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Prevalence of depression in older adults living in Ecuador and contributing factors: a population-based study

Prevalencia de depresión en adultos mayores residentes en Ecuador y factores contribuyentes: un estudio poblacional

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ABSTRACT

Objective To estimate the prevalence of depression in the older population of Ecuador and explore the independent associations of key socio-demographic and health-related factors with moderate/severe depression.
Methods A cross-sectional study was conducted using a national database. The outcome variable was estimated using the Short Form of the Geriatric Depression Scale. A cut-value of >9 was used to ascertain the outcome variable. We conducted bivariate and logistic regression analysis.
Results The study sample consisted of 5 235 subjects, with a median age of 70 years, 53.5% were female, and 44.9% of the sample was living in rural areas. Our study found a prevalence of any depression of 35.4%. Individuals were classified as having mild depression (1 239, 23.7%), moderate depression (457, 8.7%), and severe depression (156,~3%). The prevalence of moderate/severe depression was of 11.7%. Among socio-demographic factors, no education (OR=3.69 [95% CI: 1.35-11.94]), Afro-Ecuadorian race (OR= 2.1 [1.03-4.06]), living alone (OR=2.37 [1.67-3.31]), perception of insufficient income (OR= 3.56 [2.14-6.38]), and suffering physical abuse (OR=2.33 [1.59-3.36]) remained statistically significant. Among health-related factors, drinking alcohol (OR=0.27 [0.08-0.66]), exercise (OR=1.68 [1.24-2.31]), incontinence (OR=2.00 [1.54-2.59]), lower perception of hearing (OR=2.19 [1.41-3.32]), cancer (OR=1.90 [1.00-3.51]), and being functionally dependent (OR=1.59 [1.22-2.08]) remained statistically significant.
Conclusions Our investigation brings light to an important public health problem in Ecuador. Addressing depression and its contributing factors may help to improve the quality of life and long-term health outcomes in Ecuador's growing older population.

Key Words: Depression; aged; depressive disorder; Ecuador (*source: MeSH, NLM*).

RESUMEN

Objetivo Estimar la prevalencia de depresión en la población adulta mayor de Ecuador y explorar la asociación de factores sociodemográficos y de salud claves con depresión moderada o severa.
Métodos Se realizó un estudio de corte transversal utilizando una base de datos nacional. La variable dependiente fue estimada por medio del formulario corto de la Geriatric Depression Scale. Se usó un valor de corte > 9 para definir la variable de desenlace. Se realizó un análisis bivariado y de regresión logística.
Resultados La muestra del estudio fue de 5 235 sujetos, con una mediana de edad de 70 años, 53,5% fueron mujeres y 44,9% de la muestra reside en áreas rurales. Nuestro estudio estimó una prevalencia global de depresión de 35,4%. Individuos fueron clasificados como depresión leve (1 239, 23,7%), moderada (457, 8,7%), severa (156,~3%), y moderada/severa (11,7%). Entre los factores sociodemográficos, falta de educación (OR=3,69 [95% CI: 1,35-11,94]), raza afroecuatoriana (OR=2,1 [1,03-4,06]), vivir solo (OR=2,37 [1,67-3,31]), falta de ingresos (OR=3,56 [2,14-6,38]) y abuso físico (OR=2,33 [1,59-3,36]) perma-

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necieron estadísticamente significativos. Entre los factores de salud, consumo de alcohol (OR=0,27 [0.08-0.66]), ejercicio (OR=1,68 [1,24 2,31]), incontinencia (OR=2,00 [1,54-2,59]), audición disminuida (OR=2,19 [1,41-3,32]), cáncer (OR=1,90 [1,00-3,51]) y dependencia funcional (OR=1,59 [1,22-2,08]) permanecieron estadísticamente significativos.
Conclusión Nuestra investigación trae luz a un importante problema de salud pública en el Ecuador. Abordar la depresión y sus factores de riesgo podrían ayudar a mejorar la calidad de vida y los desenlaces de salud a largo plazo en la creciente población adulta mayor del Ecuador.

Palabras Clave: Depresión; anciano; trastorno depresivo; Ecuador (*fuente: DeCS, BIREME*).

Depressive disorders are highly prevalent among older adults (>65 years) and were ranked as one of the top five causes contributing to years lived with disability, as well as one of the top ten contributing factors to the global burden of diseases in 2016 (1). Depression is strongly associated with a wide range of comorbidities including diabetes, heart disease, all-cause mortality, worse prognosis of cancer, and progression of disability due to chronic conditions (2,3). It is also associated with behaviors that can negatively impact health and decrease the efficacy of healthcare interventions, including non-adherence to medical treatments, smoking, and alcohol use (2,4,5). In addition, there is a substantial gender difference in depression in individuals who are 60 and older toward the female sex (6).

The majority of studies reporting data on depression in older adults have been conducted in North America, Asia, and Europe, with less evidence originating from other regions such as Latin America and the Caribbean (LAC) (6). Yet, the population of Latin America (LA) is aging faster compared to other United Nation's regions (7) and accommodating the care of this aging population is one of the largest challenges faced by health care systems in the region (8).

Ecuador is an example of the dramatic demographic transitions that have been occurring in LA in recent decades. For example, 6.7% of its population were older adults in 2010, and by 2025 this number is projected to reach up to 9.3% of the population (9). Further, chronic and degenerative diseases are now the principal causes of morbidity and mortality in the Ecuadorian older population (10). Despite these growing concerns, the prevalence of depression in older adults has not yet been assessed at a population level. To address this key gap in knowledge, we utilized national survey data to estimate the prevalence of depression in the elderly population of Ecuador. In addition, we explored the independent associations of socio-demographic and health-related factors with moderate and severe depression.

METHODS

Setting and dataset

Ecuador, an Andean country located in South America has a population of 17 million people (11), 70% of this population is living in urban settings (9). Similarly, to other Latin America country, the Ecuadorian population is ethnically and racially diverse (9). The present study is based on data from Encuesta Nacional sobre Salud, Bienestar y Envejecimiento (SABE-ECU), which is a de-identified and publicly available dataset. This survey used a probabilistic and population-proportionate sample (n= 5235) of households with a least one person aged 60 years or older residing in the highland and coastal regions of Ecuador (12,13).

Measures

Depression

The SABE-ECU study used the Geriatric Depression Scale (GDS) to assess the presence of depressive symptoms. The scale consists of 15 dichotomous questions (yes/no responses) that are assigned a value of 0 or 1. A response with a value of 1 is considered positive for depressive symptoms and a value of 0 corresponds to an absence of depressive symptoms. The GDS stratifies depression into three categories: mild (5-8), moderate (9-11), and severe (12-15). In a validation study, the Long Form and Short Form of the GDS had a high correlation ($r=.84$, $p<.001$) to differentiate depressed from non-depressed individuals (14). Since moderate and severe depression is associated with increased risk of fatal and non-fatal cardiovascular events, all-cause mortality, dementia, and worse prognosis of cancer (3,15); we used a composite outcome of moderate/severe depression (GDS scale >9).

Socio-demographic variables

The SABE-ECU study collected several socio-demographic variables of the participants. Based on previous studies (7,16), we included the following variables in the multiple regression: age, residential area (urban vs. rural), race (White, Indigenous, Black, Mestizo, or Mulatto), sex (female vs. male), self-reported level of education (primary, secondary, and tertiary education), self-reported income (sufficient vs. insufficient), and living arrangements (alone vs. otherwise having a social network). Sufficient income was defined as having enough material resources to afford living expenses properly.

Health-related variables

The variables of substance abuse (alcohol and tobacco), exercise, physical abuse, and incontinence (urinary or

fecal) were self-reported and categorized as "yes" or "no" responses. To assess the presence of chronic conditions among older Ecuadorian adults, we dichotomized comorbidities (hypertension, diabetes, chronic obstructive pulmonary disease [COPD], cancer, and/or arthritis) as "none or one comorbidity" versus "two or more" as described elsewhere (7). The SABE-ECU study used the instrumental activities of daily living (IADL) scale to assess functionality based on performance of eight activities. We classified an older individual as "dependent" if she/he had difficulty with at least one task. Polypharmacy was defined as the use of greater than 5 medications per day in SABE's older adults and was dichotomized in our own study as a "yes" or "no" response (17). Finally, the quality of hearing perception was categorized as "lower", "regular" or "good/excellent" for the purpose of analyses.

Statistical Analysis

Descriptive statistics were used to summarize the baseline characteristics of study participants. Continuous variables were reported as median and interquartile range (IQR) due to skeweness, and categorical variables were reported as counts and percentages. Due to a previously reported sex-based difference in depression (6), we assessed the impact of sex on the distribution of socio-demographic and health-related variables with Pearson's chi-square or Kruskal-Wallis test, as appropriate. The variables with less than 5% of missing information in the database were imputed through regression method according to Rubin rules (18). We conducted bivariate analysis to assess the relationship between depression of different categories of severity and the variables of interest. Logistic regressions were used to model key socio-demographic and health-related factors as exposure variables with the outcome of moderate/severe depression, measures of association are presented as odds ratios (OR) with their 95% confidence intervals (95% CI). The full regression model was tested for the collinearity among the independent variables by variance inflation factor (VIF). We assessed the goodness-of-fit of our model by several tests including likelihood ratio test (LRT), c-statistic, and Hosmer-Lemeshow test. In addition, we performed a sensitivity analysis to assess the magnitude of change in the ORs using a model with the endpoint variable only the category of severe depression. Results with statistical significance were those with a p-value less than 0.05. All statistical analyses were conducted using R v. 3.2.2.

RESULTS

The study sample (n=5235) represented a population of which 53.5% were female, with a median age of 70 (60-77), 44.9% lived in rural areas, 62.5% reported less than six years of schooling, 64.5% self-identified as Mestizo, and 10.5% reported living alone (Table 1). In general, women were more likely to be obese (23.9%), to have chronic diseases (hypertension, diabetes, cancer, COPD, and arthritis), to report polypharmacy (22.6%), to have a good or excellent quality of hearing perception (61.9%), and to be functionally dependent (46.2%) compared to males (Table 1). In addition, we did not find differences among the imputed values for age, race, physical abuse, hypertension, diabetes mellitus, cancer, COPD, arthritis, and body mass index (BMI) between females and males (Data not shown).

According to the GDS scale, 1239 (23.7%) individuals were classified as having mild depression, 457 (8.7%) individuals as having moderate depression, and 156 (~3%) individuals as having severe depression. The prevalence of the composite endpoint (moderate/severe depression) was of 11.7%. In the bivariate analysis we found that the prevalence of severe depression was significantly higher in females than in males (~2% vs. 1.01%, respectively; $p<.05$). Further, severe depression was more likely to be present in individuals living alone, with the perception of insufficient income, experiencing physical abuse, living with low physical/functional capacity, and with overall diminished health (Table 2).

Table 3 shows odds ratios (ORs) and 95% CIs of moderate/severe depression in relation to key socio-demographic and health-related factors. Among socio-demographic factors, no education (OR=3.69 [95% CI: 1.35-11.94]), Afro-Ecuadorian race (OR=2.1 [95% CI: 1.03-4.06]), living alone (OR=2.37 [95% CI: 1.67-3.31]), perception of insufficient income (OR=3.56 [95% CI: 2.14-6.38]), and suffering physical abuse (OR=2.33 [95% CI: 1.59-3.36]) remained statistically significant after the multiple logistic regression analysis. Among health-related factors, drinking alcohol (OR=0.27 [95% CI: 0.08-0.66]), exercise (OR=1.68 [95% CI: 1.24-2.31]), urinary or fecal incontinence (OR=2.00 [95% CI: 1.54-2.59]), lower perception of hearing (OR=2.19 [95% CI: 1.41-3.32]), among having a chronic disease the presence of cancer obtained the highest association (OR=1.90 [95% CI: 1.00-3.51]), and being functionally dependent (OR=1.59 [95% CI: 1.22-2.08]) remained significant.

In our sensitivity analysis we found that the variables of race (Afro-Ecuadorians), physical abuse, drinking alcohol, COPD, and arthritis did not remain statistical associated after the multivariable analysis. Overall, the magnitudes of the ORs using severe depression were higher compared to the composite endpoint model (Table 4). Finally, our final model fitted the observed data appropriately according to several assessment tests (LRT: <0.001; c-statistic: 0.79; and Hosmer-Lemeshow test: 0.28), and we were not able to find collinearity among the model variables.

Table 1. Baseline characteristics of the study sample by gender

Characteristic	Female n=2803	Male n=2432	p-value	Missing dataa n (%)
Socio-demographic factors				
Age (yr), median (IQR)	70 (60-77)	70 (60-77)	0.7	220 (4.2)
Residential area, n (%)			0.01	NA
Urban	1590 (56.7)	1294 (53.2)		
Rural	1213 (43.3)	1138 (46.8)		
Education, n (%)			<0.001	1231 (23.5)
No schooling	81 (3.9)	46 (2.3)		
Primary (≤6 years)	1594 (77.9)	1554 (79.4)		
Secondary (7-12 years)	284 (13.9)	216 (11)		
Tertiary (≥13 years)	88 (4.3)	141 (7.2)		
Race, n (%)			0.7	284 (5.4)
White	366 (13.9)	300 (12.9)		
Indigenous	281 (10.7)	264 (11.4)		
Black (Afro-Ecuadorians)	90 (3.4)	85 (3.7)		
Mestizo	1799 (68.4)	1580 (68.1)		
Mulatto	94 (3.6)	92 (3.9)		
Living arrangements, n (%)			0.3	NA
Accompanied	2496 (89.1)	2188 (90)		
Alone	307 (10.9)	244 (10)		
Perception of income, n (%)			0.8	1669 (31.9)
Sufficient	320 (18.1)	331 (18.4)		
Insufficient	1451 (81.9)	1464 (81.6)		
Physical abuse, n (%)			0.15	64 (1.9)
Yes	217 (7.9)	164 (6.8)		
Health-related factors				
Smoking, n (%)			<0.001	NA
Never	2431 (86.7)	793 (32.6)		
Former smoker	309 (11)	1187 (48.8)		
Current smoker	63 (2.2)	452 (18.6)		
Alcohol, n (%)			<0.001	NA
Yes	71 (2.5)	243 (9.9)		
Exercise, n (%)			<0.001	NA
Yes	692 (24.7)	990 (40.7)		
Hypertension, n (%)			<0.001	49 (0.9)
Yes	1384 (49.9)	903 (37.4)		
Diabetes Mellitus, n (%)			<0.001	51 (0.9)
Yes	414 (14.9)	263 (10.9)		
Cancer, n (%)			<0.001	8 (0.1)
Yes	93 (3.3)	51 (2.1)		
COPD, n (%)			<0.001	12 (0.2)
Yes	250 (8.9)	163 (6.7)		
Arthritis, n (%)			<0.001	36 (0.7)
Yes	1106 (39.7)	543 (22.5)		
BMI (kg/m2), n (%)			<0.001	3 (0.01)
Underweight (<18.49)	175 (6.2)	111 (4.6)		
Normal (18.5-24.9)	918 (32.8)	1128 (46.4)		
Overweight (25-29.9)	1038 (37)	922 (37.9)		
Obese (>30)	671 (23.9)	269 (11.1)		
Polypharmacy, n (%)			<0.001	434 (8.3)
0-2	922 (36.3)	1031 (45.6)		
3-5	1043 (41.1)	855 (37.8)		
>5	574 (22.6)	376 (16.6)		
Incontinence (Urinary/Fecal), n (%)			<0.001	NA
Yes	815 (29.01)	453 (18.6)		
Perception of hearing, n (%)			<0.01	NA
Lower	249 (8.8)	237 (9.7)		
Regular	819 (29.2)	791 (32.5)		
Good/Excellent	1735 (61.9)	1404 (57.7)		
Chronic diseases, n (%)			<0.001	NA
0-1	1804 (64.3)	1937 (79.6)		
≥2	999 (35.6)	495 (20.3)		
Functional dependence (IADL), n (%)			<0.001	NA
Yes	1294 (46.2)	683 (28.1)		

[a]Missing data encompass unknown or no-answered questions by study participants; IQR: Interquartile Range; NA: Not Applicable; COPD: Chronic Obstructive Pulmonary Disease; BMI: Body Mass Index; IADL: Lawton Instrumental Activities of Daily Life Scale.

Table 2. Comparison among depression categories in the study sample

Characteristic	Mild n=1239	Moderate n=457	Severe n=156	p-value
Socio-demographic factors				
Age (yr), median (IQR)	71 (60-79)	71 (60-78)	71 (60-79)	0.9
Sex, n (%)				0.04
Female	729 (58.8)	279 (61)	103 (69.2)	
Residential area, n (%)				0.4
Rural	618 (49.9)	230 (50.3)	69 (44.2)	
Education, n (%)				0.07
No schooling	27 (2.2)	18 (3.9)	11 (7)	
Primary (≤6 years)	736 (59.4)	294 (64.3)	114 (73.1)	
Secondary (7-12 years)	72 (5.8)	31 (6.8)	10 (6.4)	
Tertiary (≥13 years)	14 (1.1)	11 (2.4)	1 (0.6)	
Race, n (%)				0.8
White	181 (14.6)	56 (15.5)	2 (14.1)	
Indigenous	182 (14.7)	71 (15.5)	22 (14.1)	
Black (Afro-Ecuadorians)	35 (2.8)	19 (4.1)	6 (3.8)	
Mestizo	784 (63.3)	294 (64.3)	100 (64.1)	
Mulatto	57 (4.6)	17 (3.7)	6 (3.8)	
Living arrangements, n (%)				0.03
Alone	145 (11.7)	71 (15.5)	27 (17.3)	
Perception of income, n (%)				<0.01
Sufficient	95 (12.8)	23 (7.3)	6 (4.7)	
Physical abuse, n (%)				<0.001
Yes	109 (8.8)	76 (16.6)	19 (12.2)	
Health-related factors				
Smoking, n (%)				0.7
Never	830 (66.9)	307 (67.2)	108 (69.2)	
Former smoker	319 (25.7)	113 (24.7)	41 (26.3)	
Current smoker	90 (7.3)	37 (8.1)	7 (4.5)	
Alcohol, n (%)				0.04
Yes	49 (3.9)	11 (2.4)	1 (0.6)	
Exercise, n (%)				<0.01
Yes	322 (25.9)	103 (22.5)	24 (15.4)	
Hypertension, n (%)				<0.01
Yes	589 (47.5)	256 (56)	79 (50.6)	
Diabetes Mellitus, n (%)				0.08
Yes	188 (15.2)	87 (19)	31 (19.9)	
Cancer, n (%)				0.1
Yes	52 (4.2)	15 (3.3)	11 (7)	
COPD, n (%)				<0.01
Yes	110 (8.9)	58 (12.7)	26 (16.7)	
Arthritis, n (%)				0.02
Yes	495 (39.9)	217 (47.5)	68 (43.6)	
BMI (kg/m2), n (%)				0.3
Underweight (<18.49)	111 (8.9)	37 (8.1)	11 (7)	
Normal (18.5-24.9)	502 (40.5)	174 (38.1)	64 (41)	
Overweight (25-29.9)	393 (31.7)	173 (37.8)	64 (32.7)	
Obese (>30)	233 (18.8)	73 (15.9)	30 (19.2)	
Polypharmacy, n (%)				0.5
<3	429 (34.6)	164 (35.9)	49 (31.4)	
3-5	440 (35.5)	164 (35.9)	59 (37.8)	
>5	250 (20.2)	103 (22.5)	42 (26.9)	
Incontinence (Urinary/Fecal), n (%)				<0.001
Yes	390 (31.5)	170 (37.2)	75 (48.1)	
Perception of hearing, n (%)				<0.01
Lower	158 (12.7)	84 (18.4)	26 (16.7)	
Regular	460 (37.1)	191 (41.8)	59 (37.8)	
Good/Excellent	621 (50.1)	182 (39.8)	71 (45.5)	
Chronic diseases, n (%)				<0.01
0-1	797 (64.3)	254 (55.6)	90 (57.7)	
≥2	442 (35.7)	203 (44.4)	66 (42.3)	
Functional dependence (IADL), n (%)				0.3
Yes	665 (53.7)	256 (56)	93 (59.6)	

IQR: Interquartile Range; BMI: Body Mass Index; IADL: Lawton Instrumental Activities of Daily Life Scale; COPD: Chronic Obstructive Pulmonary

Table 3. Multiple Logistic regression analysis of the association of socio-demographic and health-related factors with moderate/severe depression

Variables	Unadjusted OR (95% CI)	Adjusted OR (95% IC)
Socio-demographic factors		
Sex		
Male	1.0§	1.0§
Female	1.70 (1.38-2.09)***	1.30 (0.93-1.82)
Residential area		
Urban	1.0§	1.0§
Rural	1.19 (0.98-1.45)	1.16 (0.88-1.52)
Education		
Tertiary (≥13 years)	1.0§	1.0§
Secondary (7-12 years)	2.17 (0.99-5.42)	1.87 (0.74-5.77)
Primary (≤6 years)	3.20 (1.61-7.58)**	2.12 (0.91-6.21)
No schooling	7.39 (3.24-19)***	3.69 (1.35-11.94)*
Race		
White	1.0§	1.0§
Indigenous	1.81 (1.23-2.69)**	1.29 (0.76-2.18)
Black (Afro-Ecuadorians)	1.60 (0.90-2.76)	2.1 (1.03-4.06)*
Mestizo	1.12 (0.82-1.56)	1.1 (0.76-1.62)
Mulatto	1.24 (0.67-2.19)	1.41 (0.67-2.80)
Living arrangements		
Accompanied	1.0§	1.0§
Alone	1.90 (1.44-2.46)**	2.37 (1.67-3.31)***
Perception of income		
Sufficient	1.0§	1.0§
Insufficient	4.92 (3.01-8.69)***	3.56 (2.14-6.38)***
Physical abuse		
No	1.0§	1.0§
Yes	2.55 (1.90-3.38)***	2.33 (1.59-3.36)***
Health-related factors		
Smoking		
Never	1.0§	1.0§
Former smoker	0.75 (0.59-0.94)*	0.93 (0.66-1.30)
Current smoker	0.58 (0.39-0.85)**	0.94 (0.54-1.60)
Alcohol		
No	1.0§	1.0§
Yes	0.13 (0.04-0.32)***	0.27 (0.08-0.66)*
Exercise		
Yes	1.0§	1.0§
No	2.14 (1.68-2.76)***	1.68 (1.24-2.31)**
Polypharmacy		
0-2	1.0§	1.0§
3-5	1.24 (0.98-1.56)	0.99 (0.75-1.33)
>5	1.57 (1.20-2.04)***	1.03 (0.74-1.45)
Incontinence (Urinary/Fecal)		
No	1.0§	1.0§
Yes	2.72 (2.22-3.32)***	2.00 (1.54-2.59)***
Hearing		
Good/Excellent	1.0§	1.0§
Regular	1.99 (1.60-2.48)***	1.81 (1.39-2.37)***
Lower	3.24 (2.43-4.28)***	2.19 (1.41-3.32)***
Hypertension		
No	1.0§	1.0§
Yes	1.64 (1.34-2.00)***	1.27 (0.91-1.78)
Diabetes Mellitus		
No	1.0§	1.0§
Yes	1.86 (1.44-2.38)***	1.42 (0.97-2.06)
Cancer		
No	1.0§	1.0§
Yes	2.17 (1.34-3.35)***	1.90 (1.00-3.51)*
COPD		
No	1.0§	1.0§
Yes	2.57 (1.93-3.36)***	1.67 (1.10-2.52)*
Arthritis		
No	1.0§	1.0§
Yes	2.21 (1.81-2.69)***	1.67 (1.19-2.35)**
Chronic diseases		
0-1	1.0§	1.0§
≥2	2.41 (1.98-2.94)***	0.97 (0.59-1.57)
Functional dependence (IADL)		
No	1.0§	1.0§
Yes	2.55 (2.09-3.11)***	1.59 (1.22-2.08)***

CI: Confidence Interval; IADL: Lawton Instrumental Activities of Daily Life Scale; COPD: Chronic Obstructive Pulmonary Disease * 0.01; ** <0.01; *** <0.001;§ Reference group.

Table 4. Multiple logistic regression analysis of the association of socio-demographic and health-related factors with severe depression (sensitivity analysis)

Variables	Unadjusted OR (95% CI)	Adjusted OR (95% IC)
Socio-demographic factors		
Sex		
Male	1.0§	1.0§
Female	1.99 (1.41-2.83)***	1.54 (0.93-2.56)
Residential area		
Urban	1.0§	1.0§
Rural	0.97 (0.70-1.33)	1.02 (0.67-1.52)
Education		
Tertiary (≥13 years)	1.0§	1.0§
Secondary (7-12 years)	4.65 (0.88-85.65)	2.83 (0.49-53.42)
Primary (≤6 years)	8.57 (1.90-151.18)*	4.97 (0.99-89.09)
No schooling	21.62 (4.13-397.6)**	9.37 (1.63-178.18)*
Race		
White	1.0§	1.0§
Indigenous	1.29 (0.69-2.43)	0.99 (0.44-2.17)
Black (Afro-Ecuadorians)	1.15 (0.41-2.74)	1.32 (0.43-3.52)
Mestizo	0.96 (0.60-1.61)	1.00 (0.60-1.77)
Mulatto	1.08 (0.39-2.57)	1.27 (0.40-3.42)
Living arrangements		
Accompanied	1.0§	1.0§
Alone	1.82 (1.17-2.74)**	1.94 (1.00-3.16)*
Perception of income		
Sufficient	1.0§	1.0§
Insufficient	4.69 (2.25-12.03)***	3.24 (1.52-8.43)**
Physical abuse		
No	1.0§	1.0§
Yes	1.71 (1.00-2.75)*	1.40 (0.75-2.45)
Health-related factors		
Smoking		
Never	1.0§	1.0§
Former smoker	0.81 (0.17-0.80)*	1.26 (0.77-2.06)
Current smoker	0.40 (0.56-1.16)	0.86 (0.31-2.03)
Alcohol		
No	1.0§	1.0§
Yes	0.10 (0.006-0.44)*	0.21 (0.02-1.01)
Exercise		
Yes	1.0§	1.0§
No	2.66 (1.75-4.23)***	1.91 (1.17-3.27)*
Polypharmacy		
0-2	1.0§	1.0§
3-5	1.25 (0.85-1.84)	1.18 (0.76-1.85)
>5	1.80 (1.18-2.73)**	1.37 (0.83-2.26)
Incontinence (Urinary/Fecal)		
No	1.0§	1.0§
Yes	3.01 (2.18-4.15)***	2.26 (1.54-3.30)***
Hearing		
Good/Excellent	1.0§	1.0§
Regular	1.64 (1.15-2.33)**	1.43 (0.94-2.14)
Lower	2.44 (1.52-3.82)***	2.27 (1.24-4.01)**
Hypertension		
No	1.0§	1.0§
Yes	1.29 (0.94-1.78)	0.96 (0.58-1.58)
Diabetes Mellitus		
No	1.0§	1.0§
Yes	1.70 (1.12-2.50)*	1.29 (0.74-2.21)
Cancer		
No	1.0§	1.0§
Yes	2.82 (1.41-5.09)**	2.68 (1.17-5.65)*
COPD		
No	1.0§	1.0§
Yes	2.44 (1.55-3.70)***	1.46 (0.79-2.61)
Arthritis		
No	1.0§	1.0§
Yes	1.68 (1.21-2.33)**	1.18 (0.71-1.93)
Chronic diseases		
0-1	1.0§	1.0§
≥2	1.87 (1.35-2.59)***	1.06 (0.51-2.19)
Functional dependence (IADL)		
No	1.0§	1.0§
Yes	2.50 (1.81-3.48)***	1.63 (1.10-2.43)*

CI: Confidence Interval; IADL: Lawton Instrumental Activities of Daily Life Scale; COPD: Chronic Obstructive Pulmonary Disease; * 0.01; ** <0.01: *** <0.001:§ Reference group.

DISCUSSION

Our study informed the prevalence of depression in older adults living in Ecuador and its relationship to key socio-demographic and health-related factors. Here we report a prevalence of any depression of 35.4% and of severe depression of ~3%. Among socio-demographic factors examined, no education (OR=3.69) and the perception of insufficient income (OR=3.56) were the strongest associations for moderate/severe depression. In addition, among the health-related factors examined, incontinence (OR=2.00) and having a lower hearing function (OR=2.19) were the strongest associations for this condition. Our investigation brings light to an important public health problem in Ecuador and elucidates key health associations that could guide further research and support strategies to identify older people with depression in the country.

This study advances the current understanding of depression in older adults in Ecuador in various ways. Firstly, our study provides prevalence values at a population level, whereas prior literature has reported frequency measures based on a small cohort of individuals located in the coastal region of Ecuador (19). Secondly, our study provides measures of the prevalence of depression stratified by the severity of symptoms, unlike a previous study using the SABE-ECU dataset (13) that defined depression as a score of 6 or more in the GDS 15-item scale without further disaggregation. Thirdly, our study examines independent associations between moderate/severe depression and key health determinants.

Comparison of current results with literature

The prevalence of severe depression observed in our study population was lower compared to high-income nations, where prevalence of severe depression ranges from 4.6% to 9.3% (20). This difference could be related to the selection of the study samples, since these studies generally included samples with a higher proportion of women, older individuals (75+), and individuals with a higher level of cognitive impairment (20,21). However, in comparing our point prevalence to other LAC nations, it is within a previously described range from 0.3% to 9.5% (7). This wide heterogeneity in prevalence could be explained by several factors, such as differences in social network characteristics (low levels of social integration and supportive services), health insurance coverage and access to health services, and high rates of unemployment and social insecurity across the region (22,23).

Previous literature has shown sex-based differences in depression in older adults, with women being more likely to experience early initial episodes of more severe, enduring depression than males (6). Our results are concordant with this as we found a higher prevalence of severe depression in females compared to males (~2% vs. 1.01%). These rates are also within the ranges reported across the region from 0.3 to 9.2% in women and from 0.4 to 5.2% in men, respectively (7). This gender inequality could be due to that women are more frequently exposed to gender-related disadvantages or life stressors related to financial strain/poverty, marital status/living alone, physical functioning, caregiving, and poor health status (6,7,24).

Among the independent predictors (socio-economic and health-related) for moderate/severe depression in this study, we found that those related to lower socio-economic status (income and education), living alone, low physical/functional capacity, and poor health remained significant after adjusting for potential confounding. These findings are in agreement with previous studies conducted in other LAC countries and elsewhere (6,7,16,25). However, some risk factors carry more influence than others. For example, there is a higher risk of depression among older adults living in countries with less availability of health and social services that counteract economic and health constraints (26). In addition, depressive symptoms are more pronounced in countries that place high importance on traditional family-based values, namely the expectation of children to provide support and care to their elders (16). We were surprised to find a protective effect of alcohol use for moderate/severe depression. However, literature reports that using alcohol helps to stress coping and is used to ameliorate the symptoms of depression (27).

Implications of findings

Moderate and severe depression in older people is associated with increased risk of fatal and non-fatal cardiovascular events, all-cause mortality, dementia, and worse prognosis of cancer (3,15). The relationship between depression and cardiovascular disease (CVD) and mortality is complex, and heterogeneous findings may be due to differences in the measurement of depression, sample size, follow-up time and the potential for reverse causation (15). However, recent evidence from a population-based study has shown robust results by measuring depression before the first diagnosis of cardiovascular disease (coronary heart disease and stroke) or cancer, thus minimizing the possibility of reverse causality (3). These results suggest that the early detection and treatment of depression could mitigate the risk of CVD and reduce long-term mortality from cancer. In Ecuador specifically, this early detection practice could benefit, as projected by 2025 up to ~1.6 million older adults. However, this intervention

opportunity is heavily jeopardized due to the fact that Ecuador is one of the few countries in Latin America that does not have an official mental health policy (28). The average number of psychiatry units in general hospitals and day centers in South America are 0.3 and 0.45 per 100,000 population, respectively. In Ecuador, the number of psychiatric units in hospitals is 0.1 units per 100,000 population with no reported day centers (29). Depression followed by anxiety, stress and poly-substance misuse are the most common mental illnesses in the country (28,29). Hence, the Ecuadorian healthcare system could potentially greatly reduce costs and the social burden of chronic conditions by allocating more attention and resources to identifying and treating those individuals at high risk for depression.

Strengths and limitations

Our study used data from a national survey that is representative of the entire Ecuadorian older population, which maximizes its generalizability. The GDS scale is a well-validated and established screening instrument that has been used to measure depression among older people across cultures, which increases our certainty in the estimates (7,30). A cutoff value of >9 on the GDS-15 was used to reduce misclassification bias to detect moderate/severe depression (31). We were able to model a broad set of predictors for moderate/severe depression and obtained a good discrimination value (c-statistic: 0.79). In addition, in the sensitivity analysis, we found same results in the ORs (direction and statistical significance) in most of the variables with the exception of race (black), physical abuse, alcohol, COPD, and arthritis. This might be due to the lower numbers of outcome data to fit the model. However, our study has some limitations that should be considered. The obtained prevalence values might be underestimated due to survival bias. Furthermore, due to recall bias, non-differential exposure misclassification bias may be present in the estimation of the association between the predictors and the outcome variable, which could attenuate the magnitude of the ORs. Nevertheless, self-reported information appears to be reliable (32).

In conclusion, our study provides point prevalence measures of depression in the older population of Ecuador. We observed a prevalence rate of moderate/severe and severe depression of 11.7%% and ~3%, respectively. In the multivariable analysis we found that moderate/severe depression was strongly associated with being Afro-Ecuadorian, lower socio-economic status, living alone, poor health status, physical abuse, and diminished physical/functional capacity. Addressing depression and its risk factors may help to improve the quality of life and long-term health outcomes in Ecuador's growing older population ♦

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