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Association of Depression, Psycho-Social Stress and Acculturation with Respiratory Disease Among Puerto Rican Adults in Massachusetts

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Abstract

To assess associations between acculturation, depression, and self-reported stress score with reported diagnosis of respiratory disease (RD) in Puerto Rican adults, participants ($N = 1,168$) were identified from areas of high Hispanic density in the Boston, MA metropolitan area. Eligible participants were interviewed in the home by bilingual interviewers in either Spanish or English. Scales included topics ranging from general background to depressive symptomatology. Respiratory disease was self-reported and checked against prescribed medication. More than one-third (37.8%) of subjects reported doctor-diagnosed RD. A final binary logistical regression model ($N = 850$), which was adjusted for potential confounders (sex, age, education, poverty) showed that RD was significantly associated with psychological acculturation ($OR = 1.97$, $P = 0.005$), depressive symptomatology ($OR = 1.52$, $P = 0.03$) high perceived stress score ($OR = 1.97$, $P = 0.009$), and current smoking ($OR = 1.61$, $P = 0.03$). Significant inverse associations included a high level of language acculturation ($OR = 0.65$, $P = 0.03$), light ($OR = 0.67$, $P = 0.01$) and moderate to heavy physical activity versus sedentary physical activity ($OR = 0.40$, $P = 0.03$). We found self reported physician diagnosed RD was associated with high perceived stress and

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depression, as well as higher levels of psychological acculturation. Longitudinal research is needed to determine if there is a causal pathway for these associations.

Keywords

Respiratory disease; Depression; Stress; Acculturation; Hispanics; Puerto Ricans

Introduction

The population of Puerto Rican ancestry residing in the mainland United States has been growing steadily over the last two decades [1]. Previous studies have shown that Puerto Ricans have more disabilities and report poorer health status than other populations, including non-Hispanic whites and non-Hispanic blacks [2, 3]. Additionally, Puerto Rican elders in the Northeastern United States have higher prevalence of several chronic conditions than non-Hispanic white elders living in the same neighborhoods [4, 5].

A recent study found an overall prevalence of asthma in US adults of 8.9%. However, when stratified into subgroups, Puerto Rican adults had the highest prevalence of all groups (17.0%), non-Hispanic blacks (9.6%) and non-Hispanic whites (9.2%) had mid-levels, and Mexican–American adults had the lowest prevalence of all groups (3.9%) [6].

Review of the 2006 Behavioral Risk Factor Surveillance System found that 9.9% (8.9–11.0%) of the American-Hispanic population has current depressive symptoms and 12.6% (11.6–13.7%) has had depressive symptoms at least once in their lifetime [7]. However, Puerto Ricans living in both the mainland US and in Puerto Rico have been shown to have the highest prevalence of depressive disorders when compared to other Hispanic subgroups, including Cuban–Americans and Mexican–Americans [8]; a recent study found that 11.2% (10.1–12.3%) of island Puerto Ricans have current depressive symptoms, with a lifetime prevalence of 18.1% (16.9–19.5%) [7]. Additional studies have shown a high prevalence of depression in the Puerto Rican population (6.9%), when compared to other ethnic populations living in the US [9].

Asthma and depression have been linked to each other, in both children and adults, even though no specific mechanism has been found [8, 10–12]. A study of an American population found, after adjusting for age, sex, race, and other factors, an odds ratio (OR) of 1.7 (1.6–1.9) for asthma and current depressive symptoms and an OR of 1.8 (1.7–1.9) for asthma and lifetime prevalence of depressive symptoms [7]. On the other hand, association between stress, which is a significant predictor of depression, and the diagnosis of asthma have been unclear as studies have found conflicting results [13–15].

Acculturation is the process of learning the new culture as well as adaptation to the behaviors of the new culture. During the acculturation process, individuals may undergo changes in language use, cognitive style, personality, identity, attitude, and stress levels [16]. Studies have not measured acculturation and asthma directly in the Puerto Rican population, but have instead employed proxies (length of residence in US and English language abilities). For example, a recent study used place of birth and area of residence as a measure

of acculturation and found that children living in Puerto Rico were more likely to have a diagnosis of asthma than Puerto Rican children residing in the South Bronx [17]. Another study has suggested that an increase in acculturation, measured as a combination of years in United States and language of choice, was associated with both a higher risk of mental illness and higher risk of asthma [8].

Puerto Ricans have a long-standing presence in the Boston area going back to the 1960s. Despite a large number of years on the US mainland, this population of Puerto Ricans retains a high use of Spanish in daily activities, low levels of education, high poverty, and fairly low acculturation as measured by the Psychological Acculturation Scale (PAS) (Falcon, Todorova, and Tucker, under review).

Based on previous studies, we hypothesized that current symptoms of depression and stress, as well as higher levels of psychological acculturation would be associated with self-reported respiratory disease (RD) in a sample of Puerto Rican adults living in Boston, MA metropolitan area. In this study, the age range of 45–75 years was selected based on previous studies that have shown substantial prevalence of disability, depression, and cognitive impairment among Puerto Ricans aged 60 and above, with the disease onset averaging up to a decade earlier than for non-Hispanic whites [5, 18, 19].

Methods

Subjects and Sampling Methods

The Tufts University School of Medicine Institutional Review Board approved the study protocol. The data were collected for the Boston Puerto Rican Health Study, as described elsewhere [18, 20]. In summary, participants, who self-categorized as of Puerto-Rican ethnicity, were identified from areas of high Hispanic density in the Boston metropolitan area, as indicated in the year 2000 Census. Blocks were randomly enumerated from sampling frame and households with at least one Puerto Rican adult (age 45–75) were identified; then, one person per household was randomly selected for participation (80.4% participants identified in this manner). Additional participants (8.9%) were identified by random approach at Puerto Rican events, 4.6% were identified by response to media ads, and 6.1% were identified by personal referral. Thus, our sample is not necessarily representative of the Puerto-Rican population in the US, but it is acceptable for testing associations.

Participants who were unable to answer questions because of serious health conditions, dementia, or obvious alcoholism were excluded from the study. Overall, 2016 Puerto Rican adults were invited to participate; 1737 adults (86.2%) agreed to participate, and 1168 participants (67.2% of subjects who agreed to participate) completed the baseline interview. Interviews to obtain data were collected in the homes of the subjects by bilingual interviewers in either English or Spanish, as preferred by the participant. Subjects who declined to participate tended to be male (20.1 vs 15.6%; $P > 0.05$) and lived fewer years on US mainland (32.1 years $\pm$ 13.1 vs 34.1 year $\pm$ 11.8; $P > 0.05$).

Identification of RD and Asthma

RD is the main outcome variable employed in this study. Participants were asked: “Has a doctor ever told you that you had RD, such as emphysema, chronic bronchitis, asthma?” Medication use reported by subjects was confirmed during interviews by reference to the prescriptions that the subject had in their home. From the database, all the recorded medications that were used to treat RD, such as asthma, COPD, etc., were identified by a pulmonary fellow.

Measurement of Other Variables

For psychological acculturation we used the Psychological Acculturation Scale Dichotomized into ≤ 20 or >20 [21]. For language acculturation we used the Massachusetts Hispanic Elderly Study Acculturation Scale dichotomized as described by Bermudez et al. 2000 [19, 22]. In brief, an indicator of acculturation for Puerto Ricans was obtained from a set of seven questions on the usage of English and/or Spanish for speaking, reading and listening while engaging in activities like reading, watching television, and talking to friends and family members. We constructed a scale that ranged from 0 to 100% with 100% indicating using only English for all activities and 0% using only Spanish for all activities. Depression was measured via the Center for Epidemiologic Studies Depression Scale dichotomized into yes or no [23–25]. We used the Perceived Stress Scale Dichotomized based on median (<24 or ≥ 24) [26]. Physical activity was assessed with the Harvard Alumni Questionnaire as sedentary, light, or moderate/heavy physical activity [27, 28]. Smoking was measured with the University of Puerto Rico’s Puerto Rican Elderly Health Conditions Project scale as never, past, or current smoker [29]. These variables are described in Table 1.

Alcohol use was assessed from a semiquantitative Food Frequency Questionnaire (FFQ) adapted and validated for use with this population [30]. The survey recorded the amount of alcohol, the type of alcohol, and the increase or decrease of alcohol consumption throughout the subject’s life.

Body weight was measured with a Seca balance scale (Seca Corporation, Columbia, MD) with a capacity of 150 kg. Height was measured with a Harpenden pocket stadiometer (Holtain Ltd. Crosswell, United Kingdom). Body mass index (BMI) was calculated as weight (kg)/height (m)². Subjects were categorized into recommended BMI (BMI <25 kg/m²), overweight BMI ≥ 25 BMI <30 kg/m²), and obese BMI (BMI ≥ 30 kg/m²) [31].

Demographic Information

Other information asked and recorded by the interviewers included sex, date of birth, sources of income, level of education completed, and number of years in the US mainland. Poverty status was computed using the poverty guidelines released each year by the Department of Health and Human Services (<http://aspe.hhs.gov/poverty/index.shtml>). A subject’s total annual household income was compared to the poverty guideline for the subject’s family size and for the year of interview. If the total household income was less than this guideline, then the subject was considered to be in poverty [32].

Statistical Analyses

All statistical analyses were performed with the SPSS for Windows version 16.0 (SPSS Inc., Chicago, Illinois). Statistical analyses were conducted to test the possible associations of variables with the outcome of interest, the diagnosis of RD. Chi square tests were used to assess the associations between being diagnosed with RD and each of the categorical exposure variables of interest, and between RD diagnosis and each categorical demographic variable, such as sex, poverty status, and education level. Independent *t*-tests were conducted to test the association between RD and years in the US.

In order to control for demographics (sex, age, poverty, education, years in US) as well as for independent variables, binary logistic regression was used. The non-demographic variables were grouped into 3 divisions: acculturation (psychological acculturation, language acculturation), social environment (depression symptomatology, stress), and personal behaviors (PA, smoking, alcohol consumption, BMI). The association of each variable in the division with RD was tested with three different models using binary logistic regression. All first models contained age and sex as cofactors; all second models contained model 1 cofactors plus poverty status, education, years in US, and marital status as cofactors; third models contained model 2 cofactors plus other variables that are not found in the same division as the variable being tested. Since CES-D was found to be highly correlated with stress score ($r = 0.70$), only CES-D was included in the third model. Finally, a full model using binary logistic regression with all variables adjusted to each other was created with 850 participants who had complete data for all variables. As described before, either CES-D or stress score was used in the model, but not both together.

Odds ratios (OR) and 95% confidence intervals (CIs) were calculated for each model. All *P* values are two-sided. Significance was set at $P < 0.05$.

Results

Population Demographics

Population demographics are described in Table 2. There were 1,168 participants who completed baseline interviews. Of these, 38% reported RD. Almost all participants were born in Puerto Rico and a majority were female. More than half were in poverty and only half had completed a ninth grade education. Twenty-three percent were current smokers and 38% reported current drinking of alcohol. Their mean age was 58 years, mean time in the US was 54 years and mean BMI was 32.

Validation of RDs by Medication

Confirmation of RD was assessed by review of medications taken. Three hundred subjects (29%) reported taking medication for RD ($P < 0.001$ when tabulated with RD). Overall, medication data suggest that self-report of RD is a reliable health outcome variable. Most respondents reporting RD also had medications for RD and it is reasonable to expect that some people with RD would not be medicated. It was not possible to disaggregate type of RD (asthma, COPD, etc.).

Demographic Variables

Without controlling for any factors, each demographic variable was independently tested for association with diagnosis of RD. Age was not significantly associated with RD, while being female was (OR = 2.07; 95% CI: 1.53–2.80; $P < 0.001$). Poverty status (OR = 1.55; 1.19–2.02), having education of 8th grade or less (OR = 1.48; 1.15–1.91), and living longer in the US were also significantly associated with RD. Additionally, individuals with RD were more likely to report fair/poor health status (OR = 2.56; 95% CI: 1.88–3.50; $P < 0.001$) (Table 3).

Independent Variables

Neither psychological acculturation (OR = 1.12; 0.91–1.56) nor language acculturation (OR = 0.90; 0.64–1.28) was associated with RD in unadjusted models, and trends were in opposite directions. Additionally, we found that only 15% of the subjects had a mean language acculturation score greater than 3, suggesting that the majority of this population speaks more Spanish than English during everyday activities (data not shown). Both presence of depression symptomatology (CES-D 16; OR = 2.31; 1.76–3.03) and higher perceived stress levels (median = 24; OR = 1.59; 1.23–2.06) were significantly associated with RD. It was not unexpected that both of these variables had similar associations, as CES-D score is highly correlated with stress level ($r = 0.70$).

Current smoking (versus never; OR = 1.49; 1.08–2.05), but not past smoking, was significantly associated with RD. Neither past nor current alcohol consumption was associated with RD, although current drinking (versus never; OR = 0.76; 0.56–1.03) tended to have protective effect ($P = 0.1$). Both light (OR = 0.67; 0.52–0.87) and moderate/heavy (OR = 0.25; 0.11–0.54) physical activity, when compared to sedentary physical activity, were associated with lower likelihood of RD. Finally, being obese (vs. recommended; OR = 1.60; 1.07–2.40) was significantly associated with RD but being overweight (OR = 0.96; 0.61–1.49) was not. These results are summarized in Table 3.

Binary Logistic Regression Models

For each independent variable, we constructed three models, two that controlled for demographic variables (models 1 and 2) and one for additional potential confounders (model 3). Psychological acculturation became significant in the third model that adjusted for demographic variables and other confounders. Controlling for both demographic and other variables (model 3) resulted in the depression odds ratio decreasing from the first model (OR = 2.19; 1.66–2.90) to the third model (OR = 1.87; 1.40–2.56), but the association remained significant in all three models ($P < 0.001$). Likewise, the stress variable remained significant in all three models (OR = 1.36; 1.01–1.83 for model 3).

When the demographic factors were controlled for, the protective effect of light physical activity on RD remained significant (OR = 0.70; 0.52–0.93), but when depressive symptoms, psychological or language acculturation variables were added to the model, the effect of light physical activity did not remain significant (OR = 0.76; 0.56–1.03; $P = 0.07$). Conversely, moderate/heavy physical activity remained significant in all models (OR = 0.41; 0.18–0.93 for model 3). Past smoking was not significant in any of the models, while current smoking remained significant even though the OR decreased slightly between model 1 (OR

= 1.82; 1.30–2.54) and model 3 (OR = 1.58; 1.08–2.30). Alcohol consumption, overweight/obesity, and language acculturation were not significantly associated with RD in any models.

Full Model

We put all demographic and independent variables in a single model ($N = 850$). The number of individuals in this model was reduced by 318 compared to the full database because of missing variables. In this model, RD was positively associated with female sex (OR = 1.72; 1.18–2.50), years in the US (OR = 1.02; 1.01–1.03; 2% increase in RD for each year in the US), current (versus never) smoking (OR = 1.61; 1.09–2.39), and depressive symptomatology (OR = 1.88; 1.37–2.56). Psychological acculturation was statistically significant ($P = 0.04$) and was positively associated (OR = 1.40; 1.01–1.94) with RD. RD was significantly negatively associated with light (OR = 0.72; 0.53–0.99) and moderate/heavy (OR = 0.39; 0.17–0.90) (versus sedentary) physical activity, and with higher education (OR = 0.72; 0.52–0.98) (versus B8th grade education). As CES-D was highly correlated with stress score ($r = 0.70$), they were entered into the model separately. When CES-D was replaced with stress score, the latter was significant (versus <median = 24; OR = 1.36; 1.01–1.83). Language acculturation, past smoking, past and current alcohol consumption, BMI, and poverty status were not significantly associated with RD in the full model (Table 4).

We found that physical activity and language acculturation were significantly correlated with psychological acculturation and with each other (Supplement Table 1). Accordingly, we tested whether the significance of these variables would change if one of them were taken out from the full model. When language acculturation was taken out, psychological acculturation ($P = 0.05$), light physical activity ($P = 0.03$), and moderate/heavy physical activity ($P = 0.03$) all remained significant. When psychological acculturation was taken out, language acculturation was nonsignificant ($P = 0.68$), moderate/heavy physical activity remained significant ($P = 0.03$) while light physical activity was attenuated ($P = 0.08$). Finally, when physical activity was taken out, language acculturation remained nonsignificant ($P = 0.80$), and psychological acculturation was attenuated ($P = 0.07$).

Discussion

In this adult sample of Puerto Rican adults living in Boston, ~40% of participants reported having RD. Prevalence of RD was associated with high psychological acculturation, years in the US, depressive symptomatology, stress, physical activity, and smoking. This is the first study of which we are aware that tested associations of acculturation (both psychological and language), social environment or its components (depression symptomatology and stress), and personal behaviors (physical activity, smoking, alcohol consumption, BMI) with RD in Puerto Rican adults in the same study. As this was a cross-sectional study, we could not determine whether the relationships we found were causal. Still, our findings suggest that there are multiple possible determinants in this population that may interact together to influence RD.

No studies known to us have looked at the relationship of psychological acculturation and language acculturation with RD. It was unexpected that years in the US mainland was

significantly associated with RD while language acculturation was not, especially since years in US have been found to be a good predictor of language acculturation [33]. In our study, language acculturation and years in US were also significantly correlated. When language acculturation was taken out of the full model, years in the US mainland remained significantly associated with RD but when years in the US mainland was taken out, language acculturation remained nonsignificant. However, in our study, only 15% of the individuals had language acculturation mean of 3 (speaking more English than Spanish during daily activities), a possible reason for why a protective association was seen that failed to reach significance.

Other work has shown that reporting of asthma is higher among US born Dominicans and other Hispanics when compared to their non-US born counterparts. In fact, Dumanovsky and Matte [34] found that US born Dominicans and other Hispanics had asthma prevalence rates comparable to that of Puerto Ricans. Thus, our finding that number of years in the United States and higher psychological acculturation result in greater odds of RD is consistent with their work. There is evidence that, among Puerto Ricans, acculturation influences medical compliance [35] and the likelihood of being diagnosed. Additionally, it has been suggested that individuals with lower levels of acculturation are less likely to have seen a doctor within the previous year [36]. Another study has suggested that an increase in acculturation, measured as a combination of years in United States and language of choice, is associated with both a higher risk of mental illness and higher risk of asthma. The authors of this research hypothesize that this outcome may be due to the breakdown of the family network and social support system [8]. Among Puerto Rican parents of children with asthma, higher acculturation has been shown to be associated with higher compliance with medication regimes [35]. One potential explanation is that acculturation—including English language usage—influences or facilitates the reporting of symptoms and, as such, results in a higher prevalence for those more acculturated.

We found that depressive symptomatology and stress were associated with RD. When both depressive symptomatology and perceived stress were put into the full regression model, both remained significantly associated with RD. Because depressive symptoms influence interaction with others and a person's willingness to seek help, it could influence an individual's response to RD. Health behaviors such as the reporting of symptoms or compliance with treatment can also be influenced by depressive mood [37]. Consequently, depression and stress might have independent relationships to RD diagnosis. A recent review suggests that there are also possible biological links between depression and asthma [38], including immunological association (individuals with depression are at greater risk of developing IgE-mediated allergic conditions) [39], genetic links (additive genetic factors) [40], and autonomic nervous system links [38].

Our findings confirm the results of previous studies that have found associations between depression and asthma in Puerto Rican adults [8] and children [41]. As our study was cross-sectional, the direction of causality between depression and RD cannot be discerned, although one longitudinal study showed that asthma precedes development of psychological problems [42]. The association between perceived stress and asthma has not been previously

studied in the Puerto Rican population. However, a study of asthma in children has found a significant association between stressful events in the past year and asthma [43].

Even though education was significantly associated with RD in our full model, unexpectedly poverty was not, even though poverty and education were significantly associated with each other. When education was taken out of the full model, poverty remained nonsignificant (not shown). It is possible that unmeasured confounders are influencing the poverty variable. Other studies have found conflicting results. One study in a general Hispanic population found that both education and poverty were significantly associated with asthma [41], while another study found that poverty but not education was significantly associated with asthma [34]. However, in agreement with Litonjua et al. [44], having higher education (at least 9th grade) was observed in our study to be protective against RD.

The prevalence of Puerto Rican smokers in the US is very high, with one survey reporting a prevalence of 31% [45]. Like previous studies in Puerto Rican populations, our results suggest that current smoking is significantly associated with RD. Further, we did not observe a significant association between alcohol consumption and likelihood of having RD, which differs from Rose et al. [6], who found that both current drinking and past drinking increase risk of asthma in the Puerto Rican population. BMI was not significantly associated with RD in our analysis, but both light and moderate/physical activities were significantly negatively associated with RD. Our results differ from Perez-Perdomo et al. [46] who found that obesity but not physical activity was linked to asthma in Puerto Ricans. Another study found that being more acculturated to the US was associated with increased self-report of physical activity [47]. Most of the subjects here were overweight/obese or severely obese, with few having a healthy BMI. This could also be a factor in our finding that BMI was not significant in the full model.

Limitations of our study include a lack of measurement of other known predictors of RD, such as indoor/outdoor pollution, second-hand smoke, living near a highway, chemicals in the home, and occupational factors. Secondhand smoke exposure has been found to be significantly associated with development of asthma (RR = 1.45) [48]. A recent review concluded that living near a highway is significantly associated with asthma development in children, and that girls are more at risk than boys [49]. Additionally, research has found that indoor air pollutants (e.g. formaldehyde), and allergens (e.g. cats, dogs, cockroaches, dust mites, mold, and pollen) are associated with asthma symptoms in children [50].

Our study did not look at the occupation of subjects. This is an important omission since certain occupations, such as welding, and working in restaurants and construction, have been linked to asthma development and hospitalizations due to asthma. Studies have also found that socioeconomic status was associated with asthma [51], which might be associated with hazardous jobs. However, since 710 (69.6%) of the subjects in our analysis were not working at the time of the interview, we think that the effect of occupation would likely be modest.

A major limitation of our study is an imprecise outcome variable—we were unable to distinguish between asthma and other respiratory diseases. The parent study from which this

data was drawn was not primarily designed to study RD. Instead, the RD outcome was nested within a non-respiratory study. While we could not differentiate between RD diagnoses, we were able to use medications to confirm most self-reports of RD. We could not address the severity or exacerbation of asthma. Additionally, the vast majority of the individuals in our study were born in Puerto Rico narrowing level of acculturation and our ability to test for nativity. In cases where regression models reduced associations between demographic or independent variables and RD, because our measures do not necessarily fully reflect underlying concepts, we cannot exclude the possibility of residual confounding. Additionally, we could not assess the genetic susceptibility or resistance to developing RD.

Our results add to the growing body of research on RD in Puerto Ricans. Together, these results suggest that RD is prevalent in Puerto Rican women, current smokers, those with lower education, those who are more psychologically acculturated to the US culture, and those who have high stress or depressive symptomatology. Conversely, light to moderate physical activity showed a protective effect against the development of RD. Future research could help elucidate the possible causal relationships.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Description of scales used to obtain certain variables and their use in statistics

Variable name	Scale employed	Reference for scale	Use in statistics	Notes
Psychological acculturation	Psychological acculturation scale (PAS)	Tropp et al. [21]	Dichotomized into 20 or >20[21]	High consistency between English and Spanish versions ($r = 0.94$); High internal consistency for English and Spanish version ($\alpha = 0.93$ and 0.95 , respectively) [21].
Language acculturation	Massachusetts hispanic elderly study acculturation scale	Bermudez et al. [19], Cuellar et al. [22]	Dichotomized as described by Bermudez et al. [19]	Reliability and validity have not been established.
Depression	Center for epidemiologic studies depression scale (CES-D)	Cho et al. [23], Robinson et al. [24], Stroup-Benham et al. [25]	Dichotomized into yes or no	Validated, high internal consistency [23], has been used with Puerto Rican populations[24].
Stress	Perceived stress scale	Cohen et al. [26]	Dichotomized based on median (<24 or 24)	High reliability ($\alpha = 0.84$), high test-retest correlation ($r = 0.85$)[26].
Physical activity	The Harvard alumni questionnaire	Paffenbarger et al. [27], Kennel et al. [28]	Trichotomized into sedentary, light, or moderate/heavy physical activity	Weighing factor (metabolic equivalents) paralleled oxygen consumption for different kinds of activities [52].
Smoking	University of Puerto Rico's Puerto Rican elderly: health conditions project	Palloni [29]	Trichotomized into never, past, or current smoker	

Table 2

Population demographics

Demographic variable	Number of subjects (%) or Mean $\pm$ SD
Completed baseline interviews	1168 (78% of eligible subjects)
Doctor-diagnosed respiratory disease	386 (38%)
Born in Puerto Rico	1133 (97%)
Female	841 (72%)
Poverty	688 (59%)
Current smoker	273 (23%)
Past smoker	350 (30%)
Current alcohol drinker	446 (38%)
Past alcohol drinker	349 (30%)
Reported fair/poor health	837 (72%)
Completed 9th grade education	595 (51%)
Current depression based on CES-D score	696 (60%)
Age (years)	57.8 $\pm$ 7.4
Years in US	54.1 $\pm$ 11.8
BMI (kg/m ²)	32.1 $\pm$ 6.8

Table 3

Univariate associations of variables with respiratory disease

	<u>Respiratory disease</u>		OR (95% CI)
	Yes (SD)	No (SD)	
Demographic variables			
Sex ***			
Female	42.4%	57.6%	2.07 (1.53–2.80)
Male	26.2%	73.7%	1
Age	57.99 (7.58)	57.62 (7.26)	
Poverty **			
Yes	42.3%	57.7%	1.55 (1.19–2.02)
No	32.2%	67.8%	1
Education **			
No schooling-8th grade	42.6%	57.4%	1.48 (1.15–1.91)
At least 9th grade	33.4%	66.6%	1
Years in US **	35.3 (11.33)	33.3 (11.99)	
Reported Health ***			
Fair/poor	43.6%	56.4%	2.56 (1.88–3.50)
Good/excellent	23.2%	76.8%	1
Independent variables			
Psychological acculturation			
>20	40.1%	59.6%	1.12 (0.91–1.56)
20	36.4%	63.6%	1
Language acculturation			
3	35.7%	64.3%	0.90 (0.64–1.28)
<3	38.0%	62.0%	1
Depression symptomatology ***			
Yes (CES-D 16)	45.6%	54.4%	2.31 (1.76–3.03)
No (CES-D <16)	26.6%	73.4%	1
Stress score ***			
24	42.9%	57.1%	1.59 (1.23–2.06)
<24	32.1%	67.8%	1
Physical activity			
Moderate/heavy (PA ≥40) ***	16.3%	83.7%	0.25 (0.11–0.54)
Light (30 ≤ PA <40) **	34.5%	65.5%	0.67 (0.52–0.87)
Sedentary (0 < PA <30)	44.1%	55.9%	1
Smoking			
Current *	44.1%	55.9%	1.49 (1.08–2.05)
Past	38.9%	61.1%	1.21 (0.89–1.63)
Never	34.6%	65.4%	1

	<u>Respiratory disease</u>		OR (95% CI)
	Yes (SD)	No (SD)	
Alcohol consumption			
Current	33.8%	66.2%	10.76 (0.56–1.03)
Past	39.9%	60.1%	0.99 (0.72–1.37)
Never	40.1%	59.9%	1
BMI, kg/m ²			
30	42.7%	57.3%	1.60 (1.07–2.40)
25–29.9	30.8%	69.2%	0.96 (0.61–1.49)
<25	31.8%	68.2%	1

* Signifies $P < 0.05$,

** signifies $P < 0.01$,

*** signifies $P < 0.001$.

Percentages may not add up to 100% because of rounding

Table 4

Full model that includes all demographic and independent variables

Variable	Respiratory disease OR
Psychological acculturation	1.40 (1.01–1.94), $P=0.04$
Language acculturation	0.96 (0.65–1.43), $P=0.85$
Depression symptomatology	1.88 (1.37–2.56), $P<0.001$
Stress score	1.36 (1.01–1.83), $P=0.04$
Physical activity	
Light	0.72 (0.53–0.99), $P=0.04$
Moderate/heavy	0.39 (0.17–0.90), $P=0.03$
Smoking	
Past	1.13 (0.79–1.61), $P=0.52$
Current	1.61 (1.09–2.39), $P=0.02$
Alcohol consumption	
Past	0.93 (0.62–1.39), $P=0.73$
Current	0.77 (0.53–1.12), $P=0.17$
BMI	
Overweight/obese	1.07 (0.65–1.77), $P=0.80$
Severely obese	1.37 (0.86–2.18), $P=0.19$
Sex	1.72 (1.18–2.50), $P=0.005$
Poverty	1.21 (0.89–1.64), $P=0.23$
Education	0.72 (0.52–0.98), $P=0.04$
Years in US	1.02 (1.01–1.03), $P=0.007$