HHS Public Access
Author manuscript
Ethn Health. Author manuscript; available in PMC 2019 October 01.

Published in final edited form as:
Ethn Health. 2018 October ; 23(7): 737–751. doi:10.1080/13557858.2017.1294660.

Structural Social Support and Cardiovascular Disease Risk Factors in Hispanic/Latino Adults with Diabetes: Results from the Hispanic Community Health Study/Study of Latinos (HCHS/SOL)

Rosalba Hernandez, PhD[1], **Mercedes Carnethon, PhD**[2], **Aida L. Giachello, PhD**[2], **Frank J. Penedo, PhD**[3], **Donghong Wu**[4], **Orit Birnbaum-Weitzman, PhD**[5], **Rebeca Espinoza Giacinto, MA, MPH**[6], **Linda C. Gallo, PhD**[7], **Carmen R. Isasi, MD, PhD**[8], **Neil Schneiderman, PhD**[9], **Yanping Teng, MD, MSPH**[10], **Donglin Zeng, PhD**[10], and **Martha L. Daviglus, MD, PhD**[2,4]

[1]School of Social Work, University of Illinois at Urbana-Champaign, Urbana, IL

[2]Dept of Preventive Medicine, Northwestern University Feinberg School of Medicine, Chicago, IL

[3]Dept of Medical Social Sciences, Northwestern University Feinberg School of Medicine, University of Illinois at Chicago, Chicago, IL

[4]Institute for Minority Health Research, University of Illinois at Chicago, Chicago, IL

[5]Behavioral Medicine Research Center, University of Miami, Miami, FL

[6]SDSU/UCSD Joint Doctoral Program in Global Health, San Diego, CA

[7]Department of Psychology, San Diego State University, Chula Vista, CA

[8]Department of Epidemiology and Population Health, Albert Einstein College of Medicine, NY

[9]Department of Psychology, University of Miami, Miami, FL

[10]Collaborative Studies Coordinating Center, University of North Carolina at Chapel Hill, Chapel Hill, NC

Abstract

Objective(s)—Cross-sectional and longitudinal studies have yielded inconsistent findings on the associations of social support networks with cardiovascular health in Hispanic/Latino adults with diabetes. We examined the cross-sectional associations of structural social support and traditional cardiovascular disease (CVD) risk factors in a diverse sample of Hispanic/Latino adults with diabetes.

Research Design and Methods—This analysis included 2,994 adult participants ages 18–74 with diabetes from the Hispanic Community Health Study/Study of Latinos (HCHS/SOL—2008–2011). Select items from the Social Network Inventory (SNI) were used to assess indices of

Address for Correspondence: Rosalba Hernandez, PhD, School of Social Work, University of Illinois at Urbana-Champaign, 1010 W. Nevada Street, Urbana, IL, Tel: 217-300-1049; Fax: 217-244-5220, rherna17@illinois.edu.

Authors Hernandez, Carnethon, Giachello, Penedo, Wu, Birnbaum-Weitzman, Giacinto, Gallo, Isasi, Schneiderman, Teng, Zeng, and Daviglus have no conflict of interest.

structural social support, i.e., network size (number of children, parents, and in-laws) and frequency of familial contact. Standardized methods were used to measure abdominal obesity, BMI, hypertension, hypercholesterolemia, and smoking status. Multivariate regression was used to examine associations of structural support with individual CVD risk factors with demographics, acculturation, physical health, and psychological ill-being (depressive symptoms and anxiety) included as covariates.

Results—There were no significant cross-sectional associations of structural support indices with abdominal obesity, hypertension, hypercholesterolemia, or smoking status. There was a marginally significant (OR: 1.05; 95%CI 0.99–1.11) trend toward higher odds of obesity in participants reporting a larger family unit (including children, parents, and in-laws) and those with closer ties with extended family relatives (OR: 1.04; 95%CI 0.99–1.09).

Conclusions—Structural social support was marginally associated with higher odds of obesity in Hispanic/Latino adults with diabetes. Alternate forms of social support (e.g., healthcare professionals, friends, peers) should be further explored as potential markers of cardiac risk in Hispanics/Latinos with diabetes.

Keywords

diabetes; cardiovascular disease risk factors; social support; Hispanics/Latinos

1.0 Introduction

Hispanic/Latino adults experience greater burden due to diabetes, with a documented prevalence rate twice that of their non-Hispanic white counterparts (Cowie et al., 2009; Daviglus et al., 2012). They also experience disproportionately higher rates of poor glycemic control, diabetes-related microvascular complications, morbidity (e.g., retinopathy and kidney failure), and mortality (Campbell, Walker, Smalls, & Egede, 2012). The American Diabetes Association (ADA) has recently advised that optimization of diabetes-related outcomes is best achieved in patients with favorable levels of traditional cardiovascular disease (CVD) risk factors such as BMI, blood pressure, and lipids ("Standards of Medical Care in Diabetes-2015: Summary of Revisions," 2015). Unfortunately, Hispanic/Latino adults also experience high rates of these risk factors. The Hispanic Community Health Study/Study of Latinos (HCHS/SOL), the largest epidemiologic cohort study of US Hispanics/Latinos to date, demonstrated that approximately three-quarters of Hispanic/Latino adults have adverse levels of at least one major CVD risk factor (Daviglus et al., 2012). Relative to non-Hispanic whites, Hispanics/Latinos with diabetes are also less likely to achieve the recommended levels of other CVD risk factors such as blood pressure, lipid profiles, waist-to-hip ratio, and weight (Harris, 2000). Given the disproportionate burden of diabetes on Hispanics/Latinos and comorbid prevalence of other CVD risk factors, research is needed to identify protective factors to aid in preventing disease progression and the mounting numbers of diabetes-related complications.

Considering the strong familial ties, collectivist nature, and reliance on informal networks in the Hispanic/Latino culture, interpersonal psychosocial resources (i.e., social support) may be a particularly salient protective factor for promoting improved physiological functioning

(L. C. Gallo, Penedo, Espinosa de los Monteros, & Arguelles, 2009; Katiria Perez & Cruess, 2014). However, the cardiometabolic influence of social support remains unclear and underexplored in Hispanics/Latinos with diabetes due to the literature's near-exclusive focus on non-Hispanic whites (van Dam et al., 2005). Furthermore, previous studies examining the association of social support and indices of CVD risk in non-Hispanic whites with diabetes have reported inconsistent findings (Strom & Egede, 2012). Several studies report an inverse association between social support and clinical indicators of cardiovascular risk (Frosch, Uy, Ochoa, & Mangione, 2011; Strom & Egede, 2012), while others document no or detrimental health effects (Chlebowy & Garvin, 2006). Though several operational definitions exist, one prominent conception (indexed as *structural social support*) characterizes the social network size and frequency of personal contact within it (Lakey & Cohen, 2000). As network size/frequency increases, family-centered support (size and strength) can be accurately measured and often serves as a proxy for social connectedness, resulting in diminished perceptions of social isolation (Ashida & Heaney, 2008). Nonetheless, it remains unclear whether social support has beneficial or detrimental associations with physiological processes in persons with diabetes, particularly Hispanics/Latinos.

Prior research in Hispanic/Latino adults on the relationship between structural support and CVD risk factors has been limited by an insufficient examination of structural support as provided by the central family unit and extended family members, a singular focus on Hispanics/Latinos of Mexican descent and with low socioeconomic status (Fortmann, Gallo, & Philis-Tsimikas, 2011; Rees, Karter, & Young, 2010), and a lack of objective measures of CVD risk factors (Carranza & LeBaron, 2004; Wen, Shepherd, & Parchman, 2003). To our knowledge no study has examined the associations of structural social support (as provided by immediate or extended family members) with objectively measured CVD risk factors in a large heterogeneous sample of Hispanic/Latino adults with diabetes. Using data from HCHS/SOL (Sorlie et al., 2010) we examined the cross-sectional associations of structural social support and traditional CVD risk factors (blood pressure, lipids, body mass index, waist-to-hip ratio, and smoking status) in a sample of Hispanic/Latino adults with diabetes. We hypothesized that persons reporting greater levels of structural social support would display more favorable CVD risk indices independent of socio-demographic factors, self-rated physical health, and psychological distress (trait anxiety and depression symptoms).

2.0 Research Design and Methods

2.1 Study population and data source

The HCHS/SOL is a large community-based multi-center cohort study examining risk and protective factors for chronic illnesses, and quantifying patterns of morbidity and mortality, in a heterogeneous group of Hispanic/Latino adults. The diverse HCHS/SOL sample includes adults reporting ancestry from Mexico, Cuba, Puerto Rico, Dominican Republic, and Central and South American. Details of the HCHS/SOL recruitment and study protocol have been previously published (Sorlie et al., 2010). Briefly, original study enrollment occurred from March 2008 to June 2011 across four US regions (Bronx, New York; Chicago, Illinois; San Diego, California; Miami, Florida) and included a total of 16,415 adults between the ages of 18–74 years. The sampling design consisted of a two-stage clustering technique with oversampling of Hispanics/Latinos ages 45 to 74 years. A total of 9,872 households were selected, yielding a diverse Hispanic/Latino sample with distinct socioeconomic characteristics and varied national origins. Enrolled participants underwent an extensive baseline evaluation that included surveys (e.g., self-reported demographic factors, mental, and physical health), clinical examinations (e.g., phlebotomy, 2-hour glucose load), and guided review of all medication usage. Approval for the study was obtained through the Institutional Review Boards of at all affiliated study sites and written informed consent provided by all enrolled participants.

Analyses for the current study involved a total of 2,994 participants. Of the 16,415 HCHS/SOL participants who attended the baseline clinical visit, we excluded those not meeting the below criteria for having diabetes (n = 13,197) as well as those with missing data on CVD risk factors (n = 66), social support indices (n = 64), and key covariates of interest (n = 94). Participants were identified as having diabetes if they met the following criteria as defined by ADA guidelines: (a) fasting plasma glucose (FPG) ≥ 126 mg/dL, *and/or* (b) 2-hour oral glucose tolerance test (OGTT) level ≥ 200 mg/dL, *and/or* (c) HbA1c ≥ 6.5% (48mmol/mol), *and/or* (d) self-reported use of hypoglycemic medications (Inzucchi et al., 2010). In sensitivity analyses, participants unaware of their glucose dysregulation status and additionally not taking hypoglycemic medication were categorized as newly diagnosed cases. All others were identified as having a previous diagnosis of diabetes.

2.2 Study measures

Social support—Select items from the Social Network Inventory (SNI) (Cohen, Doyle, Skoner, Rabin, & Gwaltney, 1997) were used to assess structural social support. Three distinct indices were captured as follows: (1) total number of living children, parents, and in-laws; (2) extent of regular contact with children, parents, and in-laws (interaction at least once every 2 weeks); and (3) number of perceived close ties with extended family relatives (e.g., aunt, uncle, grandparents). The extent of regular familial contact was characterized as the total number children, parents, or in-laws the participant sees or talks to once every two weeks; continuous scores range from 0 to 11. A single item inquired about the number of extended family relatives with whom close ties were perceived. Response options ranged from 0 to 7 or more, with the survey item worded as, “How many other relatives (other than your spouse, parents & children) do you feel close to?”

Cardiovascular Disease Risk Factors—Standardized examination methods were used to obtain objective clinical measures of CVD risk factors. Details of the HCHS/SOL protocol and assessment methods have been published elsewhere (Daviglus et al., 2012; Sorlie et al., 2010). Briefly, BMI was calculated from staff-ascertained measures of height (to the nearest 0.1 kg) and weight (to the nearest centimeter). The waist-to-hip ratio was derived from abdominal and hip girth obtained using a Gulick II 150 and 250cm anthropometric tape measure with participants wearing light clothing. After a 5-minute rest period, three systolic and diastolic blood pressure readings were taken with participants in a seated position; the last two readings were averaged to generate the final blood pressure measure. After a 12-hour fast, venous blood specimens were drawn (~40 ml) for an assay of lipid profiles.

National guidelines were used to define adverse levels of CVD risk factors. Hypertension was defined as systolic blood pressure ≥140 mmHg, diastolic blood pressure ≥90 mmHg, or use of antihypertensive medication (Chobanian et al., 2003). Participants were identified as having hypercholesterolemia if they were currently taking lipid-lowering medication or if any of their recorded cholesterol levels were elevated (total: ≥240 mg/dL; LDL: ≥160mg/dL; or HDL: <40mg/dL) (Cleeman et al., 2001). Participants with a BMI of 30.0 or greater were categorized as obese (Ben-Menachem, 2007; Pi-Sunyer et al., 1998). Elevated abdominal obesity was defined as a waist-to-hip ratio ≥ 0.85 cm for women and ≥ 0.95 cm for men (Consultation, 2011). Lastly, smokers were defined as those self-reporting currently smoking cigarettes.

Covariates—Covariates included baseline age (in years), sex, educational attainment [less than high school (HS), HS graduate/general education degree (GED), greater than HS], income [<$20,000, $20,000 to $50,000, >$50,000, not reported], and Hispanic/Latino background (i.e., Mexican, Cuban, Puerto Rican, Dominican, Central American, South American, or other). We additionally considered acculturation status as measured using the modified 10-item Short Acculturation Scale for Hispanics (SASH) (Marin, Sabogal, Marin, Oterosabogal, & Perezstable, 1987). SASH subscales capturing language preference and ethnic social relations were treated as distinct domains and analyzed separately. Self-perceived physical health was assessed with the Physical Health Composite Scale (PCS) of the 12-item Short Form Health Survey (SF-12) (Ware, Kosinski, & Keller, 1996). Scores for the PCS range from 0 to 100, with lower scores indicating compromised or poorer self-perceived physical health. Psychological distress was captured through measurement of depressive symptoms [Center for Epidemiologic Studies Depression Scale (CES-D)] (Radloff, 1977) and trait anxiety [Spielberger State-Trait Anxiety Inventory (STAI)] (Spielberger, Gorsuch, & Lushene, 1970) (Cohen et al., 1997).

2.3 Statistical analyses

Data analysis was conducted using SAS 9.4 (SAS, Inc, Cary, North Carolina). Complex survey-specific procedures were performed across analyses to properly account for sample weights and the 2-stage sampling design involving clustering and stratification procedures (LaVange et al., 2010; Sorlie et al., 2010). Descriptive characteristics were computed for the total sample (n = 2,994) to summarize demographic and CVD risk factors, and to quantify structural support.

The relationship across indicators of structural support (i.e., (1) network size (children, parents, and in-laws), (2) extent of regular contact with children, parents, and in-laws, and (3) number of perceived close ties with extended family members) with each CVD risk factor was assessed using multivariate regression procedures. Effect modification for the association of structural support with CVD risk factors was explored by sex, Hispanic/Latino national origin, and diagnosis status (i.e., previously vs. newly diagnosed diabetes) with stratified analyses conducted only when significant interaction terms were observed (e.g., sex * social support and Hispanic/Latino group * social support). Separate regression models were used to examine the independent predictive utility of each structural support indicator (i.e., unadjusted models). Indicators were treated as continuous measures with results reported as per each 1-unit increase in network size, frequency of contact, or number of perceived close ties. Primary analyses used linear regression and considered each individual CVD risk factor, i.e., the main outcome variables, as a continuous measure. Four separate models were constructed. Model 1 was unadjusted. Model 2 adjusted for age, sex, Hispanic/Latino background, field center, income, education status, and acculturation. Model 3 conjointly adjusted for competing support indices to determine relative effects of network size versus familial interactions deemed as close-knit. Model 4 additionally adjusted for self-reported physical health and psychological distress (depressive symptoms and anxiety). Linear regression was not performed for smoking status which is a dichotomous outcome, nor was it feasible for the measure of waist-to-hip ratio due to low variance, (i.e., confidence interval ranged from 0.96 to 0.97).

The above analyses (Models 1–4) were repeated using logistic regression and dichotomous dependent variables (obesity, hypertension, hypercholesterolemia, current smoking, and abdominal obesity) as defined above. The odds ratios (ORs) and 95% confidence intervals (CIs) were estimated for changes in the prevalence of adverse values for each CVD risk factor as a function of each 1-unit increase in the support index of interest for that model. In sensitivity analyses, effect modification with diagnosis status (previously vs. newly diagnosed diabetes mellitus) was also explored to determine whether it differentially affected the relationship between structural support and CVD risk factors.

3.0 Results

3.1 Characteristics of the Study Sample

Table 1 displays the participant characteristics, and estimates the major CVD risk factors and social support, in this group with diabetes. Participants ranged in age from 18 to 74 years (M = 53.8, 95% CI = 53.0–54.7) with an approximately equal distribution by sex (54.6% female). The largest Hispanic/Latino group was those of Mexican heritage (37.4%) followed by those identifying as Cuban (21.4%), Puerto Rican (18.9%), Dominican (9.7%), Central (6.6%) and South American (3.1%). Overall, 45.8% had less than a high school education and 53.6% reported an annual income below $20,000. A majority of participants identified being married and/or living with a partner (53.4%), the remainder identified as being single (20.4%) or reported being separated, divorced, or widowed (26.2%). Of Hispanics/Latinos classified as married or living with a partner, 96.1% reported having at least one child, this compares to 87.3% reporting parenthood among those self-identified as single, divorced, or widowed. Only 7.9% percent of the total population reported having no children; 26.5% were married or living with a partner and 73.5% identified as being single/separated/ divorced/widowed. The average HbA1c value was 7.6% (60 mmol/mol), which is above the treatment target of 7% for those with a previous diagnosis of diabetes. The mean BMI was 32.1 kg/m^2, above the threshold for obesity. A total of 54.6% of participants were hypertensive, 67.9% had hypercholesterolemia, and 18.1% identified as current smokers. More detailed descriptive data for HCHS/SOL cohort participants as a whole has been previously published (Daviglus et al., 2012).

3.2 Association of Social Support with CVD Risk Factor Measures

Prior to modeling, we tested for and confirmed that there was no evidence of effect modification by sex, country of origin, or diagnosis status (i.e., previously vs. newly diagnosed diabetes mellitus), so we present all estimates pooled (see Supplementary Table 1 for details). Table 2 presents the results of our linear regression models for the associations of structural support indices with each CVD risk factor (with the exception of smoking status and waist-to-hip ratio). In our unadjusted models support indices were unrelated to BMI, systolic and diastolic blood pressure, and cholesterol. Adding potential confounders such as sociodemographic factors, perceived physical health, and psychological distress had negligible effects on our parameter estimates.

Table 3 presents odds ratios and 95% CIs for the prevalence of obesity, hypertension, hypercholesterolemia, smoking, and abdominal obesity. We identified a marginally significant trend toward higher odds of obesity in participants reporting a larger family unit (including children, parents, and in-laws) in the fully adjusted model (Model 4). A one-unit higher total number of living children, parents, and in-laws was marginally associated with 5% higher odds of having a BMI ≥30 kg/m^2 (OR: 1.05; 95% CI 0.99–1.11). A greater number of close ties with extended family relatives was also marginally associated with higher odds of obesity (OR: 1.04; 95% CI 0.99–1.09). No relationship was seen between regular contact with family members (children, parents, and in-laws) and CVD risk factors. In accordance with that published by Daviglus et al. (2012), correlations were in the expected direction for CVD risk factor indices and select demographic attributes (not shown). For instance, a negative association was evident between annual income and presence of adverse CVD risk factor indices.

4.0 Conclusions

To our knowledge, this is the first study to investigate whether familial structural support is associated with the presence of CVD risk factors in Hispanic/Latinos who have diabetes. There were no significant cross-sectional associations between structural support and any continuous measures of CVD risk, abdominal obesity, hypertension, hypercholesterolemia, or smoking status. There was, however, a non-significant trend toward greater odds of obesity (BMI≥30) with each unit increase in network size (inclusive of children, parents, and in-laws) only.

In a recent study of a subset of HCHS/SOL participants who underwent additional interviews about sociocultural risk and protective factors (the Sociocultural Ancillary Study) (Linda C Gallo et al., 2014), higher levels of both structural and functional social support were related to lower odds of prevalent diabetes even after adjustment for demographic factors, acculturation, and healthcare access (L. C. Gallo et al., 2015). Protective health effects of social support in persons with diabetes were further substantiated by a comprehensive systematic review that documented more favorable clinical outcomes (e.g., HbA1c, blood pressure, lipids) among patients with type 2 diabetes who reported higher levels of social support (Strom & Egede, 2012). These observational studies suggest that lifestyle modification programs may benefit from incorporation of components that promote or directly target social support domains as this may significantly bolster beneficial physiological effects (Powers et al., 2015; Vorderstrasse, Lewinski, Melkus, & Johnson, 2016). For instance, Strom and Egede (2012) offer the recommendation of garnering the power of technology to create virtual communities that expand social support networks and resources as a strategy to favorably impact diabetes self-management and related outcomes (Strom & Egede, 2012).

However, there is conflicting evidence challenging the current notion that social support is beneficial. For example, among the subset of participants of HCHS/SOL with diabetes who completed the Sociocultural Ancillary Study (Linda C Gallo et al., 2014), greater functional support was associated with poorer glycemic control as measured using HbA1c (Fortmann et al., 2015). Researchers have suggested that support networks may complicate self-care practices, or alternatively patients seeking heightened support may actively request this aid as a coping mechanism to mitigate disease-related distress (Lustman et al., 2000; Mayberry & Osborn, 2012). Even less is known about additional CVD risk factor patterns in the setting of diabetes, with findings from the current study deviating from those suggesting a protective influence of greater social support. A majority of the studies examining the association between social support and CVD risk factors have focused on populations of relatively healthy individuals (Uchino, 2006). In these healthy samples, greater social support is consistently associated with favorable metrics across cardiovascular risk factors, with positive influences across biological systems, e.g., autonomic nervous system activity, immune function, and endothelial function (Uchino, 2006). However, as previously stated findings have been less consistent when exploring CVD risk factor values within the context of varying levels of social support in adults with diabetes. A systematic review offered evidence that multifaceted measures of social support (not limited to that received by family relatives) are associated with more favorable levels of blood pressure and lipids in persons with diabetes (Strom & Egede, 2012). By contrast, other studies have reported no association of social support indices with clinical profiles and competing CVD risk factors (e.g., blood pressure, low-density lipoprotein) in adults with diabetes (Chlebowy & Garvin, 2006; Collins-McNeil, 2006; Tang, Brown, Funnell, & Anderson, 2008). Using the Medical Outcomes Survey Social Support Questionnaire (MOS-SSQ) to assess multiple domains of social support, Collins-McNeil et al. (2006) found no association between perceived levels of social support and the Framingham Coronary Heart Disease (CHD) Risk Prediction Score which incorporates multiple CVD risk factor levels (e.g., total cholesterol, smoking status) to predict 10-year risk for developing CHD (Collins-McNeil, 2006). Results of our current study are consistent with that of Collins-McNeil and others (Collins-McNeil, 2006).

Two major factors may be contributing to divergent findings in studies examining the link between social support and clinical outcomes in adults with diabetes. The first relates to the lack of standardization when defining and conceptualizing social support across studies. Some studies focus on the size and structure of the support network while others tap into cognitive appraisal of the support received as perceived by the recipient (Williams, Barclay, & Schmied, 2004). Furthermore, some researchers focus on familial support while others focus on support offered by friends and/or formal healthcare networks. A more unified conception of social support can be of benefit by allowing greater triangulation and cross-study comparison. A second variant across studies is the dissimilar populations being targeted, as they often have differential distributions across age and racial/ethnic attributes.

For instance, it is not altogether surprising that the saliency and salubrious influence of support networks may differ by age, as older adults may require heightened support as a consequence of diminished physical functioning or increased difficulty with activities of daily living (ADL).

Race/ethnicity may also contribute to the results obtained in the current study where larger networks were associated with greater odds of obesity. It is important to consider Hispanic/Latino cultural perspectives that may inform this phenomenon. Caballero (2011) presents the idea that loyalty to the family unit (often termed *familismo*—"the preference for maintaining a close connection with family") can take precedence over individual patient-related needs and demands of the self-care regimen. In an effort to promote and maintain harmonious familial relationships and cohesion, independent decisions concerning healthy food consumption and diabetes self-care tasks may suffer. Empirical evidence consistently highlights the cultural value that Hispanics/Latinos ascribe to familial relationships and their significant influence for emotional well-being and life satisfaction (Chang, Downey, Hirsch, & Lin, 2016). In a qualitative article by Hernandez et al. (2016) the family unit is described as, "*It [family] is the fundamental motive or driving force…for there to be love and harmony…Why would you want more?*". Nonetheless, if characterized by strife and conflict, the once protective nature of tightly woven familial bonds can exert amplified detrimental effects. In a culture that values interpersonal connectedness, disruption of familial structures of interdependence and solidarity can be more impactful when compared to cultures that place more value on attributes of independence and autonomy. More research is needed in this area with particular attention to plausible effect modifiers not previously tested.

Although further exploration is needed to elucidate the mechanistic pathway linking social support to the pathogenesis of CVD risk, social support may act as a buffer against physiological arousal for individuals exposed to stress inducing psychological challenges (Cohen & Wills, 1985). Greater social support may also facilitate engagement in healthy behaviors (Gallant, 2013). Future work should consider whether social support acts not as a direct stimulus against CVD risk, but whether it instead serves the role of an effect modifier. For example, detrimental cardiac-related effects of depression may be attenuated in the presence of high levels of social support. The interrelated contributions of psychological well-being and social support when examining cardiac health and disease prognosis in Hispanic/Latino adults also need to be examined.

Ascertainment of social support using limited items from the Social Network Inventory may not adequately capture the construct, given the multifaceted nature of social support and threats to measurement validity. Full assessment of indices of functional support such as emotional, tangible, and informational support may have yielded different results. Although HCHS/SOL participants were reporting the magnitude and perceived contact with the nuclear family unit (children, parents, and in-laws) and extended relatives, we are unable to distinguish whether these social connections were detrimental, as negative bonds may be accompanied by emotional closeness. Nonetheless, it is plausible that we are observing a true phenomenon whereby familial structural support does not explain the variance observed across CVD risk factors in Hispanic/Latino individuals with diabetes. Our results suggest the need to explore additional domains of social support beyond those offered by family members, e.g., friends, healthcare team (physician, nurse, medical assistant) or formal support from community health workers, as a means to reduce CVD risk. Or, it may suggest the need to heighten or more specifically target diabetes-related care toward patients reporting an expansive network size (inclusive of children, parents, and in-laws) or poor familial relationships, particularly if targeting weight loss and obesogenic factors.

The present study has multiple strengths. It included a large heterogeneous sample of Hispanic/Latino adults with objective measures of CVD risk factors. A rigorous approach was implemented to identify HCHS/SOL participants with diabetes with consideration of values of FPG, OGTT, and HbA1c, as well as self-reported use of hypoglycemic medication (although it was not possible to discriminate between cases of type 1 versus type 2 diabetes). Limitations include the cross-sectional design, which does not allow casual inferences. A single item from the SNI was used to capture the number of perceived close ties with extended family members making responses subject to multiple imprecisions including recall bias and heightening of measurement error. A multi-item measure of social support capturing several structural and functional domains could have enhanced psychometric properties. Finally, select items available from the Social Network Inventory did not gather detailed information on presence of siblings or enumeration of contact with specific non-traditional or extended family members (e.g., aunts vs. grandparents vs. siblings), which may differentially influence adherence to diabetes self-care activities and overall physiologic regulation. Indeed, a limitation of this study is that the measure on contact with extended family members captures a conflated computation that includes all members outside of the central family unit negating examination of unique contributions by individual members.

Notwithstanding the acknowledged limitations of the current study, ours is one of the few studies to examine (in the context of extant diabetes) the associations between structural social support and objectively measured CVD risk factors in a diverse sample of Hispanic/Latino adults. Healthcare practitioners should not be deterred from considering and targeting psychosocial factors, e.g., social support, which may exert protective effects on CVD risk factor values in patients with diabetes. We suggest only that familial ties may not be as salient for Hispanic/Latino adults in the context of diabetes and competing CVD risk factors, providing impetus to explore additional domains and sources of social support (i.e., healthcare professionals). Interventions seeking to optimize diabetes-related chronic disease management and risk profiles will want to go beyond inclusion of family members as this may not lead to effective elimination of CVD risk and diabetes burden. It is important that we continue to explore additional factors that may impact CVD risk in the Hispanic/Latino community.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

The Hispanic Community Health Study/Study of Latinos was carried out as a collaborative study supported by contracts from the National Heart, Lung, and Blood Institute (NHLBI) to the University of North Carolina (N01-

HC65233), University of Miami (N01-HC65234), Albert Einstein College of Medicine (N01-HC65235), Northwestern University (N01-HC65236), and San Diego State University (N01-HC65237). The following Institutes/Centers/Offices contribute to the HCHS/SOL through a transfer of funds to the NHLBI: National Center on Minority Health and Health Disparities, the National Institute of Deafness and Other Communications Disorders, the National Institute of Dental and Craniofacial Research, the National Institute of Diabetes and Digestive and Kidney Diseases, the National Institute of Neurological Disorders and Stroke, and the Office of Dietary Supplements. Rosalba Hernandez is funded by the National Heart, Lung, and Blood Institute (NHLBI) through award number 1K01HL130712-01A1. The authors thank the staff and participants of HCHS/SOL for their important contributions. A complete list of staff and investigators has been provided by Sorlie P., et al. in Ann Epidemiol. 2010 Aug; 20: 642-649 and is also available on the study website http://www.cscc.unc.edu/hchs/. D.W. and R.H. researched data. M.C., A.L.G., F.J.P., O.B., R.E.G., L.C.G., C. R. I., N.S., Y.T., and D.Z. reviewed/edited the full manuscript. M.L.D. researched data, contributed to discussion, and extensively reviewed/edited the manuscript. R.H. wrote the manuscript.

References

Ashida S, Heaney CA. Differential associations of social support and social connectedness with structural features of social networks and the health status of older adults. Journal of Aging and Health. 2008; 20(7):872–893. [PubMed: 18815414]

Ben-Menachem E. Clinical guidelines on the identification, evaluation, and treatment of overweight and obesity in adults: The evidence report. Epilepsia. 2007; 48:42–45. DOI: 10.1111/j.1528-1167.2007.01402.x

Caballero AE. Understanding the Hispanic/Latino patient. The American journal of medicine. 2011; 124(10):S10–S15. [PubMed: 21939793]

Campbell JA, Walker RJ, Smalls BL, Egede LE. Glucose control in diabetes: the impact of racial differences on monitoring and outcomes. Endocrine. 2012; 42(3):471–482. DOI: 10.1007/s12020-012-9744-6 [PubMed: 22815042]

Carranza S, LeBaron S. Adherence among Mexican Americans with type 2 diabetes: behavioral attribution, social support, and poverty. Family medicine. 2004; 36(8):539–540. [PubMed: 15343410]

ChangEC, , DowneyCA, , HirschJK, , LinNJ. Positive psychology in racial and ethnic minority groups: Theory, research, and practiceAmerican Psychological Association; 2016

Chlebowy DO, Garvin BJ. Social support, self-efficacy, and outcome expectations – Impact on self-care behaviors and glycemic control in Caucasian and African American adults with type 2 diabetes. Diabetes Educator. 2006; 32(5):777–786. DOI: 10.1177/0145721706291760 [PubMed: 16971711]

Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, Izzo JL, Prog, N. H. B. P. E. The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure – The JNC 7 Report. Jama-Journal of the American Medical Association. 2003; 289(19):2560–2572. DOI: 10.1001/jama.289.19.2560

Cleeman JI, Grundy SM, Becker D, Clark LT, Cooper RS, Denke MA, Expe, N. C. E. P. Executive summary of the Third Report of the National Cholesterol Education Program (NCEP) expert panel on detection, evaluation, and treatment of high blood cholesterol in adults (Adult Treatment Panel III). Jama-Journal of the American Medical Association. 2001; 285(19):2486–2497. Retrieved from <Go to ISI>://WOS:000168547600031.

Cohen S, Doyle WJ, Skoner DP, Rabin BS, Gwaltney JM. Social ties and susceptibility to the common cold. Jama-Journal of the American Medical Association. 1997; 277(24):1940–1944. Retrieved from <Go to ISI>://WOS:A1997XF08700038.

Cohen S, Wills TA. Stress, Social Support, and the Buffering Hypothesis. Psychological Bulletin. 1985; 98(2):310–357. DOI: 10.1037//0033-2909.98.2.310 [PubMed: 3901065]

Collins-McNeil J. Psychosocial characteristics and cardiovascular risk in African Americans with diabetes. Archives of Psychiatric Nursing. 2006; 20(5):226–233. DOI: 10.1016/j.apnu.2006.04.005 [PubMed: 17010826]

Consultation, W. E. Waist circumference and waist-hip ratio. 2011

Cowie CC, Rust KF, Ford ES, Eberhardt MS, Byrd-Holt DD, Li CY, Geiss LS. Full Accounting of Diabetes and Pre-Diabetes in the US Population in 1988–1994 and 2005–2006. Diabetes Care. 2009; 32(2):287–294. DOI: 10.2337/Dc08-1296 [PubMed: 19017771]

Daviglus ML, Talavera GA, Aviles-Santa ML, Allison M, Cai J, Criqui MH, Stamler J. Prevalence of Major Cardiovascular Risk Factors and Cardiovascular Diseases Among Hispanic/Latino Individuals of Diverse Backgrounds in the United States. Jama-Journal of the American Medical Association. 2012; 308(17):1775–1784. Retrieved from <Go to ISI>://WOS:000310726500024.

Fortmann AL, Gallo LC, Philis-Tsimikas A. Glycemic control among Latinos with type 2 diabetes: the role of social-environmental support resources. Health Psychology. 2011; 30(3):251. [PubMed: 21553968]

Fortmann AL, Roesch SC, Penedo FJ, Isasi CR, Carnethon MR, Corsino L, Giachello A. Glycemic control among US Hispanics/Latinos with diabetes from the HCHS/SOL Sociocultural Ancillary Study: Do structural and functional social support play a role? Journal of behavioral medicine. 2015; 38(1):153–159. [PubMed: 25107503]

Frosch DL, Uy V, Ochoa S, Mangione CM. Evaluation of a behavior support intervention for patients with poorly controlled diabetes. Archives of Internal Medicine. 2011; 171(22)

Gallant MP. Social Networks, Social Support, and Health-Related Behavior. The Oxford Handbook of Health Communication, Behavior Change, and Treatment Adherence. 2013:305.

Gallo LC, Fortmann AL, McCurley JL, Isasi CR, Penedo FJ, Daviglus ML, Carnethon MR. Associations of structural and functional social support with diabetes prevalence in US Hispanics/ Latinos: Results from the HCHS/SOL Sociocultural Ancillary Study. Journal of Behavioral Medicine. 2015; 38(1):160–170. DOI: 10.1007/s10865-014-9588-z [PubMed: 25107504]

Gallo LC, Penedo FJ, Carnethon M, Isasi C, Sotres-Alvarez D, Malcarne VL, Gonzalez P. The Hispanic community health study/study of Latinos sociocultural ancillary study: Sample, design, and procedures. Ethnicity & Disease. 2014; 24(1):77. [PubMed: 24620452]

Gallo LC, Penedo FJ, Espinosa de los Monteros K, Arguelles W. Resiliency in the face of disadvantage: do Hispanic cultural characteristics protect health outcomes? J Pers. 2009; 77(6): 1707–1746. DOI: 10.1111/j.1467-6494.2009.00598.x [PubMed: 19796063]

Harris MI. Health care and health status and outcomes for patients with type 2 diabetes. Diabetes Care. 2000; 23(6):754–758. DOI: 10.2337/diacare.23.6.754 [PubMed: 10840991]

Hernandez R, Carnethon M, Penedo FJ, Martinez L, Boehm J, Schueller SM. Exploring well-being among US Hispanics/Latinos in a church-based institution: a qualitative study. The Journal of Positive Psychology. 2016:1–11. [PubMed: 26640507]

Inzucchi S, Bergenstal R, Fonseca V, Gregg E, Mayer-Davis B, Spollett G, Assoc, A. D. Diagnosis and Classification of Diabetes Mellitus. Diabetes Care. 2010; 33:S62–S69. DOI: 10.2337/Dc10-S062 [PubMed: 20042775]

Katiria Perez G, Cruess D. The impact of familism on physical and mental health among Hispanics in the United States. Health Psychol Rev. 2014; 8(1):95–127. DOI: 10.1080/17437199.2011.569936 [PubMed: 25053010]

Lakey B, Cohen S. Social support theory and measurement. Social support measurement and intervention: A guide for health and social scientists. 2000:29–52.

LaVange LM, Kalsbeek WD, Sorlie PD, Avilés-Santa LM, Kaplan RC, Barnhart J, Ryan J. Sample design and cohort selection in the Hispanic Community Health Study/Study of Latinos. Annals of Epidemiology. 2010; 20(8):642–649. [PubMed: 20609344]

Lustman PJ, Anderson RJ, Freedland KE, De Groot M, Carney RM, Clouse RE. Depression and poor glycemic control: a meta-analytic review of the literature. Diabetes Care. 2000; 23(7):934–942. [PubMed: 10895843]

Marin G, Sabogal F, Marin BV, Oterosabogal R, Perezstable EJ. Development of a Short Acculturation Scale for Hispanics. Hispanic Journal of Behavioral Sciences. 1987; 9(2):183–205. DOI: 10.1177/07399863870092005

Mayberry LS, Osborn CY. Family support, medication adherence, and glycemic control among adults with type 2 diabetes. Diabetes Care. 2012; 35(6):1239–1245. [PubMed: 22538012]

Pi-Sunyer FX, Becker DM, Bouchard C, Carleton RA, Colditz GA, Dietz WH, Force, O. I. T. Executive summary of the clinical guidelines on the identification, evaluation, and treatment of overweight and obesity in adults. Journal of the American Dietetic Association. 1998; 98(10): 1178–1191. Retrieved from <Go to ISI>://WOS:000076317200027.

Powers MA, Bardsley J, Cypress M, Duker P, Funnell MM, Fischl AH, Vivian E. Diabetes self-management education and support in type 2 diabetes a joint position statement of the American Diabetes Association, the American Association of Diabetes Educators, and the Academy of Nutrition and Dietetics. Diabetes Educ. 2015; 41(4):417–430. [PubMed: 26047627]

Radloff LS. The CES-D scale A self-report depression scale for research in the general population. Applied psychological measurement. 1977; 1(3):385–401.

Rees CA, Karter AJ, Young BA. Race/ethnicity, social support, and associations with diabetes self-care and clinical outcomes in NHANES. Diabetes Educ. 2010; 36(3):435–445. [PubMed: 20332281]

Sorlie PD, Aviles-Santa LM, Wassertheil-Smoller S, Kaplan RC, Daviglus ML, Giachello AL, Heiss G. Design and Implementation of the Hispanic Community Health Study/Study of Latinos. Annals of Epidemiology. 2010; 20(8):629–641. DOI: 10.1016/j.annepidem.2010.03.015 [PubMed: 20609343]

Spielberger CD, Gorsuch RL, Lushene RE. Manual for the state-trait anxiety inventory. 1970

Standards of Medical Care in Diabetes-2015: Summary of Revisions. Diabetes Care. 2015; 38:S4–S4. DOI: 10.2337/dc15-S003

Strom JL, Egede LE. The Impact of Social Support on Outcomes in Adult Patients with Type 2 Diabetes: A Systematic Review. Current Diabetes Reports. 2012; 12(6):769–781. DOI: 10.1007/s11892-012-0317-0 [PubMed: 22949135]

Tang TS, Brown MB, Funnell MM, Anderson RM. Social support, quality of life, and self-care behaviors among African Americans with type 2 diabetes. Diabetes Educator. 2008; 34(2):266–276. DOI: 10.1177/0145721708315680 [PubMed: 18375776]

Uchino BN. Social support and health: A review of physiological processes potentially underlying links to disease outcomes. Journal of Behavioral Medicine. 2006; 29(4):377–387. DOI: 10.1007/s10865-006-9056-5 [PubMed: 16758315]

van Dam HA, van der Horst FG, Knoops L, Ryckman RM, Crebolder HF, van den Borne BH. Social support in diabetes: a systematic review of controlled intervention studies. Patient education and counseling. 2005; 59(1):1–12. [PubMed: 16198213]

Vorderstrasse A, Lewinski A, Melkus GDE, Johnson C. Social Support for Diabetes Self-Management via eHealth Interventions. Current Diabetes Reports. 2016; 16(7):1–8. [PubMed: 26699764]

Ware JE, Kosinski M, Keller SD. A 12-item short-form health survey – Construction of scales and preliminary tests of reliability and validity. Med Care. 1996; 34(3):220–233. DOI: 10.1097/00005650-199603000-00003 [PubMed: 8628042]

Wen LK, Shepherd MD, Parchman ML. Family support, diet, and exercise among older Mexican Americans with type 2 diabetes. Diabetes Educ. 2003; 30(6):980–993.

Williams P, Barclay L, Schmied V. Defining social support in context: a necessary step in improving research, intervention, and practice. Qualitative health research. 2004; 14(7):942–960. [PubMed: 15296665]

Author Manuscript

Author Manuscript

Author Manuscript

Table 1

Descriptive characteristics of HCHS/SOL study participants with diabetes

Total N = 2,994	***M* or % (95% CI)**
Sociodemographic Factors	
Age, *M* (95% CI)	53.8 (53.0, 54.7)
Female, %	54.6 (51.9, 57.2)
Hispanic/Latino Background, % (95% CI)	
Mexican	37.4 (33.3, 41.4)
Cuban	21.4 (17.3, 25.5)
Puerto Rican	18.9 (16.4, 21.3)
Dominican	9.7 (7.7, 11.7)
Central	6.6 (5.5, 7.8)
South American	3.1 (2.4, 3.8)
Other	2.9 (1.5, 4.3)
Education Level, % (95% CI)	
< High School	45.8 (43.0, 48.6)
High School graduate	22.4 (20.0, 24.7)
Greater than high school	31.8 (29.0, 34.6)
Income Level, % (95% CI)	
< $20,000	53.6 (50.7, 56.5)
$20,000–$50,000	37.8 (35.2, 40.4)
>$50,000	8.6 (6.8, 10.4)
Not reported	9.1 (7.7, 10.6)
Marital Status, % (95% CI)	
Single	20.4 (18.4, 22.5)
Married or Living with a partner	53.4 (50.6, 56.1)
Separated/Divorced/Widowed	26.2 (23.9, 28.5)
CVD Risk Factors	
Body Mass Index, *M* (95% CI)	32.1 (31.7, 32.4)
Waist-to-Hip Ratio, *M* (95% CI)	0.96 (0.96, 0.97)
Blood Pressure, *M* (95% CI)	
Diastolic	74.8 (74.2, 75.4)
Systolic	128.7 (127.7, 129.7)
Hypertension, % (95% CI)	54.6 (51.8, 57.4)
Serum Cholesterol, *M* (95% CI)	203.3 (200.6, 206.0)
Hypercholesterolemia, % (95% CI)	67.9 (65.6, 70.3)
Smoking Status, % (95% CI)	
Yes	18.1 (16.0, 20.2)
No	81.9 (79.8, 84.0)
Abdominal Obesity,* % (95% CI)	84.4 (82.3, 86.4)

Total N = 2,994	***M* or % (95% CI)**
Sociodemographic Factors	
Previous diabetes diagnosis, % (95% CI)	56.9 (54.3, 59.5)
Diabetes Medication Use, % (95%CI)	56.1 (53.4, 58.7)
Antihypertensive Drug Use, % (95%CI)	42.3 (39.5, 45.1)
Lipid Lowering Drug Use, % (95%CI)	34.8 (32.1, 37.6)
Structural Social Support, ***M*** **(95% CI)**	
Total number of children, parents, and in-laws	4.0 (3.9, 4.2)
Regular contact with children, parents, and in-laws	3.3 (3.1, 3.4)
Number of perceived close ties with extended family relatives	3.7 (3.6, 3.8)

*Defined as ≥0.85 cm for women and ≥0.95cm for men.

Table 2

Multivariate Linear Association of Structural Support Indices and each Cardiovascular Disease (CVD) Risk Factor

	Major Cardiovascular Disease Risk factors							
	BMI		**Systolic BP**		**Diastolic BP**		**Cholesterol**	
M1: Unadjusted	β (SE)	*p*	β (SE)	*p*	β (SE)	*p*	β (SE)	*p*
Total number (children, parents, in-laws)	0.08 (0.08)	0.35	−0.29 (0.29)	0.32	0.11 (0.14)	0.45	−0.43 (0.68)	0.53
Regular contact (children, parents, in-laws)	0.01 (0.09)	0.93	−0.13 (0.34)	0.70	−0.03 (0.15)	0.86	0.08 (0.72)	0.92
Close ties with extended family relatives	−0.06 (0.07)	0.39	0.01 (0.20)	0.98	0.02 (0.10)	0.86	0.70 (0.54)	0.19
M2								
Total number (children, parents, in-laws)	0.08 (0.10)	0.41	0.44 (0.27)	0.11	0.23 (0.16)	0.16	0.01 (0.67)	0.99
Regular contact (children, parents, in-laws)	−0.02 (0.11)	0.89	0.47 (0.30)	0.12	0.08 (0.17)	0.65	0.02 (0.69)	0.97
Close ties with extended family relatives	0.01 (0.08)	0.99	−0.16 (0.17)	0.33	−0.08 (0.11)	0.45	0.16 (0.49)	0.75
M3								
Total number (children, parents, in-laws) *	0.09 (0.09)	0.33	0.44 (0.27)	0.11	0.23 (0.16)	0.17	−0.02 (0.67)	0.98
Regular contact (children, parents, in-laws) *	0.02 (0.10)	0.85	0.49 (0.31)	0.11	0.09 (0.18)	0.62	−0.10 (0.68)	0.89
Close ties with extended family relatives †	0.02 (0.08)	0.84	−0.16 (0.17)	0.35	−0.08 (0.11)	0.47	0.12 (0.50)	0.82
M4: Fully Adjusted								
Total number (children, parents, in-laws) *	0.08 (0.09)	0.37	0.45 (0.27)	0.09	0.22 (0.16)	0.17	−0.06 (0.67)	0.93
Regular contact (children, parents, in-laws) *	0.03 (0.10)	0.81	0.47 (0.31)	0.13	0.09 (0.17)	0.61	−0.05 (0.68)	0.94
Close ties with extended family relatives †	0.03 (0.08)	0.72	−0.20 (0.17)	0.26	−0.08 (0.11)	0.49	0.22 (0.51)	0.67

M1: Unadjusted model.

M2: Adjusted for age, sex, Hispanic/Latino background, field center, income, education level, marital status, and acculturation.

M3: Adjusted for age, sex, Hispanic/Latino background, field center, income, education level, marital status, acculturation, physical health, and competing structural social index.

M4: Adjusted for age, sex, Hispanic/Latino background, field center, income, education level, marital status, acculturation, physical health (SF-12), structural social index, depressive symptoms, and anxiety.

* Number of perceived close ties with extended family relatives included as a covariate in multivariate adjusted models, i.e., M3 and M4.

† Total number of children, parents, and in-laws included as a covariate in multivariate adjusted models, i.e., M3 and M4.

Table 3

Logistic Regression of Association of Structural Support Indices and Adverse Cardiovascular Disease (CVD) Risk Factors

	Major Cardiovascular Disease Risk factors				
	BMI≥30	**Hypertension**	**Hypercholesterolemia**	**Current Smoker**	**Abdominal Obesity**
M1: Unadjusted	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Total number (children, parents, in-laws)	1.04 (0.99–1.10)	0.92 (0.88–0.97)	0.96 (0.92–1.02)	0.91 (0.84–0.98)	0.94 (0.88–1.01)
Regular contact (children, parents, in-laws)	1.03 (0.98–1.09)	0.92 (0.87–0.97)	0.93 (0.88–0.98)	0.90 (0.83–0.97)	0.94 (0.88–1.01)
Close ties with extended family relatives	1.02 (0.98–1.06)	0.99 (0.95–1.02)	1.02 (0.98–1.06)	0.97 (0.92–1.02)	0.97 (0.92–1.02)
M2					
Total number (children, parents, in-laws)	1.04(0.98–1.11)	0.99(0.93–1.05)	0.98(0.92–1.04)	0.98(0.89–1.07)	0.97(0.89–1.05)
Regular contact (children, parents, in-laws)	1.02(0.95–1.09)	0.97(0.91–1.03)	0.94(0.89–1.00)	0.98(0.89–1.07)	0.96(0.89–1.04)
Close ties with extended family relatives	1.03(0.98–1.08)	0.97(0.93–1.01)	1.03(0.98–1.08)	1.00(0.94–1.06)	1.01(0.95–1.06)
M3					
Total number (children, parents, in-laws) *	1.05(0.99–1.11)	0.99(0.94–1.06)	0.98(0.92–1.04)	0.98(0.90–1.07)	0.97(0.89–1.05)
Regular contact (children, parents, in-laws) *	1.03(0.96–1.09)	0.98(0.92–1.05)	0.94(0.89–1.00)	0.98(0.89–1.08)	0.97(0.90–1.05)
Close ties with extended family relatives †	1.04(0.99–1.09)	0.97(0.93–1.02)	1.03(0.98–1.08)	1.00(0.94–1.06)	1.01(0.95–1.07)
M4: Fully Adjusted					
Total number (children, parents, in-laws) *	**1.05(0.99–1.11)**	1.00(0.94–1.06)	0.98(0.92–1.04)	0.97(0.89–1.07)	0.97(0.89–1.05)
Regular contact (children, parents, in-laws) *	1.03(0.96–1.09)	0.98(0.92–1.04)	0.94(0.89–1.00)	0.99(0.89–1.09)	0.97(0.90–1.05)
Close ties with extended family relatives †	**1.04(0.99–1.09)**	0.97(0.92–1.01)	1.03(0.98–1.08)	1.01(0.95–1.07)	1.01(0.95–1.07)

M1: Unadjusted model.

M2: Adjusted for age, sex, Hispanic/Latino background, field center, income, education level, marital status, and acculturation.

M3: Adjusted for age, sex, Hispanic/Latino background, field center, income, education level, marital status, acculturation, physical health, and competing structural social index.

M4: Adjusted for age, sex, Hispanic/Latino background, field center, income, education level, marital status, acculturation, physical health (SF-12), structural social index, depressive symptoms, and anxiety.

* Number of perceived close ties with extended family relatives included as a covariate in multivariate adjusted models, i.e., M3 and M4.

† Total number of children, parents, and in-laws included as a covariate in multivariate adjusted models, i.e., M3 and M4.