


**RESEARCH ARTICLE**

# Factors related to depressive symptoms and self-reported diagnosis of depression in community-dwelling older Chileans: A national cross-sectional analysis

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**Aim:** The aims of this study were to describe the prevalence of screening-positive depression and to identify the frequency and factors related to self-reported depression diagnosis in people with screen-positive depression.

**Methods:** Using the Geriatric Depression Scale (GDS-15), 4065 older Chileans were screened for depression. Social and health variables were included. Self-reported depression diagnosis and antidepressant use were analyzed according to screen-positive depression (GDS-15  $\geq$  5). Chi-square and logistic regression analyses were conducted to identify factors related to screen-positive depression, and self-reported diagnosis and current antidepressant use.

**Results:** Overall, mean age was 71.0 years, 60.9% women, and 71.4% had  $\leq$ 8 years of education. 28.3% of the population screened positive for depression (mild: 21.7%; moderate-severe: 6.5%). Only 35.9% of screen-positive depression individuals self-reported a depression diagnosis (mild: 32.6%; moderate-severe: 47.0%), with significant differences between the sexes (women: 42.2%; men: 22.5%;  $P < .01$ ). No education (OR = 2.00, 95% CI = 1.20-3.32), multimorbidity (OR = 1.88, 95% CI = 1.42-2.48), dependence (OR = 4.14, 95% CI = 3.11-5.51) and pain (OR = 2.49, 95% CI = 2.01-3.07) were related to screen-positive depression. In people screen-positive depression, men (OR = 0.48, 95% CI = 0.35-0.65) and 80 years or older were less likely to self-report depression diagnosis (OR = 0.35, 95% CI = 0.23-0.54), and current antidepressant use (OR = 0.31, 95% CI = 0.14-0.70).

**Conclusions:** A high prevalence of depressive symptoms and low agreement with self-reported depression is observed. There is a need to increase the diagnosis of depression especially in men and people 80 years or older.

**KEYWORDS**

depression, diagnosis, older adults, screening

## 1 | INTRODUCTION

Ageing in Chile provides myriad scenarios, being an interesting representation of present and future realities in Latin America. The country has the highest life expectancy in South America, where individuals older than 65 years represent 11.4% of the total population,<sup>1</sup> and it is predicted that by 2050 they will account for 23.6% of the population. Fifteen per cent of people older than 60 years are living in rural areas, with an important part under the line of poverty. Although Chile is classified as a high-income economy according to the World Bank, 22.1% of people older than 60 years suffer multidimensional poverty, an index that does consider education, health, housing, work, and social security.<sup>2</sup> Further, social participation is scarce, since only 35% of older Chileans report being engaged in the community. These situations could expose the older population to low resource use, isolation and loneliness, which could increase the risk of depressive symptom manifestation.<sup>3</sup>

Depression in older people is frequent and has several impacts on mood, cognitive performance, functionality, quality of life and treatment outcomes.<sup>4,5</sup> Recent World Health Organization data shows that 4.4% of the world population suffers from depression, and people aged 55 to 75 years have the highest rate (7.5% in women and 5.5% in men).<sup>6</sup> Chile reports that 5% of its population (844 000 people aged 15 years and older) have depression, which is higher than the average world prevalence. In the Survey in health, well-being, and aging in Latin America and the Caribbean (SABE) study performed in community-dwelling people aged 60 years and older who live in Santiago of Chile, the prevalence of depression identified through the Geriatric Depression Scale (GDS-15) was 29.5% in women and 18.9% in men.<sup>7</sup> Another study that used data from The Chilean National Health Survey (Encuesta Nacional de Salud), which evaluated depression prevalence with the Composite International Diagnostic Interview-Short Form (CIDI-SF) across the Chilean population, found a prevalence of 16.8% in 2003 and 13.5% in 2010 for people over 65 years.<sup>8</sup> The discrepancies found in both studies do not allow to have an appropriate evaluation of the current scenario. Since approximately 85% to 90% of older Chilean adults use the public healthcare system, it is important to utilize valid and reliable measures for depression screening in the elderly in primary care settings.

Although there is evidence that depression is underdiagnosed in older adults throughout the world,<sup>9-11</sup> these studies were conducted in specific groups outside of Latin America. Moreover, there is a lack of information regarding discrepancies between the sexes and sociodemographic and health factors that are related to depression underdiagnosis in the older population. This crucial information would help to identify subgroups susceptible to underdiagnosis and to develop context-tailored methods to increment depression diagnosis by physicians and mental health professionals. Based on this background, this study aimed to describe the prevalence of screening-positive depression in the older Chilean adult population and to identify the frequency and factor(s) related to the self-reported diagnosis of depression. This information is fundamental to highlight the importance of geriatric depression and will provide essential information to

### Key points

- Considering the demographic transition in Latin America during last years, it is a priority to analyze and highlight the mental health problems that occur in the older population in order to identify groups propense to these conditions and to develop public health strategies to mitigate its.
- Depression in older adults has an important impact on health and it is often underdiagnosed. However, there exists a lack of information regarding the sex differences in the diagnosis report and the social and health factors related to underdiagnosis.
- In this study, conducted in a national population of 4065 community-dwelling older Chilean adults, 28.3% of the population screened positive for depression (GDS-15  $\geq$  5 pts.). Only 22.5% of men with screen-positive depression reported having a diagnosis of depression compared to 42.2% of women. Moreover, living alone, low education, multimorbidity, dependence, and pain were related to screening-positive depression.
- In people with screen-positive depression (GDS-15  $\geq$  5 pts.), being men and 80 years or older were related to a lower odd to report a diagnosis of depression and current antidepressant use.

develop new strategies for appropriate screening of this syndrome in Latin American communities.

## 2 | MATERIALS AND METHODS

### 2.1 | Study design

This study was a secondary data analysis of the National Survey of Dependence in Older People in Chile,<sup>12</sup> a cross-sectional research conducted in a probabilistic representative sample of the Chilean population over 60 years. The sample size was 4766 community-dwelling people who lived in all regions of the country (Chile is administratively divided into 15 regions). Data were collected between November 2009 and January 2010. The methods of the study are described previously,<sup>13</sup> but a brief explication of sample and data collection is included below.

### 2.2 | Sample and data collection

The last Chilean national census was used as a sample framework. The selected method involved stratified sampling at several stages, with proportional selection according to population size. These procedures were conducted in order to ensure the selection of participants who lived in rural and urban areas. Homes were identified by Chilean

census area maps. The areas and homes were randomly selected from every municipality. The population older than 80 years was over-sampled to allow precise estimation of their dependency levels. After approval from the Nutrition and Food Technology Institute (INTA), University of Chile Ethics Committee, once a home was chosen, a person older than 60 years was randomly selected and invited to participate in the study. Written informed consent was obtained from all subjects.

### 2.3 | Inclusion/exclusion criteria

The exclusion criteria for the present study were: cognitive impairment (abbreviated Mini-Mental State Examination score < 13 and Pfeffer Functional Activities Questionnaire > 5),<sup>14</sup> or at least one incomplete question of the considered variables. Subjects with cognitive impairment were excluded to reduce recall bias in the self-reported depression diagnosis, treatment, and other health conditions. From 4766 subjects, 573 were excluded due to cognitive impairment and 128 incomplete questionnaires. The final total sample of 4065 people was included in the study and analysis.

### 2.4 | Study variables

For this study, the main variables were depression screening, self-reported depression diagnosis, and self-reported current antidepressant use. Sociodemographic characteristics, dependence severity, multimorbidity, and pain were also considered in the analysis.

### 2.5 | Depression screening

Depression was measured with the GDS-15,<sup>15</sup> which is used to screen for depressive symptoms during the last 2 weeks in people 60 years and older. The scale has 15 items with dichotomous answer (Yes/No). The Spanish-language version has good sensitivity (86.4%-86.7%) and specificity (63.1%-85.6%) for depression screening in the elderly.<sup>16,17</sup> A GDS-15 score  $\geq 5$  indicates positive depressive symptoms. A score from 5 to 10 indicates mild depression and >10 denotes moderate-severe depression.

### 2.6 | Self-reported depression diagnosis and antidepressant use

Participants were asked whether they currently have received a depression diagnosis by a physician or healthcare practitioner (self-reported diagnosis). If people answered "Yes" (n = 1153), they were consulted about whether they received an antidepressant prescription (Yes/No; "Yes", n = 415), and then whether they are currently using antidepressants for depression treatment (Yes/No).

### 2.6.1 | Sociodemographic characteristics

In order to characterize the sample, information related to age, sex, marital status, years of education and family arrangements was collected.

### 2.6.2 | Dependence severity

Dependence was measured through a self-reported need for help questionnaire based on 12 basic activities of daily living (ADL) and seven instrumental activities of daily living (IADL), specifically considering performance for every activity over the prior 2 weeks. People were categorized as mild-moderate dependence if they always or almost always required help to perform  $\geq 1$  ADL or  $\geq 2$  IADL. People unable to perform  $\geq 1$  ADL or  $\geq 2$  IADL were classified as having severe dependence.<sup>18</sup>

### 2.6.3 | Multimorbidity

Selected chronic health conditions were examined with self-reporting measure (hypertension [HT], diabetes, stroke, Parkinson disease, chronic obstructive pulmonary disease [COPD] and arthritis/arthrosis). Multimorbidity was defined as having two or more chronic diseases.<sup>19</sup>

### 2.6.4 | Pain

Pain was assessed by its presence and sensation during the last month. It was described with a range of intensity in a Likert format question (without pain, mild, moderate or severe), and was divided in three categories: no pain, mild-moderate, and severe pain.

### 2.7 | Data analysis

An unweighted descriptive analysis of sociodemographic and health characteristics by sex was conducted. Frequency and confidence intervals (CIs) of self-reported previous depression diagnosis and the frequency of depression identified by a GDS-15 score  $\geq 5$  were estimated. The sociodemographic and health characteristics of the sample according to depression diagnosis and severity were compared between groups using the chi-square test. Logistic regression models were utilized to estimate variables associated with self-reported previous diagnosis, positive screen for depression, and medication use. Interaction among independent variables was tested for every model. The Hosmer-Lemeshow test was used to estimate the goodness of fit for the models. Contemplating the number of analyses carried in the logistic regression, variables with a significance level of .01 were included as a statistically significant result. All data were analyzed using STATA 15.0 software, considering a CI of 95%.

## 2.8 | Ethics statement

The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008. All procedures involving human subjects were approved by the Ethic-Scientific Committee (CEC) of the Nutrition and Food Technology Institute (INTA), Dr Fernando Monckeberg B., University of Chile.

## 3 | RESULTS

### 3.1 | Sociodemographic and health characteristics

Table 1 shows the sociodemographic and health characteristics separated by sex and total. Overall, 60.9% of participants were women. The mean age was 71.0 (SD: 7.8 years), and 15.9% were  $\geq 80$  years. Regarding marital status, 49.4% were married, 30.6% widowed and 20% single or divorced. Further, 71.4% of people had

**TABLE 1** Sociodemographic and health background by sex and total sample

	Women (n = 2479), n (%)	Men (n = 1586), n (%)	Total (n = 4065), n (%)	t/ $\chi^2$	P
<b>Age (years)</b>					
60-69	1157 (46.7%)	785 (49.5%)	1942 (47.77%)	3.6513	.161
70-79	925 (37.3%)	548 (34.5%)	1473 (36.24%)		
$\geq 80$	397 (16%)	253 (16%)	650 (15.99%)		
Mean $\pm$ SD (min-max)	71.12 $\pm$ 7.81 (60-101)	70.89 $\pm$ 7.8 (60-100)	71.03 $\pm$ 7.8 (60-101)	0.23472	.3507
<b>Marital status</b>					
Married/couple	971 (39.17%)	1036 (65.32%)	2007 (49.4%)	307.0566	<.001
Single/divorced	526 (21.22%)	288 (18.16%)	814 (20%)		
Widowed	982 (39.61%)	262 (16.52%)	1244 (30.6%)		
<b>Education years</b>					
No education	213 (8.6%)	106 (6.68%)	319 (7.85%)	21.343	<.001
1-8 years	1617 (65.2%)	967 (60.97%)	2584 (63.56%)		
9-11 years	566 (22.8%)	436 (27.49%)	1002 (24.65%)		
$\geq 12$ years	83 (3.4%)	77 (4.85%)	160 (3.94%)		
<b>Residency</b>					
Urban	1797 (72.49%)	1024 (64.56%)	2821 (69.4%)	28.5958	<.001
Rural	682 (27.51%)	562 (35.44%)	1244 (30.6%)		
<b>Family arrangements</b>					
Living alone	440 (17.75%)	272 (17.15%)	712 (17.52%)	0.2402	.624
<b>Dependency</b>					
Mild-moderate	254 (10.25%)	151 (9.52%)	405 (9.96%)	0.7774	.678
Severe	160 (6.45%)	109 (6.87%)	269 (6.62%)		
<b>Chronic diseases</b>					
HT	1666 (67.75%)	867 (55.47%)	2533 (62.98%)	61.8141	<.001
Diabetes	566 (23.14%)	282 (18.09%)	848 (21.17%)	14.5560	<.001
Stroke	76 (3.09%)	62 (3.96%)	138 (3.43%)	2.1578	.142
COPD	321 (13.08%)	163 (10.46%)	484 (12.06%)	6.1368	.013
Arthritis/arthrosis	569 (22.95%)	148 (9.33%)	717 (17.64%)	123.5274	<.001
Parkinson disease	41 (1.65%)	29 (1.83%)	70 (1.72%)	0.1742	.676
<b>Multimorbidity</b>					
0-1	1453 (59.61%)	1277 (73.7%)	2622 (64.5%)	134.5262	<.001
2	753 (30.38%)	297 (18.73%)	1050 (25.83%)		
$\geq 3$	273 (10.01%)	12 (7.57%)	393 (9.67%)		
<b>Pain</b>					
Mild-moderate	1186 (47.64%)	749 (47.23%)	1930 (47.48%)	104.8396	<.001
Severe	712 (28.72%)	270 (17.02%)	982 (24.16%)		

Note: COPD, chronic obstructive pulmonary disease; HT, hypertension; t: Student's t test;  $\chi^2$ , chi-square test; P, significance level.

≤8 years of education, 69.4% lived in an urban area and 17.5% lived alone.

Related to health characteristics, 16.5% presented ADL dependence (9.9% mild-moderate and 6.6% severe). Nearly three-fourths (74.6%) of subjects had at least one chronic disease (35.5% had two or more). Of the diseases, HT (62.9%), diabetes (21.1%), and arthritis/arthrosis (17.6%) were most frequent. Additionally, 71.6% of people reported pain in the last month (24.1% reported severe pain).

### 3.2 | Prevalence of depression

Table 2 shows the prevalence of depression (according to GDS-15) in older Chilean adults by sex, age range, family arrangements, education years, residency (urban/rural), dependence, chronic diseases, multimorbidity, and pain. From the total sample, 28.3% had mild (21.7%) or moderate-severe (6.5%) depression. Women presented a higher depression prevalence (GDS-15 ≥ 5) than men (31.6% and 23.2%, respectively;  $P < .01$ ). People 80 years and older reported the highest prevalence of depression; there was a significant difference in mild depression in this age range (24.1%) compared to people 60 to 69 years old (20.8%). The subjects who lived alone reported greater depression prevalence than people who lived with others (31.6% and 27.6%, respectively;  $P < .05$ ). With regards to education, people with 1 to 8 years (30.1% of the total sample) and especially those without education reported a higher prevalence in total depression (38.5%) compared to people with 9 or more education years ( $\chi^2 = 48.5565$ ,  $P < .01$ ).

Older adults who had some degree of dependence showed significantly higher depression compared to independent people (mild-moderate dependence: 45.9%; severe dependence: 62.1%;  $P < .01$ ). In this group, older people with severe dependence exhibited the highest depression prevalence for the entire sub-group population (mild depression: 40.8%; moderate-severe depression: 21.1%). People who reported Parkinson disease (54.9%), COPD (46.1%), stroke (36.7%) and arthritis/arthrosis (35.7%) had a higher depression prevalence. Participants with two or more chronic diseases had a greater screening of depression compared to those with none or one disease ( $P < .01$ ). Individuals with three or more chronic diseases showed the highest prevalence for the different depression levels (32.5% mild and 12.9% moderate-severe). A similar pattern was found in people with pain; 51.7% of people with severe pain exhibited depressive symptoms.

### 3.3 | Self-reported depression diagnosis and current antidepressant use

Figure 1 illustrates the percentages of participants with and without a self-reported depression diagnosis, according to GDS-15. For the group of people who presented depression based on GDS-15, 35.9% received a depression diagnosis from a physician or healthcare practitioner (32.6% mild and 47.0% moderate-severe). Notably, there were

significant sex differences with regards to self-reporting depression diagnosis in people with positive depressive symptoms according to GDS-15 for mild (women: 38.2%; men: 20.8%;  $\chi^2 = 26.3741$ ,  $P < .01$ ) and moderate-severe depression (women: 55.7%; men: 28.2%;  $\chi^2 = 17.6233$ ,  $P < .01$ ).

Table 3 illustrates logistic regression models for factors related to screen-positive depression, self-reported depression diagnosis, and current antidepressant use. Model 1 describes factors related to screening-positive depression according to GDS-15 in the total sample ( $n = 4062$ ). No education, odds ratio (OR = 2.00,  $P = .008$ ), two or more chronic diseases (2 diseases OR = 1.45,  $P = .001$ ; ≥3 diseases OR = 1.88,  $P < .001$ ), ADL dependence (mild-moderate OR = 2.24,  $P < .001$ ; severe OR = 4.14,  $P < .001$ ) and pain (mild-moderate OR = 2.49,  $P < .001$ ; severe OR = 5.75,  $P < .001$ ) all presented statistically significant odds for positive depression screening. Being 80 years or older was related to lower odds of screen-positive depression (≥80 OR = 0.71,  $P < .005$ ).

Model 2 was performed in people who self-reported depression diagnosis and had screening-positive depression according to the GDS-15 ( $n = 1153$ ). Being male (OR = 0.48,  $P < .001$ ) and 70 years and older (70-79 OR = 0.60,  $P = .001$ ; ≥80 OR = 0.35,  $P < .001$ ) was associated to a lower odd to report a depression diagnosis from a physician or healthcare practitioner. Having one or more chronic disease was related to higher odd of manifesting depression diagnosis (1 disease OR = 1.98,  $P = .001$ ; 2 diseases OR = 2.19,  $P < .001$ ; ≥3 diseases OR = 3.25,  $P < .001$ ).

Model 3 was performed among people with self-reported depression diagnosis, screening-positive depression and current antidepressant use ( $n = 415$ ). Being 80 years or older was related to lower odds to currently use antidepressants (OR = 0.31,  $P = .004$ ).

There was an interaction between residency and dependency, where people who lived in rural areas and exhibited severe dependency were less likely to display depressive symptoms (OR = 0.74,  $P = .027$ ) and self-report depression diagnosis (OR = 0.60,  $P = .024$ ).

## 4 | DISCUSSION

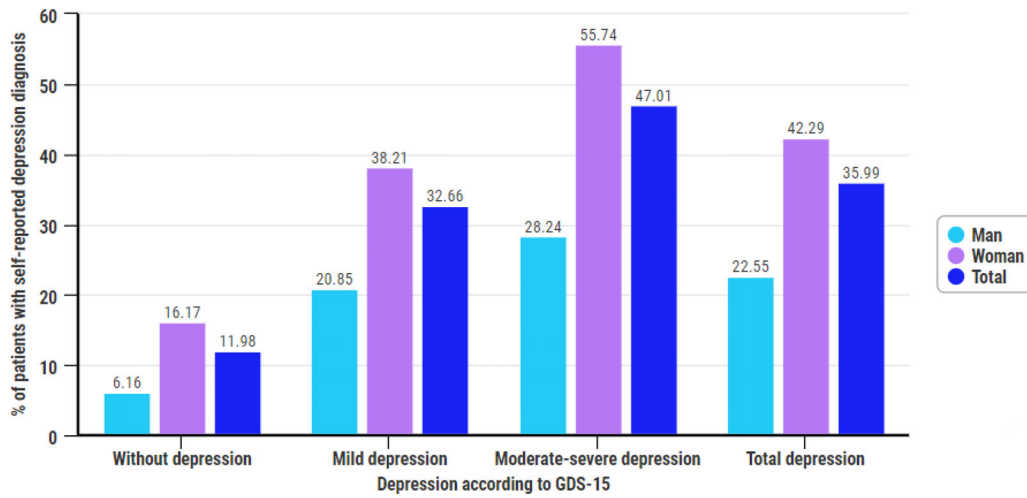
In this national cross-sectional study in Chileans aged 60 years and older, 28.3% of the participants screened positive for depression according to the GDS-15 (21.7% mild and 6.5% moderate-severe), from which only 35.9% self-reported a depression diagnosis. Among people with moderate-severe depression (GDS-15 > 10), only 47.1% reported a depression diagnosis. The situation is more concerning for men, where only 28.0% of males with moderate-severe depression reported a depression diagnosis. Regarding sociodemographic characteristics, depression was high in women, individuals older than 80 years, and people without education. Besides, people with ADL dependence, multimorbidity and pain had the highest prevalence of depression. To our knowledge, this study is the first to compare depression diagnosis self-reporting with depressive symptom screening in older Latin American adults. It further identified sex as well as sociodemographic and health factors that affect depression diagnosis.

**TABLE 2** Prevalence of depression by socio-demographic and health characteristics

	Depression by GDS-15			$\chi^2$
	Mild (GDS-15 = 5-10 pts.)	Moderate-severe (GDS-15 > 10 pts.)	Total (GDS-15 $\geq$ 5 pts.)	
	% (95% CI)	% (95% CI)	% (95% CI)	
<b>Sex</b>				
Women (n = 2479)	24.28% (22.63-26.01)	7.38% (6.42-8.48)	31.67% (29.86-33.53)	34.0930 (P < .001)
Men (n = 1586)	17.84% (16.03-19.8)	5.36% (4.35-6.58)	23.2% (21.19-25.35)	
<b>Age range</b>				
60-69 years (n = 1942)	20.85% (19.1-22.72)	7.26% (6.19-8.5)	28.12% (26.16-30.16)	1.0278 (P = .598)
70-79 years (n = 1473)	21.93% (19.89-24.12)	6.04% (4.93-7.38)	27.97% (25.73-30.32)	
80 years or more (n = 650)	24.15% (21.01-27.6)	5.85% (4.28-7.94)	30% (26.59-33.65)	
<b>Family arrangements</b>				
Living alone (n = 712)	24.3% (21.28-27.59)	7.3% (5.6-9.47)	31.6% (28.28-35.12)	4.4515 (P = .035)
Living with 1 $\leq$ people (n = 3353)	21.23% (19.88-22.65)	6.44% (5.66-7.33)	27.68% (26.19-29.22)	
<b>Education years</b>				
No education (n = 319)	28.21% (23.52-33.43)	10.34% (7.43-14.22)	38.56% (33.35-44.05)	48.5565 (P < .001)
1-8 years (n = 2584)	22.91% (21.33-24.57)	7.24% (6.30-8.30)	30.15% (28.41-31.95)	
9-11 years (n = 1002)	17.76% (15.52-20.26)	4.59% (3.45-6.08)	22.36% (19.88-25.05)	
$\geq$ 12 years (n = 160)	15.63% (10.74-22.18)	1.25% (0.31-4.93)	16.88% (11.79-23.57)	
<b>Residency</b>				
Urban (n = 2821)	21.52% (20.04-23.07)	6.49% (5.63-7.46)	28% (26.38-29.69)	0.5874 (P = .443)
Rural (n = 1244)	22.35% (20.11-24.75)	6.83% (5.56-8.38)	29.18% (26.72-31.77)	
<b>Dependence severity</b>				
Independent (n = 3391)	18.79% (17.5-20.14)	4.81% (4.14-5.58)	23.59% (22.19-25.05)	249.9932 (P < .001)
Mild-moderate (n = 405)	34.07% (29.6-38.85)	11.85% (9.04-15.4)	45.93% (41.11-50.82)	
Severe (n = 269)	40.89% (35.14-46.91)	21.19% (16.69-26.52)	62.09% (56.1-67.72)	
<b>Chronic diseases</b>				
HT (n = 2533)	24.04% (22.42-25.75)	7.78% (6.8-8.89)	31.82% (30.03-33.66)	39.5055 (P < .001)
Diabetes (n = 848)	26.18% (23.32-29.25)	7.43% (5.84-9.4)	33.61% (30.5-36.86)	
Stroke (n = 138)	27.54% (20.66-35.68)	10.14% (6.06-16.5)	37.68% (29.91-46.15)	6.1029 (P = .013)
COPD (n = 484)	33.47% (29.39-37.81)	12.60% (9.92-15.88)	46.07% (41.66-50.55)	84.8113 (P < .001)
Arthritis/arthrosis (n = 717)	26.92% (23.79-30.29)	8.79% (6.92-11.1)	35.7% (32.27-39.29)	
Parkinson disease (n = 40)	40.00% (28.99-52.12)	14.29% (7.74-24.87)	54.29% (42.31-65.79)	
<b>Multimorbidity</b>				
None (n = 1032)	16.09% (13.96-18.46)	3.78% (2.77-5.13)	19.86% (17.54-22.42)	117.3787 (P < .001)
1 (n = 1590)	19.37% (17.5-21.39)	6.35% (5.25-7.66)	25.72% (23.63-27.93)	
2 (n = 1050)	26.95% (24.35-29.72)	7.33% (5.9-9.08)	34.29% (31.47-37.22)	
3 or more (n = 393)	32.57% (28.1-37.38)	12.97% (9.99-16.69)	45.55% (40.66-50.52)	
<b>Pain</b>				
No pain (n = 1153)	10.15% (8.53-12.03)	1.47% (0.92-2.36)	11.62% (9.89-13.6)	426.3305 (P < .001)
Mild-moderate (n = 1930)	21.24% (19.47-23.13)	5.23% (4.32-6.32)	26.48% (24.55-28.49)	
Severe (n = 982)	36.46% (33.5-39.52)	15.27% (13.15-17.67)	51.73% (48.6-54.85)	
<b>Total</b>	<b>21.77% (20.53-23.07)</b>	<b>6.59% (5.87-7.40)</b>	<b>28.36% (27.00-29.77)</b>	

Note: COPD, chronic obstructive pulmonary disease; GDS-15, Geriatric Depression Scale 15 items; With depression, GDS-15  $\geq$  5 pts.; mild depression, GDS-15 = 5 to 10 pts.; moderate-severe depression, GDS-15 > 10 pts.; HT, hypertension; 95% CI, 95% confidence interval;  $\chi^2$ , chi-square test; P, significance level.





**FIGURE 1** Self-reported depression diagnosis according to current screening of depression. Without depression: GDS-15 < 5 pts.; total depression: GDS-15 ≥ 5 pts.; mild depression: GDS-15 = 5 to 10 pts.; Moderate-severe depression: GDS-15 > 10 pts

**TABLE 3** Logistic regression of adults with screen-positive depression, self-reported depression diagnosis, and current antidepressant use

	Model 1: Screening-positive depression in total sample <sup>1</sup> (n = 4065)		Model 2: Self-reported depression diagnosis in people with screening-positive depression <sup>2</sup> (n = 1153)		Model 3: Current antidepressant use in people with self-reported depression diagnosis and screening-positive depression <sup>3</sup> (n = 415)	
	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P
Man <sup>a</sup>	0.85 (0.72-1.01)	.059	0.48 (0.35-0.65)	.000	0.71 (0.41-1.21)	.209
Age <sup>b</sup>						
70-79 years	0.82 (0.70-0.98)	.025	0.60 (0.45-0.79)	.001	0.86 (0.54-1.38)	.542
≥80 years	0.71 (0.57-0.90)	.005	0.35 (0.23-0.54)	.000	0.31 (0.14-0.70)	.004
Education years <sup>c</sup>						
No education	2.00 (1.2-3.32)	.008	0.78 (0.33-1.86)	.576	1.33 (0.31-5.69)	.697
1-8 years	1.62 (1.03-2.54)	.035	0.87 (0.38-2.00)	.742	1.78 (0.49-6.50)	.386
9-11 years	1.26 (0.79-2.01)	.334	0.66 (0.26-1.67)	.382	4.37 (1.12-17.11)	.034
Living alone <sup>d</sup>	1.31 (1.06-1.62)	.013	0.97 (0.67-1.39)	.869	0.83 (0.46-1.50)	.539
Marital status <sup>e</sup>						
Single/divorced	1.05 (0.84-1.3)	.687	1.14 (0.78-1.66)	.492	1.66 (0.90-3.00)	.103
Widowed	1.11 (0.92-1.35)	.283	1.35 (0.98-1.85)	.069	1.03 (0.62-1.70)	.913
Rural <sup>f</sup>	0.91 (0.77-1.07)	.259	0.84 (0.63-1.12)	.222	0.92 (0.57-1.49)	.726
Multimorbidity <sup>g</sup>						
1	1.12 (0.91-1.37)	.289	1.98 (1.31-2.98)	.001	1.47 (0.68-3.15)	.326
2	1.45 (1.17-1.81)	.001	2.19 (1.43-3.35)	.000	2.19 (1.01-4.73)	.047
≥3	1.88 (1.42-2.48)	.000	3.25 (2.01-5.24)	.000	2.46 (1.07-5.63)	.034
Dependence <sup>h</sup>						
Mild-moderate	2.24 (1.77-2.84)	.000	0.92 (0.66-1.33)	.653	1.79 (0.99-3.25)	.056
Severe	4.14 (3.11-5.51)	.000	0.83 (0.56-1.23)	.347	1.89 (0.95-3.78)	.071
Pain <sup>i</sup>						
Mild-moderate	2.49 (2.01-3.07)	.000	0.81 (0.53-1.26)	.352	1.34 (0.63-2.82)	.449
Severe	5.75 (4.57-7.24)	.000	1.13 (0.73-1.75)	.584	0.88 (0.42-1.87)	.739

Note: Reference categories: Woman<sup>a</sup>, 60-69 years<sup>b</sup>, ≥12 years<sup>c</sup>, Living with 1 or more people<sup>d</sup>, Married/couple<sup>e</sup>, Urban<sup>f</sup>, Without diseases<sup>g</sup>, Independent<sup>h</sup>, Without pain<sup>i</sup>. Goodness of fit (Hosmer-Lemeshow test): <sup>1</sup>χ<sup>2</sup> = 1581.7; P = .0827; <sup>2</sup>χ<sup>2</sup> = 954.96; P = .5217; <sup>3</sup>χ<sup>2</sup> = 386.20; P = .2134. OR, odds ratio; 95% CI, 95% confidence interval; P, significance level.

In this study, only 35.9% of the people who positively screened for depression self-reported a depression diagnosis from a physician or healthcare practitioner (mild: 32.6%; moderate-severe: 47.0%). Men were less likely to self-report a previous depression diagnosis. This finding is not new; men tend to use mental health services less due to depression stigma and low depression knowledge.<sup>20</sup> This situation is especially important globally, since men older than 75 years have the highest suicide and suicide attempt lethality rate, even though they tend to report less suicide ideation and attempts.<sup>21</sup> Thus, healthcare practitioners and services should develop specific training and interventions to address early mental health diagnosis and treatment in older men in order to reduce the gender gap.<sup>22</sup>

People 80 years and older were less likely to positively screen for depression. Other studies showed a decrease in mood and anxiety disorder after 80 years of age.<sup>23</sup> However, part of that decrease could be explained by the exclusion of people with cognitive impairment, considering that in Chile approximately 45% of the population over 85 years exhibit cognitive impairment.<sup>24</sup> The rates observed in this study could be modified if it included individuals with dementia since depression is a common comorbidity in that group.<sup>25</sup> Despite this, people over 80 years who screened positive for depression were less likely to self-report a depression diagnosis. Depression and age are one of the most important modifiable and non-modifiable risk factors for dementia, respectively.<sup>26</sup> This information is even more relevant if one considers that older individuals with subsyndromal depression have a higher risk to develop major depression 6 to 12 months later.<sup>27,28</sup>

In this study, limited years of education was a social factor related to screening-positive depression. In general, older adults with less education have a higher risk of developing major depression compared to those with more education.<sup>29</sup> Although lower education could affect the accuracy of self-reported diagnosis, in the studies of Hale et al<sup>30</sup> and Leikauf and Federman,<sup>31</sup> age, sex, educational level, and level of health knowledge were not associated with changes in the level of agreement between the self-report of diseases and the medical record.

Pain, multimorbidity, and ADL dependence were also associated with positive depression screening. People with three or more chronic diseases showed the highest rate of self-reported depression diagnosis (49.1%). Depression treatment in people with high multimorbidity has myriad difficulties, including polypharmacy and inappropriate prescribing. Further, depression is associated with a higher risk of multimorbidity, frailty, and poorer treatment outcomes.<sup>32</sup> More attention must be given to non-pharmacological approaches that effectively treat depression in frail and dependent older adults; this approach would alleviate polypharmacy and inappropriate prescribing concerns.<sup>33</sup>

There is a mutual relationship between ADL performance and the presence of depressive symptoms.<sup>34</sup> Depressive symptoms are highly related to functional deterioration, fall risks, fear of falls and poor rehabilitation outcomes.<sup>35,36</sup> In a study conducted by Gitlin et al.,<sup>37</sup> functional performance was a mediator of depression treatment outcomes in older adults, where the people who exhibited improvement

in functional performance presented lower depressive symptoms after the intervention. Hence, functional recovery should be considered as a major outcome for any depression treatment in the elderly. In this study, we observed an interaction between severe ADL dependency and living in rural areas. On one hand, people with severe dependency in rural areas were less likely to report depressive symptoms compared with those in urban areas. Family caregivers of dependent people in rural areas tend to have a mostly positive family experience/identity and generally accept the caregiving role when compared to those who live in urban settings.<sup>38</sup> That could be a factor influencing the report of the depressive symptoms of the care recipient. On the other hand, they are less likely to self-report a depression diagnosis, a situation that could be explained by their reduced accessibility to mental healthcare services in rural locations.

While depression prevalence in this study is somewhat discordant with the national survey studies, it is important to consider the methodological aspects to interpret these differences. First, the Chilean National Health Survey was conducted in a smaller sample of older adults (476 people) and used the CIDI as a diagnosis tool. This method considers symptoms over the past 12 months and excludes those cases with symptoms related to substance abuse, drug consumption, and bereavement. Despite this difference, the prevalence of moderate-severe depression was very similar to the prevalence found in the 2010 survey (6.2%).<sup>8</sup>

#### 4.1 | Limitations

The study has limitations to be considered. First, the sample does not incorporate important sub-groups of older people such as homeless, hospitalized, institutionalized, and incarcerated subjects where the prevalence of depression could be higher. Second, an important limitation was the use of a self-reported depression diagnosis as a proxy for a confirmed diagnosis. In the ideal scenario, a confirmed depression diagnosis would be compared to medical records. Nonetheless, GDS-15 is a widely used scale that measures depressive symptoms in older adults with high sensitivity (86.4%-86.7%) and specificity (63.1%-85.6%) in community-dwelling populations for the Spanish-language version.<sup>16,17</sup> As reported, the sensitivity/specificity range for self-reported depression is close to 61%/89% in the general population, respectively.<sup>39</sup> In older people, few studies have evaluated this agreement. In a study including the self-report and records of 323 older adults, the sensitivity/specificity was 74%/72% correspondingly.<sup>31</sup> In other carried out in Finland with 273 very old adults (average 90 years),<sup>40</sup> the agreement between the self-report and the medical report was 79%. In both studies, older adults present a tendency to over-report the diagnosis of depression (medical report is lower than people report). Thus, in general, the agreement is moderate-high with utility for a population study, but not necessarily for individual cases and clinical practice. More studies are needed to identify this relationship accurately.

Antidepressant self-report could lead to bias in older adults' populations, suggesting precaution with the interpretation of these



results. Nonetheless, a recent study conducted in a large sample in Scotland<sup>41</sup> showed that sensitivity for self-reported antidepressant use compared to the official record was 0.85 (95% CI: 0.82–0.87) with a positive predictive value of 0.89 (95% CI: 0.87–0.91). Increased age was associated with lower false negatives for antihypertensives, antidepressants, and possibly aspirin (PFDR = 0.074) (antidepressant: 0.97 [95% CI: 0.95–0.99]). The main strength of this study is the large, representative sample of older Chileans, including those who reside in rural and urban settings.

In conclusion, there was a high prevalence of depressive symptoms and a low agreement with self-deported diagnosis of depression in the older Chilean population, with significant differences between sexes. Individuals with less education, high multimorbidity, dependency, and pain were most likely to screen positive for depression. Men and people over 80 years were less likely to self-report a depression diagnosis. One disease or more was related to an increased probability of a self-reported diagnosis. This study provides crucial information for clinicians and policy makers regarding depression screening and diagnosis in the elderly, and factors that could help to identify populations potentially propense to underdiagnosis, and less likely to receive treatment. It is necessary to include routine and sensitive depression screening in primary care as well as increase healthcare practitioner training regarding depression diagnosis, considering gender differences, and effective treatments in the elderly.

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## CONFLICT OF INTEREST

None declared.

## DATA AVAILABILITY STATEMENT

This study utilised secondary data analysis of the National Survey of Dependence in Older People in Chile. This survey was conducted by the National Service of Older People in Chile (SENAMA). To access this database, it must ask permission to SENAMA. Address: Catedral 1#575, floor 2, Santiago, Chile. Phone: +56225853500.

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