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# The Impact of Neighborhood Socioeconomic Position on Prevalence of Diabetes and Pre-diabetes in Older Latinos: The Sacramento Area Latino Study on Aging

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## Abstract

Diabetes is a leading cause of morbidity and mortality in Latinos, but few studies of disease risk in this subpopulation examine both area-level socioeconomic position and its association with individual-level risk factors. This study sought to examine the cross-sectional relationship between neighborhood socioeconomic position (NSEP) and prevalent diabetes and pre-diabetes status among older Latinos. Longitudinal health data were collected from 1,789 participants in the Sacramento Area Latino Study on Aging (SALSA). Among SALSA participants, higher NSEP was associated with lower diabetes prevalence ($p = 0.001$). Adjustment for BMI and other individual-level factors did not affect this relationship. No association was observed between NSEP and pre-diabetes in both unadjusted and adjusted models. Neighborhoods with higher SEP had a lower prevalence of diabetes. This study highlights the importance of considering neighborhood factors that may place older Latinos at high risk for this disease.

### Keywords

neighborhood; diabetes; Latinos; aging

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Type 2 diabetes disproportionately impacts the Latino community, and is a leading cause of preventable mortality and morbidity for Latinos (Espinoza, Jung, & Hazuda, 2013). In the

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United States, diabetes was the 5th leading cause of death for Latinos in 2010; the age-adjusted prevalence of diabetes for adult Latinos was 17.9% and the age-adjusted death rate for diabetes was 27.1 years (National Center for Health Statistics, 2013; National Center for Injury Prevention, 2007; Schiller, Lucas, Ward, & Peregoy, 2012).

It is well established that neighborhood- and community-level factors impact the physical and psychosocial health of individuals. These neighborhood effects are linked to chronic disease risk, cardiovascular and diabetes-related health outcomes (Diez Roux & Mair, 2010). Evidence suggests that neighborhood-level geographic and social factors may disproportionately impact the health of ethnic and/or racial minorities in the United States. For example, the Black Women's Health Study found that lower neighborhood socioeconomic position (NSEP) was associated with increased incident diabetes over 12 years of follow-up (Coogan et al., 2010; Krishnan, Cozier, Rosenberg, & Palmer, 2010). NSEP has also been associated with other diabetes-related risk factors such as decreased levels of physical activity, and higher prevalence of hypertension, weight gain and metabolic syndrome (Boone-Heinonen et al., 2011; Chichlowska et al., 2008; Coogan et al., 2010; Krishnan et al., 2010; Mujahid, Diez Roux, Cooper, Shea, & Williams, 2011).

Although studies have correlated individual- and household-level socioeconomic position (SEP) with diabetes risk, none have focused on the older, Latino population, nor have any examined the importance of both neighborhood and individual socioeconomic position (SEP) on diabetes risk and outcomes in older adults. Similarly, the existing literature on NSEP and health has focused on different pathways for diabetes-related outcomes, but there has been little examination of the association between NSEP and diabetes status in older Latinos.

Lower individual SEP is associated with increased risk of diabetes in older adults. It is also related to poorer diabetes-related and cardiovascular outcomes. Furthermore, low SES may disproportionately increase the likelihood of poor long-term outcomes among elderly Latinos: a cross-sectional study found that low SEP was associated with increased self-reported diabetes-related complications such as retinopathy, nephropathy and cardiovascular disease in Latinos, as compared to non-Latino Whites (Thomson, Nuru-Jeter, Richardson, Raza, & Minkler, 2013).

The relationship between NSEP and diabetes represents a significant public health concern, since Latinos are disproportionately more likely than non-Hispanic Whites to live in poverty (Lopez & Cohn, 2011; Macartney, Bishaw, & Fontenot, 2013), and also more likely to suffer from diabetes (Hertz, Unger, & Ferrario, 2006; Romero, Romero, Shlay, Ogden, & Dabelea, 2012; Sharma, Malarcher, Giles, & Myers, 2004). In addition, it is estimated that Latinos will make up one third of the US population by 2050, with older Latinos (age >64+) comprising 20% of this large and growing minority population (Passel, Cohn, & Lopez, 2011; Thomson et al., 2013; Vincent & Velkoff, 2010).

Nativity is an important factor in examining diabetes-related health outcomes in Latinos. Differences in cardiovascular mortality rates have been observed between US- born versus Mexico-born Latinos. In the San Antonio Heart Study (SAHS), US-born Latino diabetics had a higher risk of all-cause and CVD-related mortality than non-Latino White diabetics (Hunt et al., 2002). In contrast, diabetic Latinos born in Mexico had a similar risk of all-cause and CVD-related mortality than diabetic non-Latino Whites, suggesting that birthplace is an important factor for the Latino SAHS participants in assessing their risk of CVD mortality. Similarly, findings from the National Health and Nutrition Examination Survey (NHANES) III indicated that birthplace, in addition to language preference and gender, was associated with differential coronary heart disease mortality risk in Latinos (Sundquist & Winkleby, 1999). US-born, Spanish-speaking Latinos had the highest 10-year estimated coronary heart disease mortality risk, whereas Mexico-born Latinos had the lowest. The authors speculate that it may be socioeconomic: these individuals may not have adequate opportunities (education, occupation, language skills) to compete in the US.

This study examines the cross-sectional relationship between NSEP and prevalent diabetes and pre-diabetes status among older Latinos in the Sacramento Area Latino Study on Aging (SALSA). It was hypothesized that lower NSEP would be associated with a higher prevalence of diabetes and pre-diabetes in the study population.

## Methods

### Study Participants

Participants were from the Sacramento Area Latino Study on Aging (SALSA), a longitudinal cohort study of physical and cognitive impairment and cardiovascular diseases in community-dwelling older Mexican Americans residing in Sacramento Metropolitan Statistical Area (Haan et al., 2003). Recruitment occurred between 1998–1999 and included 1,789 participants between the ages of 60–101 years at baseline. Every 12 to 15 months, interviews, biological and clinical data were collected on participants during in-home visits, with a maximum of six follow-ups. The Institutional Review Boards (IRB) at the University of Michigan, the University of California, San Francisco, and the University of California, Davis approved the SALSA study and along with the principles of the Helsinki Declaration. All participants provided appropriate informed consent annually.

Participants with missing information ($n$ = 10) or outliers ($n$ = 2) on key study variables were excluded, yielding a final sample size of 1,777 participants.

### Measures

For this analysis, we used two levels of data whereby individuals were nested within neighborhoods.

#### Individual-level data

**Assessment of type-2 diabetes and pre-diabetes status:** during the baseline examination, fasting blood was collected and analyzed for glucose levels. Prevalent type-2 diabetes was ascertained by a self-report of a physician diagnosis of diabetes, documented use of prescription diabetes medication from a medicine cabinet inventory, and/or a fasting glucose level ≥126 mg/dl. Pre-diabetes was ascertained by a fasting blood glucose level between 100 mg/dL and 125 mg/dL.

**Assessment of other clinical and biological data:** During the baseline examination, systolic (SBP) and diastolic (DBP) blood pressures were measured using a digital blood pressure monitor. Hypertension was ascertained by a self-report of a physician diagnosis of hypertension, use of hypertension medication, and/or a systolic blood pressure ≥140 mmHg or a diastolic blood pressure ≥ 90 mmHg. Trained interviewers measured study participants' standing height and weight; body mass index (BMI; $kg/m^2$), was calculated as weight/ $height^2$. Depressive symptoms were assessed using the 20-item version of the Center for Epidemiologic Studies- Depression Scale (CES-D), with scores ranging from 0–60. We defined elevated depressive symptoms on the clinical cutoff of 16 (i.e. CES-D score ≥ 16). Participants reported the number of hours per week they engaged in certain physical activities (e.g. doing yard work, heavy housework, and walking around neighborhood), which were combined into a summary physical activity score and used as a continuous variable. At baseline, participants also reported the presence of any cardiovascular disease (CVD), ascertained via self-report of a physician diagnosis of any of the following conditions: myocardial infarction (MI), angina pectoris, stroke, heart failure, intermittent claudication, atrial fibrillation, deep vein thrombosis, or heart/coronary catheterization.

**Assessment of socio-demographics:** at baseline, demographic profiles of participants were constructed based on self-reports of current age, gender (M/F), nativity (SALSA participants were born in US or Mexico), and marital status (married, single, other).

**Assessment of individual-level SEP measures:** several individual-level SEP factors were also measured at baseline. Each participant self-reported level of education (number of years completed), gross past-month household income, and occupation. We created a variable that grouped gross past-month household income into low (<$1,500) and high (≥ $1,500) categories, and another variable that categorized participant occupation as manual, non-manual, or other (a category that included housewives, the unemployed, etc.).

### Neighborhood-level data

**Neighborhood socioeconomic position (NSEP):** In line with prior literature, we operationalized neighborhoods as census tracts (Mujahid et al., 2011; Sheffield & Peek, 2009; Wight et al., 2006). Participants' baseline addresses were geocoded to the 2000 US Census tracts, with participant data subsequently linked to census data. We utilized factor analysis to construct a NSEP score using previously validated procedures (Wight et al., 2006). The factor analysis was performed with census tract-level socioeconomic variables using PROC FACTOR in SAS with a promax rotation. Neighborhood characteristics that showed a loading greater than 0.4 in either a positive or negative direction were selected, z-score standardized for scale consistency, reverse coded, and then summed to create a NSEP score (mean (standard deviation) = 22.4 (4.8) and range = 0–30.6). On the basis of the factor loading cutoff, we included 6 variables in the NSEP analysis: the percentage of individuals 25 years of age or older without a high school diploma; the percentage of the population living below the poverty line; the percentage of individuals ≥16 years of age who at one time had been in the work force and who were unemployed; the percentage of households that owned their home, percentage of housing units that were vacant; and the median number of rooms in the household. Higher NSEP scores indicated higher neighborhood socioeconomic status. Further details on the statistical methods resulting in NSEP have been published elsewhere (Zeki Al Hazzouri et al., 2011).

### Statistical Analysis

We compared characteristics such as age, gender, nativity status, and BMI, across NSEP quartiles by diabetes status. We used chi-square tests to compare the frequencies of categorical variables, and t-tests to compare the means of continuous variables across diabetes status.

We fit multilevel multinomial logistic regression models to assess the relationship between NSEP and the three level diabetes status outcome. For analysis, we used NSEP score in units of the interquartile range = 7. Analyses were performed separately to include adjustment for either BMI or waist circumference (adjustment for both was not possible due to collinearity). We tested three-way interactions between neighborhood score, nativity, and obesity measures to assess whether relationships between these covariates differed between individuals born in Mexico compared to those born in the US. These interactions were not initially significant. We ran analyses stratified by nativity based on literature that indicates differences exist in health outcomes for Latinos according to their nativity status (Boone-Heinonen et al., 2011; Garcia et al., 2012; Kershaw et al., 2011). We found some suggestive evidence that the NSEP-diabetes status association was modified by BMI and waist circumference among those born in Mexico, but not for those born in the US. Consequently, in subsequent regressions, we included two-way interaction terms to account for effect modification between neighborhood score and the obesity measures (but only for the models for Mexico-born participants). For interpretation purposes, in these models we centered NSEP, BMI, and waist circumference at their median values for the SALSA sample.

Analyses were carried out using SAS version 9.2 (SAS Institute, Cary, NC, USA) and Stata version 11 (Stata Corp LP, College Station, TX, USA). All statistical tests were two-tailed; $P<0.05$ was considered statistically significant.

## Results

### Descriptive Statistics

At baseline, the prevalence of diabetes was 33% and of pre-diabetes was 17.5% (Table 1). Of the Latinos with diabetes a higher proportion were born in the US (55.3%) than in Mexico (44.7%). In contrast, 55.5% of those without diabetes were born in Mexico. Among those with pre-diabetes, the proportions were approximately 50/50. Diabetics and pre-diabetics had a higher mean body mass index (BMI) than non-diabetics. Diabetics tended to report less physical activity and less alcohol use than non-diabetics.

Individual level factors related to socioeconomic position (SEP) variables such as education, income and occupation, were not associated with diabetes status (Table 1). In comparison, NSEP was associated with diabetes status (Table 2). Lower NSEP was associated with a higher prevalence of diabetes, whereas a higher NSEP was associated with lower prevalence of diabetes.

**Association between neighborhood socioeconomic position (NSEP) and diabetes status—**Table 3 shows the association between NSEP and prevalent diabetes status, based on the three-level multinomial logistic regression models with covariate adjustment. Higher NSEP was associated with lower diabetes prevalence. Adjustment for BMI and other individual factors did not affect this relationship (OR=0.76; 95% CI: 0.61, 0.93). In the models with adjustment for waist circumference, higher NSEP was also significantly associated with lower diabetes prevalence. No association was observed between NSEP and pre-diabetes in unadjusted or adjusted models.

**Nativity status (US born versus Mexico born): Interaction between neighborhood socioeconomic position (NSEP), body mass index (BMI) and waist circumference (WC)—**Table 3 shows the association between NSEP and prevalent diabetes status among US-born participants. Participants residing in neighborhoods with higher NSEP had lower risk of diabetes at baseline. When other covariates (i.e. age, BMI, gender, years of education, physical activity, depression, hypertension and cardiovascular disease) were added to the model, no significant association (OR= 0.79; 95% CI: 0.59, 1.05) was observed between NSEP and diabetes. No association (OR=1.14; 95% CI: 0.82, 1.59) was observed between NSEP and pre-diabetes. In the models adjusting for waist circumference, NSEP was also not significantly associated with prevalence of pre-diabetes or diabetes.

Among SALSA study participants born in Mexico, a higher NSEP was associated with a lower prevalence of pre-diabetes ($p = 0.04$). Adjustment for other covariates did not change this relationship. Higher NSEP was also associated with a lower prevalence of diabetes ($p = 0.03$), but when covariates (i.e. age, gender, education, physical activity, depression, hypertension and cardiovascular disease, BMI/waist circumference) were added to the model, no association was observed. We included two-way interactions to account for potential effect modification between NSEP and obesity measures (as operationalized by the BMI and waist circumference measures). In these models, there was some suggestive evidence of a neighborhood effect modification. Larger waist circumference was associated with a higher prevalence of pre-diabetes and diabetes. Those with larger waist circumference and live in a neighborhood with a higher NSEP have a higher prevalence of pre-diabetes than those who live in a neighborhood with a lower NSEP ($p = 0.03$, Figure 1a). There was a similar association with BMI, but less strong of an effect. Because these tests of the interactions were based on two separate hypothesis tests, one testing for an interaction between NSEP and BMI for pre-diabetes vs. normal and the other testing for an interaction between NSEP and BMI for diabetes vs. normal, the probability of identifying at least one significant interaction due to chance increases as more hypotheses are tested. A simultaneous likelihood ratio test was performed to test the null hypothesis of no interaction between NSEP and BMI. The data do not provide enough evidence to reject the null hypothesis of no interaction ($p = 0.23$). Likewise, this test was also not significant for testing the null hypothesis of no interaction between NSEP and waist circumference ($p = 0.08$). A Bonferroni correction was made to adjust for the chances of obtaining false-positive results (type I errors) when several hypothesis tests are performed simultaneously. 97.5% confidence intervals for the BMI and waist circumference odds ratios at various levels of

NSEP were calculated and displayed in Figure 1a and Figure 1b. These 97.5% confidence intervals provide a simultaneous 95% confidence interval for the BMI or waist circumference odds ratios based on a Bonferroni adjustment.

## Discussion

Our objective was to examine the relationship between NSEP and diabetes and pre-diabetes prevalence in a cohort study of older Mexican Americans living in Sacramento. Higher NSEP was associated with a lower prevalence of diabetes. Adjustment for individual-level factors, such as age, gender, nativity, education, physical activity, depression, hypertension and cardiovascular disease, did not change this relationship. Our results support the hypothesis that individuals who live in neighborhoods with higher NSEP score have a lower risk of having diabetes.

Similar to other studies, we found a significant association between diabetes status and NSEP (Krishnan et al., 2010). Our results are consistent with the BWHS findings, which both suggested that the risk of incident diabetes was associated with a lower NSEP in unadjusted and adjusted models controlling for individual factors. In contrast to the BWHS, however, we did not find a significant association between individual level factors and diabetes or pre-diabetes. It may be that for older Mexican Americans, the neighborhood where they reside plays a larger role in their health. For example the lack of access to healthy foods and/or safe places to be physically active may contribute to conditions in their community that may impede a healthier lifestyle. Thus a low NSEP negatively impacts older Mexican Americans health as observed in the high prevalence of diabetes and pre-diabetes in this cohort. Therefore, innovative outreach programs that reduce diabetes in older Latino communities are needed. For example, providing a one day “mini-medical school” for older Latinos to learn about critical health issues (such as pre-diabetes and diabetes) in their native language and to discuss these topics with bilingual health care professionals from medical universities, clinics and the community, may be the ideal setting to provide the health information that older Latinos need.

Studies have shown that nativity status is associated with cardiovascular related risk factors such as diabetes in Latino populations (Pabon-Nau, Cohen, Meigs, & Grant, 2010; Rodriguez, Hicks, & Lopez, 2012). Our results also found a significant association between nativity for participants born in Mexico, NSEP and diabetes status. These results are consistent with other studies that have found differences in cardiovascular disease risk factors by nativity status (Kershaw, Greenlund, Stamler, Shay, & Daviglus, 2012; Pabon-Nau et al., 2010). It may be that Latino migrants are healthier than their US born counterparts. This has been referred to as the healthy migrant effect, that is, migrants are on average healthier than their US ethnic/racial counterparts but over time this health advantage diminishes with each subsequent generation.

Since this is a cross-sectional study of the relationship between NSEP and diabetes status, temporal ambiguities may exist between NSEP and diabetes status, and no causal inferences can be made. Limitations include reliance on participant self-report, the potential for selection bias. In addition, it may be possible that we did not include other unknown factors that may increase the risk of diabetes and pre-diabetes. In our analysis we attempted to control for known risk factors.

SALSA is a well-designed, population-based study examining cognitive impairment, dementia and cardiovascular disease (CVD) as well as risk factors such as diabetes in elderly Latinos. It is also one of the first to examine NSEP and diabetes status in a cohort of older Mexican Americans and since the SALSA participants are a stable cohort that have resided in the same community for several years, we anticipate little bias due to repatriation to country of origin. It includes extensive clinical, medical and social measures. Diabetes is a leading cause of morbidity and mortality in Latinos, so it is critical that we understand both individual and neighborhood factors that place individuals at high risk for the disease.

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## References

Boone-Heinonen J, Diez Roux AV, Kiefe CI, Lewis CE, Guilkey DK, Gordon-Larsen P. Neighborhood socioeconomic status predictors of physical activity through young to middle adulthood: the CARDIA study. Social Science and Medicine. 2011; 72(5):641–649.10.1016/j.socscimed.2010.12.013 [PubMed: 21316829]

Chichlowska KL, Rose KM, Diez-Roux AV, Golden SH, McNeill AM, Heiss G. Individual and neighborhood socioeconomic status characteristics and prevalence of metabolic syndrome: the Atherosclerosis Risk in Communities (ARIC) Study. Psychosomatic Medicine. 2008; 70(9):986–992.10.1097/PSY.0b013e318183a491 [PubMed: 18799428]

Coogan PF, Cozier YC, Krishnan S, Wise LA, Adams-Campbell LL, Rosenberg L, Palmer JR. Neighborhood socioeconomic status in relation to 10-year weight gain in the Black Women's Health Study. Obesity (Silver Spring). 2010; 18(10):2064–2065.10.1038/oby.2010.69 [PubMed: 20360755]

Diez Roux AV, Mair C. Neighborhoods and health. Annals of the New York Academy of Sciences. 2010; 1186:125–145.10.1111/j.1749-6632.2009.05333.x [PubMed: 20201871]

Espinoza SE, Jung I, Hazuda H. The Hispanic Paradox and Predictors of Mortality in an Aging Biethnic Cohort of Mexican Americans and European Americans: The San Antonio Longitudinal Study of Aging. Journal of the American Geriatrics Society. 2013; 61(9):1522–1529.10.1111/jgs.12421 [PubMed: 24000922]

Garcia L, Gold EB, Wang L, Yang X, Mao M, Schwartz AV. The relation of acculturation to overweight, obesity, pre-diabetes and diabetes among U.S. Mexican-American women and men. Ethnicity and Disease. 2012; 22(1):58–64. [PubMed: 22774310]

Haan MN, Mungas DM, Gonzalez HM, Ortiz TA, Acharya A, Jagust WJ. Prevalence of dementia in older Latinos: the influence of type 2 diabetes mellitus, stroke and genetic factors. Journal of the American Geriatrics Society. 2003; 51(2):169–177. [PubMed: 12558712]

Hertz RP, Unger AN, Ferrario CM. Diabetes, hypertension, and dyslipidemia in Mexican Americans and non-Hispanic whites. American Journal of Preventive Medicine. 2006; 30(2):103–110.10.1016/j.amepre.2005.10.015 [PubMed: 16459207]

Hunt KJ, Williams K, Resendez RG, Hazuda HP, Haffner SM, Stern MP. All-cause and cardiovascular mortality among diabetic participants in the San Antonio Heart Study: evidence against the "Hispanic Paradox". Diabetes Care. 2002; 25(9):1557–1563. [PubMed: 12196427]

Kershaw KN, Diez Roux AV, Burgard SA, Lisabeth LD, Mujahid MS, Schulz AJ. Metropolitan-level racial residential segregation and black-white disparities in hypertension. American Journal of Epidemiology. 2011; 174(5):537–545.10.1093/aje/kwr116 [PubMed: 21697256]

Kershaw KN, Greenlund KJ, Stamler J, Shay CM, Daviglus ML. Understanding ethnic and nativity-related differences in low cardiovascular risk status among Mexican-Americans and non-Hispanic Whites. Preventive Medicine. 2012; 55(6):597–602.10.1016/j.ypmed.2012.09.019 [PubMed: 23036519]

Krishnan S, Cozier YC, Rosenberg L, Palmer JR. Socioeconomic status and incidence of type 2 diabetes: results from the Black Women's Health Study. American Journal of Epidemiology. 2010; 171(5):564–570.10.1093/aje/kwp443 [PubMed: 20133518]

Lopez, MH.; Cohn, D. Hispanic Poverty Rate Highest in New Supplemental Census Measure. Washington, DC: Pew Institute; 2011.

Macartney, S.; Bishaw, A.; Fontenot, K. Poverty Rates for Selected Detailed Race and Hispanic Groups by State and Place: 2007–2011. U.S. Census Bureau; 2013. Retrieved from http://www.census.gov/prod/2013pubs/acsbr11-17.pdf

Mujahid MS, Diez Roux AV, Cooper RC, Shea S, Williams DR. Neighborhood stressors and race/ethnic differences in hypertension prevalence (the Multi-Ethnic Study of Atherosclerosis). American Journal of Hypertension. 2011; 24(2):187–193.10.1038/ajh.2010.200 [PubMed: 20847728]

National Center for Health Statistics. Health, United States, 2012: With Special Feature on Emergency Care. Hyattsville, MD: 2013.

National Center for Injury Prevention. WISQARS Leading Causes of Death Reports, 1999–2007. Centers for Disease Control and Prevention Web-based Injury Statistics Query and Reporting System (WISQARS); 2007. Retrieved July 1, 2013 http://webappa.cdc.gov/sasweb/ncipc/leadcaus10.html

Pabon-Nau LP, Cohen A, Meigs JB, Grant RW. Hypertension and diabetes prevalence among U.S. Hispanics by country of origin: the National Health Interview Survey 2000–2005. Journal of General Internal Medicine. 2010; 25(8):847–852.10.1007/s11606-010-1335-8 [PubMed: 20490949]

Passel, JS.; Cohn, V.; Lopez, MH. Census 2010: 50 Million Latinos Hispanics Account for More Than Half of Nation's Growth in Past Decade. Washington, D.C: Pew Institute; 2011.

Rodriguez F, Hicks LS, Lopez L. Association of acculturation and country of origin with self-reported hypertension and diabetes in a heterogeneous Hispanic population. BMC Public Health. 2012; 12:768.10.1186/1471-2458-12-768 [PubMed: 22966844]

Romero CX, Romero TE, Shlay JC, Ogden LG, Dabelea D. Changing trends in the prevalence and disparities of obesity and other cardiovascular disease risk factors in three racial/ethnic groups of USA adults. Advances in Preventive Medicine. 2012; 2012:172423.10.1155/2012/172423 [PubMed: 23243516]

Schiller JS, Lucas JW, Ward BW, Peregoy JA. Summary health statistics for U.S. adults: National Health Interview Survey, 2010. Vital and Health Statistics. Series 10: Data from the National Health Survey. 2012; (252):1–207.

Sharma S, Malarcher AM, Giles WH, Myers G. Racial, ethnic and socioeconomic disparities in the clustering of cardiovascular disease risk factors. Ethnicity and Disease. 2004; 14(1):43–48. [PubMed: 15002922]

Sheffield KM, Peek MK. Neighborhood context and cognitive decline in older Mexican Americans: results from the Hispanic Established Populations for Epidemiologic Studies of the Elderly. American Journal of Epidemiology. 2009; 169(9):1092–1101.10.1093/aje/kwp005 [PubMed: 19270047]

Sundquist J, Winkleby MA. Cardiovascular risk factors in Mexican American adults: a transcultural analysis of NHANES III, 1988–1994. American Journal of Public Health. 1999; 89(5):723–730. [PubMed: 10224985]

Thomson EF, Nuru-Jeter A, Richardson D, Raza F, Minkler M. The Hispanic Paradox and older adults' disabilities: is there a healthy migrant effect? International Journal of Environmental Research and Public Health. 2013; 10(5):1786–1814.10.3390/ijerph10051786 [PubMed: 23644828]

Vincent, GK.; Velkoff, VA. Current Population Reports. Washington, DC: U.S. Census Bureau; 2010. THE NEXT FOUR DECADES, The Older Population in the United States: 2010 to 2050.

Wight RG, Aneshensel CS, Miller-Martinez D, Botticello AL, Cummings JR, Karlamangla AS, Seeman TE. Urban neighborhood context, educational attainment, and cognitive function among older adults. American Journal of Epidemiology. 2006; 163(12):1071–1078.10.1093/aje/kwj176 [PubMed: 16707655]

Zeki Al Hazzouri A, Haan MN, Osypuk T, Abdou C, Hinton L, Aiello AE. Neighborhood socioeconomic context and cognitive decline among older Mexican Americans: results from the Sacramento Area Latino Study on Aging. American Journal of Epidemiology. 2011; 174(4):423–431.10.1093/aje/kwr095 [PubMed: 21715645]

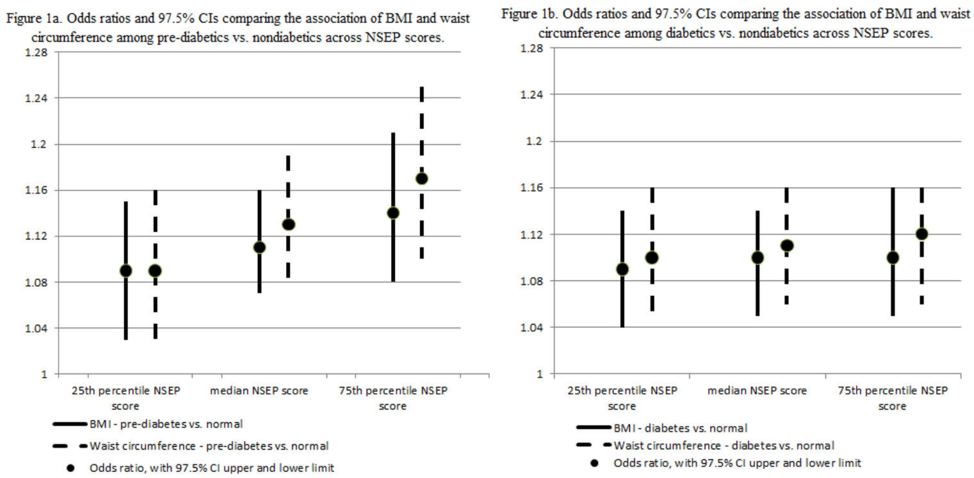


**Figure 1.**

Odds ratios (along with 97.5% CIs) of the effect of BMI and waist circumference on pre-diabetes vs. normal and on diabetes vs. normal for different levels of NSEP score: Mexico-born participants only.

**Table 1**

Baseline Characteristics of SALSA Participants by baseline diabetes status.

| Variable | Overall N=1777 | Diabetes N=586 (33.0%) | Pre-diabetes N=310 (17.5%) | No Diabetes N=881 (49.6%) | p-value |
|---|---|---|---|---|---|
| Demographics | | | | | |
| Age in years, mean (SD) | 70.7 (7.1) | 70.3 (6.9) | 69.8 (6.9) | 71.2 (7.3) | 0.003 |
| Gender, n (%) | | | | | |
| Female | 1041 (58.6) | 332 (56.7) | 174 (56.1) | 535 (60.7) | 0.19 |
| Male | 736 (41.4) | 254 (43.3) | 136 (43.9) | 346 (39.3) | |
| Nativity Status, n (%) | | | | | 0.0002 |
| U.S. Born | 871 (49.0) | 324 (55.3) | 157 (50.7) | 390 (44.3) | |
| Mexico Born | 906 (51.0) | 262 (44.7) | 153 (49.4) | 491 (55.7) | |
| Acculturation score (0–56), mean (SD) | 21.9 (12.9) | 22.1 (12.9) | 22.6 (13.2) | 21.5 (12.8) | 0.42 |
| Marital Status, n (%) | | | | | 0.74 |
| Married | 1030 (58.0) | 347 (59.3) | 175 (56.5) | 508 (57.7) | |
| Single | 51 (2.9) | 13 (2.2) | 9 (2.9) | 29 (3.3) | |
| Other | 694 (39.1) | 225 (38.5) | 126 (40.7) | 343 (39.0) | |
| Behavioral risk factors | | | | | |
| Body Mass Index (kg/m$^2$), mean (SD) | 29.7 (5.6) | 31.0 (6.3) | 31.1 (5.6) | 28.3 (5.4) | <.0001 |
| Body Mass Index (kg/m$^2$), n (%) | | | | | <.0001 |
| Normal: <25 | 310 (19.1) | 68 (12.5) | 26 (8.4) | 216 (28.0) | |
| Overweight: ≥25 and <30 | 628 (38.6) | 209 (38.4) | 114 (36.8) | 305 (39.5) | |
| Obese: ≥30 | 688 (42.3) | 267 (49.1) | 170 (54.8) | 251 (32.5) | |
| Waist circumference (in), mean (SD) | 38.1 (5.2) | 39.6 (4.9) | 39.1 (5.1) | 36.7 (5.1) | <.0001 |
| Physical activity, hrs/wk, mean (SD) | 60.5 (34.9) | 55.0 (34.5) | 59.0 (31.0) | 64.6 (36.0) | <.0001 |
| Alcohol use, n (%) | | | | | <.0001 |
| Frequent (daily) | 155 (8.8) | 27 (4.7) | 34 (11.0) | 94 (10.8) | |
| Moderate (weekly) | 185 (10.5) | 42 (7.2) | 30 (9.7) | 113 (13.0) | |
| Occasional (monthly) | 162 (9.2) | 39 (6.7) | 43 (13.9) | 80 (9.2) | |
| Yearly/rarely/never | 1259 (71.5) | 472 (81.4) | 202 (65.4) | 585 (67.1) | |
| Depression, n (%) | 439 (25.5) | 161 (28.6) | 76 (24.8) | 202 (23.7) | 0.11 |
| Hypertension, n (%) | 1207 (67.9) | 473 (80.7) | 214 (69.0) | 520 (59.0) | <.0001 |

| Variable | Overall N=1777 | Diabetes N=586 (33.0%) | Pre-diabetes N=310 (17.5%) | No Diabetes N=881 (49.6%) | p-value |
|---|---|---|---|---|---|
| Cardiovascular Disease, n (%) | 659 (37.1) | 288 (49.2) | 96 (31.0) | 275 (31.2) | <.0001 |
| Individual level SEP | | | | | |
| Years of education, mean (SD) | 7.2 (5.3) | 7.1 (5.4) | 7.6 (5.4) | 7.2 (5.3) | 0.41 |
| Household income, n (%) | | | | | 0.51 |
| Low (<$1,500) | 1140 (65.2) | 382 (66.4) | 192 (62.5) | 566 (65.4) | |
| High (≥$1,500) | 608 (34.8) | 193 (33.6) | 115 (37.5) | 300 (34.6) | |
| Lifetime occupation, n (%) | | | | | 0.59 |
| Non manual | 372 (21.2) | 122 (21.0) | 71 (23.3) | 179 (20.6) | |
| Manual | 1054 (60.0) | 346 (59.6) | 172 (56.4) | 536 (61.6) | |
| Housewives/unemployed | 330 (18.8) | 113 (19.5) | 62 (20.3) | 155 (17.8) | |

Marital status=other includes divorced, separated, widowed, living with as spouse.

## Table 2

Prevalence of pre-diabetes and diabetes defined by quartiles of neighborhood SEP scores.

| **Neighborhood SEP score** | | **Quartile 1 (10.6–<19.1) N=64** | **Quartile 2 (19.1–<23.2) N=64** | **Quartile 3 (23.2–<26.3) N=65** | **Quartile 4 (26.3–30.6) N=64** |
|---|---|---|---|---|---|
| Baseline Diabetes Status, n (%) | # of people in census tracts | 785 | 559 | 246 | 187 |
| No Diabetes | 881 (49.6) | 370 (47.1) | 275 (49.2) | 129 (52.4) | 107 (57.2) |
| Pre-diabetes | 310 (17.5) | 128 (16.3) | 104 (18.6) | 50 (20.3) | 28 (15.0) |
| Diabetes | 586 (33.0) | 287 (36.6) | 180 (32.2) | 67 (27.2) | 52 (27.8) |

Diabetes: self-report of a physician diagnosis of diabetes, documented use of prescription diabetes medication from a medicine cabinet inventory, and/or a fasting glucose level ≥126 mg/dL.

Pre-diabetes: fasting blood glucose level between 100 mg/dL and 125 mg/dL.

p-value=.04 prevalence of diabetes and pre-diabetes across quartiles.

## Table 3

Association between NSEP scores and Prevalent Pre-diabetes and Diabetes status from Multilevel Multinomial Logistic regression models with random census tract effect.

| | Model 1 | Model 2[§] | Model 3[§§] | Model 4[+] | Model 5[++] |
|---|---|---|---|---|---|
| All study participants | | | | | |
| Log Likelihood | −1802.21 | −1632.09 | −1488.87 | −1625.39 | −1479.83 |
| Association between increasing NSEP quartile and prevalent diabetes status - OR (95%CI) | | | | | |
| Pre-diabetes | 0.90 (0.73, 1.13) | 0.92 (0.73, 1.15) | 0.90 (0.71, 1.14) | 0.92 (0.73, 1.15) | 0.90 (0.72, 1.14) |
| Diabetes | 0.73 (0.61, 0.88)** | 0.73 (0.60, 0.89)** | 0.76 (0.61, 0.93)** | 0.74 (0.61, 0.89)** | 0.76 (0.62, 0.94)* |
| US-born study participants only | | | | | |
| Log Likelihood | −895.75 | −826.98 | −755.80 | −818.57 | −745.24 |
| Association between increasing NSEP quartile and prevalent diabetes status - OR (95%CI) | | | | | |
| Pre-diabetes | 1.09 (0.80, 1.48) | 1.14 (0.83, 1.57) | 1.14 (0.82, 1.59) | 1.13 (0.82, 1.56) | 1.15 (0.83, 1.60) |
| Diabetes | 0.68 (0.53, 0.88)** | 0.73 (0.55, 0.95)* | 0.79 (0.59, 1.05) | 0.73 (0.56, 0.96)* | 0.80 (0.60, 1.07) |

§ Model 2 adjusted for BMI.

§§ Model 3 adjusted for BMI, age, gender, education, physical activity, CESD, HTN, CVD.

\+ Model 4 adjusted for waist circumference.

++ Model 5 adjusted for waist circumference gender, education, physical activity, CESD, HTN, CVD.

* p-value < 0.05,

** p-value < 0.01,

*** p-value < 0.001.