13% of adults worldwide were overweight and obese, respectively (1). Adult women generally have higher prevalence of obesity than men worldwide (3). Additionally, countries with higher Sociodemographic Index (SDI) worldwide tend to have higher prevalence of obesity across most age groups (3).

In the United States, 39.8% of adults were obese in 2015-2016 (4). Adult men and women share a similar trend of obesity prevalence by age. Adults aged 40-59 years had a higher prevalence of obesity (42.8%) than younger adults aged 20-29 (35.7%), while older adults aged 60+ had an obesity prevalence not significantly different from the younger two groups (41.0%) (4). Obesity prevalence also varies by race and ethnicity. Nearly half of Hispanics adults in the United States were obese (47.0%), followed closely by non-Hispanic black adults (46.8%) (4). Just over a third of non-Hispanic white adults

had obesity (37.9%) while Asian adults had a significantly lower proportion of obesity (12.7%) (4).

Health outcomes in the United States are often examined by race/ethnicity, but it has been argued that the differences in health outcomes by racial/ethnic group are confounded—though not entirely—by socioeconomic status (SES) to varying degrees; most minority groups in the United States are of lower SES compared to their non-Hispanic white counterparts, except for Asian/Pacific Islanders (5). An analysis by Braveman and colleagues examined the relationship between socioeconomic indicators and health outcomes including obesity found that those who were least educated and were in the lowest income bracket consistently had the worst health outcomes (6). Those with mid-level education and income varied some by health outcome but almost always still had worse health than those with the highest education and income (6). Thirty-six percent of adults aged 20 and older who were in the lowest income bracket were obese compared to 27% in the highest income bracket (6). A similar trend existed by educational attainment, with 35% obesity among those who had not graduated high school and 25% among those who graduated college (6). However, when broken down by race/ethnicity, this trend of decreasing obesity by increasing SES existed in White adults but not in Black nor Mexican-American adults (6).

Obesity – diagnosis

Overweight and obesity in adults are usually diagnosed by calculating Body Mass Index (BMI), which is determined by dividing weight in kilograms by height in meters squared (7). BMI is convenient and easy to calculate and is often used in population-level

research. However, BMI cannot distinguish muscle mass from adipose mass and may not be the most accurate measure of true overweight- and obesity-related disease risk. It may therefore be more appropriate to consider a measure of central adiposity when defining overweight and obesity as central accumulation of fat is a known risk factor for cardiovascular disease and other chronic conditions (7). Previous studies have examined waist-to-hip ratio (WHR), waist-to-height ratio (WHtR), and waist circumference (WC) as alternatives or complements to BMI, but there is little agreement as to which should be used to define obesity (7).

Obesity – causes

Obesity has several, complex causal pathways. The most commonly proposed causes are related to diet, physical activity/lifestyle, and genetics, but the etiology of obesity may also include physiologic, psychological, environmental, economic, social, and political factors (8). Dramatic changes in the food environment in the past few decades have increased the availability, access, and affordability of high-calorie, large-portioned, palatable food products (9). These convenient, easy-to-make products are regularly consumed by families with economic difficulties and time constraints (9).

At the same time, physical activity levels in the United States have also decreased in the past decades. While the age-adjusted proportion of adults in the United States who meet aerobic-activity and muscle-strengthening guidelines has increased from 14.3% in 1998 to 24.5% in 2017 (10), Brownson, Boehmer, and Luke found declining rates of occupation-related physical activity, transportation physical activity, and in-home activity, and an increase in sedentary activity (11). In other words, while more and more

American adults are incorporating exercise into their schedules, the overall decline in other forms of physical activity in the American lifestyle has led to an overall decrease in physical activity levels. The authors noted increasing suburbanization has caused Americans to spend more time commuting by vehicle and less by walking and stated that the industries of urban design, city planning, and transportation engineering must be engaged in the public health pursuit of increased physical activity (11).

Obesity may also have genetic and epigenetic causes, though the science stands relatively inconclusive. Genomic wide association studies have identified over 40 genetic variants related to fat distribution and obesity, though these variants to not fully explain how obesity is passed generation-to-generation (12). We do know that genetic variation is responsible for individual response to energy imbalance (intake greater than expenditure) as well as fat distribution patterns (12). Though less explored, it is also likely that environmental factors have epigenetic influence and change gene expression in an obesogenic manner (12). Still, genetics and epigenetics explain a relatively low percentage of variation in obesity among individuals (12).

Obesity's effect on health

Obesity contributed to an estimated 4.0 million deaths and 120 million disability-adjusted life-years (DALYs) worldwide in 2015 (3). Obesity has been related to deaths and disability from cardiovascular disease, diabetes, chronic kidney disease, cancer, and other health problems (3, 7). Cardiovascular disease (CVD) was the greatest contributor to both death and DALYs related to obesity, accounting for 2.7 million deaths and 66.3 million DALYs worldwide (3). Among those with obesity, CVD was responsible for 41%

of deaths and 34% of DALYs (3). Diabetes was the second largest contributor to BMI-related deaths with 0.6 million deaths and 30.4 million DALYs, while chronic kidney disease was the second largest contributor of DALYs (3). Chronic kidney disease and cancers accounted for less than 10% of BMI-related deaths worldwide each; diabetes, musculoskeletal disorders, and cancers each accounted for under 10% of DALYs (3). It is important to note that 39% of deaths and 37% of DALYs related to BMI were among people whose BMI was less than 30 (3), meaning over a third of deaths and DALYs related to BMI were among people who do not classify as obese (but may be overweight). The highest rates of BMI-related deaths and DALYs were in countries with high-middle sociodemographic indices while the lowest rates of both were in countries with the highest sociodemographic indices (3).

Obesity in mothers and generational impact

Overweight and obesity affect half of all women of child-bearing age in the United States (13). These women are more likely to gain excess weight during pregnancy, which is difficult to lose (13). Not only does this extra weight put them at risk for obesity-related complications in their own lives, sets them up to start any future pregnancies at an elevated weight, and puts them at risk for gestational diabetes, but also puts their offspring at increased risk of obesity—thus continuing the cycle of obesity and chronic disease (13). In addition to excessive weight gain during pregnancy, smoking during pregnancy, less than 12 months of breastfeeding, and less than 12 hours of sleep per day contribute to obesity in children ages 7 to 10 (13).

The health and wellbeing of women and mothers impacts the health of whole societies. Women with poor health, including both undernutrition and overnutrition (obesity), will have children with poor health (14). Research has shown that undernourished mothers put their offspring at risk of cardiovascular disease, hypertension, diabetes, and abdominal obesity (14). Female children then may grow up to be mothers and the cycle continues. It has additionally been shown that the nutrition and income of mothers influences the nutrition and health of children more than the income of men .(14) One of the single most important thing societies can do to improve the health of their people is to prioritize the health and wellbeing of women and mothers (14).

Obesity – prevention and treatment

Obesity has been shown to be difficult to reverse, so prevention is generally ideal (13, 15). For programs and interventions targeting obesity to be successful, they must involve intervention at the individual, environmental, and socioeconomic levels, engage important stakeholders, and address other factors that promote obesity (7). Effective prevention programs must work to improve the socioeconomic, physical activity, and food environments (7) to reduce external barriers to health improvement and weight reduction. As previously mentioned, physical activity in the American population has decreased through the years partially due to increasing urbanization and decreased access to walking. Therefore, programs addressing the built environment in order to increase physical activity are also integral to the success of obesity prevention (7). Additionally, programs targeting the prenatal and one-year postnatal periods in women and children may be most successful due to the relative plasticity of these developmental periods (13).

When treatment is necessary, obesity is usually addressed through dietary and physical activity interventions. The CDC recommends even small reductions in weight to improve health outcomes (16). In more extreme cases, medication or bariatric surgery may be recommended. Bariatric surgery has been associated with reduced risk for obesity comorbidities including hypertension and diabetes (compared to medical treatment), but also increased likelihood of complications including further surgeries, gastrointestinal ulcers, and iron deficiency (17). Regardless, some researchers have called for the widespread acceptance of obesity as a disease state—since obesity meets the criteria of a definable health condition/disease—in order that the medical and public health communities can more systematically approach prevention and treatment (8).

Obesity – epidemiological transition

As previously discussed, increasing prevalence of overweight and obesity are of worldwide public health concern. Once diseases of the wealthy, developing countries around the world are now facing increasing rates of overweight, obesity, and other related chronic diseases. This epidemiologic transition has also led some countries to bear the double burden of malnutrition, or the coexistence of overnutrition and undernutrition at the individual and population levels. Individuals who are exposed to undernutrition like stunting and wasting in the critical windows of earlier life have increased susceptibility to chronic diseases later in life, including obesity (18). In women, exposure to the double burden of malnutrition increases risk of birth complications (18). Simultaneously addressing obesity and undernutrition additionally strains the health and economic systems of developing countries (19).

Stress as a risk factor for obesity: state of current findings

Psychological stress has been proposed as a risk factor for metabolic syndrome, including increased BMI, although results have been mixed. A systematic review and meta-analysis by Tenk and colleagues found that perceived stress among adults was associated with both increased waist circumference and increased BMI, as well as other metabolic outcomes (20). Another meta-analysis by Wardle and colleagues examined prospective, longitudinal studies considering the relationship between psychosocial stress and stressors and objective adiposity measures and found inconsistent results; many studies had null associations, but among those that had significant results, there was a positive association between stress and adiposity (21). The authors found that sex (greater association in men), longer follow-up, and better study quality were important factors in studies with stronger association results, suggesting there are mediating factors that should be considered when examining the relationship between stress and obesity (21).

Another study by Suglia and colleagues examined the relationship between perceived stress and adiposity by sex (22). The authors found a negative association between stress and adiposity in men and a null association in women when adjusting for race/ethnicity, age, and education (22). Their findings suggest that sex differences in behavioral response to stress (for example, overeating versus restrictive eating) or other sex differences may play an important role in the effect of stress on obesity (22).

Hruska and colleagues specifically examined the relationship between stress and adiposity in mothers and fathers of young children (23), which is among the few studies to do so. The researchers found that general stress, parenting stress, and household chaos were all positively associated with BMI, adjusting for age, sex, family size, and household income (23). The study had a few limitations, including that the sample was all Canadian and largely white, bringing generalizability into question .(23) Another study in Australia by Olstad and colleagues examined hair cortisol, perceived stress, and BMI in women and children in neighborhoods of low socioeconomic status (24). The women's hair cortisol was not associated with their perceived stress score nor their BMI, but their perceived stress was associated with their BMI (24). Mother and child hair cortisol were also significantly associated (24).

The mechanism by which stress influences adiposity is complex and not well understood. Numerous previous studies have identified key hormones involved in energy balance in the human body, including leptin, insulin, ghrelin, and other gut peptides (25). However, other studies have shown that voluntary behaviors can supersede our energy balance systems; these behaviors can be habitual or triggered by memories, challenges, or pleasure (25). Thus, psychological stress has been identified as a risk factor for obesity as it can trigger eating behaviors. Approximately 80% of people tend to change their eating habits when stressed; about half of people increase their caloric intake and the other half decrease, and those who overeat tend to gain weight (25). Furthermore, both human and animal studies have shown a preference for foods with greater fat and sugar content in stressful situations (25).

The emotional nervous system plays in integral role in the relationship between stress, eating behavior, and obesity. The prefrontal cortex, responsible for "thinking" (feelings and motivated behavior), coordinates with the hypothalamus (responsible for homeostatic energy balance) and the hippocampus (the emotional brain, responsible for emotion, motivation, addiction, and habits) to control eating behaviors (25).

Dysregulation of the hypothalamus-pituitary-adrenal (HPA) axis may also influence obesity. Disturbances in function of the HPA-axis, which produces the "stress hormone" cortisol, have been connected to metabolic syndrome and obesity (26). Prolonged exposure to cortisol can produce Cushing's syndrome (26), characterized my midsection weight gain and other symptoms. Early life stress and sleep deprivation may also influence the relationship between stress and obesity (26).

Stress and obesity have regularly been studied with obesity as the outcome, but it is possible that obesity can also have an effect on stress. Living life as an obese person exposes one to the stress of societal ridicule and rejection and may damage the relationship one has with oneself and their loved ones. Additionally, obesity puts stress on the body (27). Obesity is associated with widespread inflammation in the body, which is also related to stress and cortisol (27). Foss and Dyrstad hypothesize that obesity and stress interfere with one another though a positive feedback loop (27). This hypothesis, if true, would partially explain why it can be so difficult for some people to lose weight once they are already obese. The relationship between stress and obesity is complex and warrants further examination.

Social support as an effect modifier of the relationship between stress and obesity

Mechanism

A wide body of literature has shown the positive effects of social support on health and wellbeing. Research has demonstrated that those with stronger social support networks are less likely to have mental health disorders, with specific connection to improvements in stress, anxiety, depression, and well-being (28, 29). Social support has been shown to buffer the effects of stress on health, though not as dramatically as the direct impacts of social ties on health outcomes (30). In a 2011 article by Thoits, the author proposes seven possible mechanisms by which social ties buffer the effect of stress on health (as well as directly improve health): "social influence/social comparison, social control, role-based purpose and meaning (mattering), self-esteem, sense of control, belonging and companionship, and perceived support availability" (30). The latter, perceived social support, can be broken down into emotional, informational, and instrumental support: the sense that you have people around you to support your emotional needs (love, encouragement, etc.), informational needs (advice, problem-solving), and instrumental needs (behavioral or material assistance) (30). In other words, social support may buffer stress (which leads to health decline) by helping the individual vent about the stressor, make decisions, literally take some of the stressor off their plate, or simply by having a sense that they are supported, or social support may directly impact (mental) health.

Support networks and mothers

Parenting and motherhood bring a host of stressors that warrant a particular need for strong social networks. Mothers are a subpopulation of women with unique experiences that have the potential to both improve and diminish mental health. On one-hand, motherhood may instill a sense of purpose and meaning; however, being a mother also presents challenges that may hinder mental health. Mothers are additionally at risk for postpartum depression (PPD); the Centers for Disease Control and Prevention (CDC) reported an overall prevalence of PPD of 11.5% in 2012 in the United States (31). This represents a decrease from 15.5% in 2004, and decreases were shown across most ethnic groups (31).

The relationship between social support and mental health may be particularly complicated in low-income mothers, who may be immersed in social networks of others with high levels of stress, and in single mothers, who may lack the support of a partner (28). Single mothers and mothers without strong support networks may not only lack others to rely on for assistance with parenting tasks but also others to confide in about her stressors, help her de-stress, and construct solutions.

Social ties in Hispanic populations

Hispanic/Latino populations are known for their strong social networks and familial closeness, which makes them a group of particular interest for studying the effects of social support on stress and health. A study by Mulvaney-Day, Alegría, and Sribney found that family support and family cultural conflict were strongly associated with perceived mental health status in a sample of Latinos in the United States, while controlling for demographics, SES, and language preference (32). Family support was

weakly associated with perceived physical health, and the researchers found no association between physical nor mental health and neighborhood social cohesion (32). The researchers additionally concluded that language may play an important role in how Latinos in the United States establish and maintain social connections (32).

A later study by Perez and colleagues examined the relationship between neighborhood social cohesion and depression in Latinos and found an association (though not statistically significant) between neighborhood cohesion and decreased depression, with use of parks and other recreational facilities as an important effect modifier (33). Use of such amenities may instill an individual's sense of community belonging and increases the likelihood of meeting neighbors and other community members (33).

Another group of researchers, Rivera and colleagues, sought to examine the relationship between cultural conflict, family cohesion, and psychological distress in Latinos (34). At the aggregate level, the researchers found an association between family cohesion and lower psychological distress, but this effect was reversed (an increase in psychological distress) when cultural conflict was also present (34). However, these results vary by ethnic subgroup (34), highlighting the importance of examining outcomes in Latinos by country of origin. Differences in migration patterns by country of origin are highlighted by the authors as important factors in the maintenance of familial ties; Puerto Ricans have US citizenship, Cubans have political refugee status, Mexico has strong binational ties with the United States (34).

Many Latinos in the United States are foreign-born. One study showed that social ties in Latinos in the US vary not only by foreign-born status but by length of stay in the

United States (35). US-born Latinos had the strongest social ties, followed by foreign-born Latinos who had resided in the United States for fifteen years or longer; foreign-born Latinos who had resided in the US between five and nine years had the weakest social ties (35). Additionally, foreign-born Latinos reported greater support from family but lesser support from friends compared to their US-born counterparts (35). This suggests that the process of immigration disrupts social networks, which may be particularly detrimental to foreign-born Latina mothers.

Another study examined social ties in first- and second-generation Mexican women. First-generation women in the study remarked how important social connections to people already living in the US were in the immigration process, but also that those same connections sometimes became strained after arrival when the women (and their families, if they came together) needed lodging or employment (36). They remarked sharing these feelings with other recent immigrants, and persistent social isolation was also a theme, though some women found support in community groups and activities (36). In contrast, second-generation women moved more freely within larger social networks, though still reported a small, close-knit inner circle as their primary social support system (36). Second-generation women spoke of their experiences as racialized "others" and noted the importance of maintaining connections to their Mexican cultural roots (36). Second-generation women were also less likely to report transnational ties to social-familial connections back in Mexico (36). These results also suggest that foreign-born status is an important factor in the relationship between social ties/support and stress/mental health in Hispanic/Latino populations.

Immigrant Health Paradox

An immigrant health paradox, especially in Hispanics, has been observed for a variety of health outcomes, wherein recent immigrants have better health than both their US-born same-ethnicity counterparts and white Americans. Further research has shown, however, that such paradoxes cannot be generalized across different racial/ethnic groups nor among different Hispanic ethnic groups (37), suggesting many other factors beyond immigration affect the health of immigrants.

The present study

There is vast knowledge and research about stress and obesity, social support and stress, parenting and stress, Hispanic populations and social support, and immigration experiences and social support. However, the literature thus far has neglected to consider all these factors together. The present study aims to examine how social-familial support may modify the effect of parenting stress on BMI in Hispanic mothers of foreign-born and US-born status. This will contribute to our understanding of the relationship between stress and obesity in mothers, how social support may affect this relationship, and examine how immigrants to the United States may uniquely experience strains in social relationships that ultimately affect their social, mental, and physical health.

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