

# Depressive Profiles among Older Puerto Rican Adults

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**Objectives:** This study examines the heterogeneity of depressive symptoms among older adults residing on the Island of Puerto Rico and their association with risk and protective health factors.

**Methods:** Data from the Puerto Rican Elderly: Health Conditions study (PREHCO) to identify risk and protective factors associated with profiles of depressive symptoms. The sample was comprised of 3,114 Puerto Rican older adults ages 60 to 102 (71 ± 8.2 SD). The Geriatric Depression Scale 15-item short form (GDS-15) was used to assess the presence of depressive symptoms. Latent class analysis (LCA) was used to categorize depressive symptom classes. The association between depressive symptom classes and health status, lifestyle, health behavior and demographic characteristics were evaluated.

**Results:** A three-class model was identified, they were defined as “low depressive symptoms” (56%), “medium depressive symptoms” (31%), and “high depressive symptoms” (13%). Having chronic illnesses, mainly diabetes, heart disease and high blood pressure as well as a history of smoking, and poor self-rated vision were all associated with being in a higher depressive class. Exercising regularly and participating in volunteer activities were protective to being in a high depressive class.

**Conclusion:** Chronic illnesses and poor self-rated vision were associated with being in a higher depressive classification. These findings can inform targeted interventions for sub-groups of community-dwelling older adults impacted by depression.

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Major depression is a leading cause of disability in the United States; the disability-adjusted life years and years lived with disability is 3.7% and 8.3%, respectively (1). Depression is concomitant with many chronic illnesses in later life and it is influenced by genetic, environmental, and other psychological factors (2,3). Estimates of late-life depression vary widely specifically among the Hispanic population living in the United States, including Cuban, Mexican, and Puerto Rican adults (4). For example, Puerto Rican older adults have a higher prevalence of major depression in comparison to other ethnic groups after adjusting for cultural factors, functional limitations, health conditions, and sociodemographic characteristics (5). However, little is known about the heterogeneity of depressive symptom patterns affecting the elderly population living on the Island of Puerto Rico. Therefore, the purpose of this study is to depressive symptom classes, among a nationally representative sample of older adults over 60 years of age residing on the Island of Puerto Rico. In addition, the study evaluates the association between depressive symptom classes and chronic diseases, lifestyle, and sociodemographic characteristics.

## Methods

### Study design

The Puerto Rican Elderly: Health Conditions study (PREHCO) is a longitudinal study of the physical and mental health of community-dwelling older adults aged 60 and over (6). Overall, 4,291 face-to-face interviews were conducted during baseline from May 2002 to May 2003 across the entire mainland of Puerto Rico. A multistage, stratified sample design was implemented, with oversampling in regions of Puerto Rico that have a larger proportion of people of African descent and of individuals aged over 80. All participants signed a consent form after receiving oral information about the Puerto Rican Elderly:

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Health Conditions study PREHCO. The protocol of this study was reviewed and approved by the University of Puerto Rico Medical Sciences Institutional Review Board (6).

### Participants

For the current study, 3,114 older Puerto Rican adults between the ages of 60 and 102 with information on depressive symptoms were included in the analyses. We excluded participants who were born outside of Puerto Rico ( $n=183$ ) and participants with missing data on depressive symptoms ( $n=99$ ). In addition, participants without responses on any of the covariates (health status, lifestyle, psychosocial stressors, and sociodemographic characteristics [ $n=66$ ]) were excluded for data analysis. Excluded participants did not differ from those included in the analyses by sex ( $\chi^2 = 0.214, p = 0.644$ ). However, the study sample included a higher proportion of participants who were younger, married, and more educated ( $p < 0.05$ ) in comparison to the full Puerto Rican Elderly: Health Conditions study (PREHCO) cohort.

### Measures

#### Depressive symptoms

The Geriatric Depression Scale 15-item short form (GDS-15) was used to assess the presence of depressive symptoms (7). The GDS-15 questionnaire complements the detection of late-life depression in primary care settings (8, 9). In addition, the validity and sensitivity of the GDS-15 among Hispanic elderly populations yields valid and trustworthy results (10). Scores are calculated by adding the positive response to ten of the questions and the negative response to the remaining five questions. The negative responses to the following questions are counted in the final score: a) *Are you basically satisfied with your life?* b) *Are you in good spirits most of the time?* c) *Do you feel happy most of the time?* d) *Do you think it is wonderful to be alive now?* e) *Do you feel full of energy?*

#### Health related and Lifestyle covariates

These included chronic conditions, self-rated eye health and smoking history. Participants were asked to report medical conditions diagnosed by a doctor, these included diabetes, heart disease, and high blood pressure. These diseases reflect prevalent conditions in the population, they were each individually modeled. Smoking history was assessed by the question "have you smoked 100 cigarettes or more in your life?" (0 = no, 1 = yes). Self-rated eye health was measured with the question "rate your self-rated eye health" (0 = poor/fair, 1 = good, 2 = very good/excellent). The lifestyle factors considered included exercising regularly (0 = no, 1 = yes) and volunteering in the past year (0 = no, 1 = yes).

#### Demographic

Demographic characteristics included age (60-65, 66-75, 76-85, 86+) educational attainment (<HS, HS, trade school/associates, bachelors or higher), marital status (married, widowed, divorced, unmarried) and sex (0 = men, 1 = women).

### Data analysis

A person-centered approach was used to identify distinct latent subgroups of depressive profiles. Two such person-centered approaches are cluster analysis and latent class analysis. These two approaches use patterns of scores across cases to identify persons who can be grouped together. Both cluster analysis and latent class analysis generate a series of solutions, each with one additional class than the previous one. The similarities end here, in that each approach makes markedly different assumptions regarding data and statistical procedures. With respect to cluster analysis, the assumption is that the cases with the most similar scores across variables belong in the same cluster (11). While latent class analysis, is based on the assumption of local independence. Local independence assumes indicator variables are not correlated and are only related to each other through the latent variable. The local independence assumption pertains to the observed/manifest variables within a latent class. Finally, unlike cluster analysis, latent class analysis (LCA) is model-based and provides a mathematical evaluation of how well an LCA represents the data. For these reasons, in the current study we used a latent class analytical approach. First, the number of classes were determined by fitting a one class model, followed by successive models with increasing numbers of classes. Model fit was assessed using standard evaluation criteria such as Bayesian Information Criterion (BIC), the sample size Adjusted Bayesian Information Criterion (SS-BIC), Akaike's Information Criterion (AIC), entropy, the Lo-Mendell-Rubin-likelihood ratio test (LMR-LRT) and the Vuong-Lo-Mendell-Rubin likelihood ratio test (VLMR-LRT). Smaller values for the BIC, SS-BIC and AIC, and larger values of entropy indicate better fit. A significant LMR-LRT or VLMR-LRT suggests that a model fits the data better than a model with one less class. Optimal class solutions were based on parsimony and interpretability. Latent class analyses were conducted using Mplus V8 (12).

To evaluate the association between the depressive profiles and health status, lifestyle, and sociodemographic characteristics, multinomial logistic regression analysis was used to examine multivariable factors that were associated with identified classes. Statistical significance of 0.05 was used in all analyses which were conducted using Stata version 17 (13).

## Results

### Participants' characteristics

Women comprised more than half of the sample (60%); the average age of participants was  $M = 71$   $SD = 8.2$  (range 60-102); study participants tended to be married (43%) were married and 66% had less than a high school education. Self-rated eyesight indicated that 25% of the participants had "very good" or "excellent" eyesight, while 28%, 18%, and 58% reported having been told by a doctor that they had diabetes, heart disease or high blood pressure, respectively. Thirty-four percent of older adults reported that they had smoked 100 cigarettes or more in their lifetime. The majority of participants had mild to no symptoms

80%, with an average GDS15 score of  $M = 6.9$   $SD = 2.1$  depressive symptoms. Thirty-four percent of the sampled exercised regularly and 30% reported volunteering in the past year.

**Characteristics of latent classes**

Table 1 shows the baseline characteristics of the participants by latent class. The GDS-15 score for the “low”, “medium”, and “high” class was 1, 4, and 10, respectively. The “high” depressive symptoms profile had the youngest participants  $70 \pm 8$  SD. Overall, most of the participants in the three latent classes were less educated, divorced, or unmarried, female, and had poor or fair eyesight, diabetes, heart disease, and a high blood pressure diagnosis.

**Latent class analysis**

A three-class solution was selected after examining fit statistics, parsimony, and qualitative interpretation of the solution. A model was identified as the best model fit based on a decrease in Bayesian information criteria and high entropy (see Table 2). Three distinct classes were identified based on the pattern of probabilities. These three classes were defined as “low depressive symptoms” (56%), “medium depressive symptoms” (31%), and “high depressive symptoms” (13%).

**Multinomial logistic regression**

The results of the multinomial logistic regression analysis examined factors that negatively or positively affected the probability of being part of the “high” depressive class, using the “low” class of depressive symptoms as the reference group. Several risk factors were associated with being in a high depressive class. Marital status unmarried [OR] = 1.704 [95% CI 1.310-2.218], divorced [OR] = 1.678 [95% CI 1.330-2.118], widow/er [OR] = 1.594 [95% CI 1.316-1.930] and being a woman was associated with being in a higher depressive class. Having chronic diseases was also associated with being in a higher depressive class, specifically heart disease [OR] = 1.731 [95% CI 1.437-1.930], high blood pressure [OR] = 1.227 [95% CI 1.053-1.430] and diabetes [OR] = 1.183 [95% CI 1.006-1.391].

**Table 1.** Demographic characteristics by depressive class membership

	Total N = 3114	Low Depressive Class	Medium Depressive Class	High Depressive Class	$\chi^2$
<i>Sex</i>					
Female	60%	52%	33%	15%	.0001*
Male	40%	63%	29%	8%	
<i>Race/Ethnicity</i>					
White	45%	57%	31%	12%	p = .761
Black Black & White Mixed Race	48%	55%	32%	13%	
Indian & White Mixed Race	7%	57%	32%	11%	
<i>Age</i>					
60-65	31%	60%	26%	14%	.001*
66-75	40%	57%	32%	11%	
76-85	23%	53%	34%	13%	
86+	6%	47%	40%	13%	
Age	M = 71 SD = 8.2 Range = 60 - 102				
<i>Education</i>					
<HS	66%	52%	34%	14%	.0001*
HS	16%	65%	25%	10%	
<Bachelors	10%	60%	27%	13%	
Bachelors or greater	8%	65%	26%	9%	
<i>Marital status</i>					
Married	43%	65%	25%	10%	.0001*
Widowed	35%	47%	38%	15%	
Divorced	13%	52%	32%	16%	
Unmarried	9%	53%	32%	15%	
<i>Smoking history</i>					
No	66%	58%	31%	11%	.001*
Yes	34%	54%	31%	15%	
<i>Heart disease</i>					
No	82%	59%	30%	11%	.0001*
Yes	18%	44%	34%	22%	
<i>High blood pressure</i>					
No	42%	61%	29%	10%	.0001*
Yes	58%	53%	32%	15%	
<i>Diabetes</i>					
No	72%	58%	31%	11%	.0001*
Yes	28%	52%	32%	16%	
<i>Self-Rated Eye Health</i>					
Poor/Fair	34%	44%	37%	19%	.0001*
Good	41%	59%	30%	11%	
Very good/Excellent	25%	68%	25%	7%	
<i>Exercise</i>					
No	84%	54%	32%	14%	.0001*
Yes	16%	67%	26%	7%	
<i>Volunteering</i>					
No	70%	53%	33%	14%	.0001*
Yes	30%	63%	27%	10%	
GDS-15	M = 7 SD = 2.1 Range 0 -15				

Note: \*Negative response to the depressive symptom was considered for scoring. Item-response probabilities > 0.5 in bold to facilitate interpretation.

Finally, a history of smoking was associated with being in a higher depressive class [OR] = 1.392 [95% CI 1.181-1.642]. Protective factors associated with a lower odds of being in a high depressive class were exercising on a regular basis [OR] = .667 [95% CI .539-.825], volunteering [OR] = .760 [95% CI .647-.894] and better self-rated eye health (very good/excellent) [OR] = .445 [95% CI .364-.545] and (good) [OR] = .615 [95% CI .521-.727].

**Table 2.** Latent class indices of fit

No. of classes	1	2	3
AIC	44905.2	37415.31	36392.2
BIC	44995.8	37602.66	36676.3
ABIC	44948.2	37504.16	36526.9
Entropy		0.902	0.793
LMR-LRT		0.0000	0.0000
VLMR-LRT		0.0000	0.0000

Note: No = number; AIC = Akaike information criterion; BIC = Bayesian information criterion; ABIC = Adjusted Bayesian information criterion

## Discussion

This study identified latent classes of depressive symptoms among a community-dwelling nationally representative sample of older adults aged 60 and over residing on the Island of Puerto Rico. In addition, this study examined the association of demographic, chronic diseases, and lifestyle factors on membership in depressive symptom classes. Three depressive classes were identified, low (54%), medium (33%), and high (13%). There were several key findings. First, the high depressive class was associated with having a diagnosis of diabetes, heart disease and high blood pressure. These associations were independent of demographic and lifestyle factors. Prior research has also documented associations between moderate depressive symptoms and a higher odds of having cardio-metabolic syndrome when compared to individuals with no depressive symptoms (14). For example, the association between heart disease and depression can be explained by behavioral and biological mechanisms that consider autonomic imbalance, catabolic hormonal imbalance, inflammation, and sleep disruption (15). The directionality of the relationship between chronic diseases and depression remains an unanswered question. There is a lack of clarity about whether chronic diseases like diabetes, heart disease or hypertension lead to depression or whether depression is a consequence of the burden of these chronic conditions. Future studies, especially with longitudinal data, must continue to elucidate the mechanisms that link chronic illnesses and depression. Second, in line with previous findings, we found that poorer self-rated vision was associated with being in a higher depressive class (16-18). In studies examining the relationship between dual sensory deficits and depression, visual impairment was a more robust predictor of psychological distress and wellbeing than hearing deficits (19). Future work should incorporate visual deficits into depression intervention development as well as treatment.

Finally, we found that exercising regularly and volunteering were protective factors against being in the high depressive class. Age related decreases in the intensity of physical activity that individuals participate in has been found to increase the risk of depressive symptoms among older adults (20). Volunteering has been shown to decrease negative mood and improve mental health. Our findings on the protective effect of volunteering and

being in a high depressive symptom class, is reflected in prior work (21). Future interventions with older adults in Puerto Rico and mental health, should include a volunteering component, as volunteering provides social integration that can not only improve mental health but may also have a positive impact on physical health conditions.

This study has several limitations. First, data from only one wave was considered in the data analysis; therefore, no causal inferences can be identified to understand depressive symptoms among older Puerto Ricans. Second, recall bias should be taken into consideration when interpreting results because data were collected based on respondents' retrospective reporting.

The strengths of this study are noteworthy to balance the above limitations. The data-driven methodology identified three classes of depressive symptoms in a national sample of community-dwelling older adults in a diverse and understudied group. This study contributes to the body of knowledge about the health of Puerto Rican older adults, especially risk and protective factors of their mental health. In addition, this study provides a foundation to facilitate further research on the underlying etiology of depression among older adults residing in Puerto Rico.

To conclude these findings, provide insight into the patterns of depressive symptoms among older Puerto Rican adults, which suggests a need for personalized treatment and health care that considers psychosocial and medical factors. Further studies should consider the relationship of depressive classes and mortality as well as additional mechanisms.

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