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Title: Depressive and subthreshold depressive symptomatology among older adults in a socioeconomically deprived area in Brazil

Running title: Depressive and subthreshold depressive symptomatology in older adults

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Authorship

CAN, MS, RA and DMA contributed to the conception and design of the study, collection and analysis of the data. All authors contributed to the interpretation of data and to drafting the manuscript, approved the final version of the manuscript and agreed to be accountable for all aspects of the work

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Abstract

Depressive and subthreshold depressive symptomatology are common but often neglected in older adults.

Objectives. This study aimed to assess rates of depressive and subthreshold depressive symptomatology, and the characteristics associated, among older adults living in a socioeconomically deprived area of Brazil.

Methods. This study is part of the PROACTIVE cluster randomised controlled trial. 3,356 adults aged 60+ years and registered in 20 primary health clinics were screened for depressive symptomatology with the Patient Health Questionnaire – 9 (PHQ-9). Depressive status was classified according to the total PHQ-9 score and the presence of core depressive symptoms (depressed mood and anhedonia) as follows: no depressive symptomatology (PHQ-9 score 0-4, or 5-9 but with no core depressive symptom); subthreshold depressive symptomatology (PHQ-9 score 5-9 and at least one core depressive symptom); and depressive symptomatology (PHQ-9 score \geq 10). Sociodemographic information and self-reported chronic conditions were collected. Relative risk ratios (RRR) and 95% CIs were obtained using a multinomial regression model.

Results. Depressive and subthreshold depressive symptomatology were present in 30% and 14% of the screened sample. Depressive symptomatology was associated with female gender, low socioeconomic conditions and presence of chronic conditions, whereas subthreshold depressive symptomatology was only associated with female gender and having hypertension.

Conclusions. Depressive and subthreshold depressive symptomatology is highly prevalent in this population registered with primary care clinics. Strategies managed by primary care non-mental health specialists can be a first step for improving this alarming neglect situation among older adults.

Keywords

Depression, subthreshold depression, older adult, low- and middle- income country, primary healthcare.

Key-points

This is the first study to assess subthreshold depressive symptomatology in a large sample of older adults in Brazil.

Individuals registered in primary care clinics and living in socioeconomically deprived areas were assessed for depressive and subthreshold depressive symptomatology.

Depressive and subthreshold depressive symptomatology rates were high among this population.

Higher levels of depressive symptomatology were associated with female gender, worse socioeconomic conditions and the presence of other chronic health conditions.

Introduction

Depression among older adults is a global public health concern and low- and middle-income countries account for a high global burden of depression.¹ Brazil has been experiencing a rapid population ageing and, consequently, an increasing prevalence of age-related diseases.² The current sociodemographic profile of older adults in Brazil shows a higher proportion of women and a high illiteracy rate.^{3,4} Also, the prolonged economic crisis in the country has accentuated socioeconomic inequalities within the population, affecting the most vulnerable (i.e. poor older adults).⁵ All these characteristics, such as female gender, presence of chronic diseases and disabilities and social and economic factors are commonly associated with an increased prevalence of depression.^{6,7}

Data from the Global Burden of Disease estimates that depression occurs in around 7% of the population over 60 years old.¹ This picture is worse when older adults with mild symptoms of depression (i.e. symptoms of insufficient intensity to meet criteria for depression diagnosis, also known as subthreshold or subclinical depression) are included in the estimate. Subthreshold depression among older adults was reported in a review to be around 10% in community-dwelling and 25% in primary care.⁸ Like major depression, subthreshold depression also increases functional impairment, decreases quality of life and worsens pre-existing comorbidities.^{9,10} Early recognition of subthreshold depressive symptoms can help to prevent the onset of a full-blown depressive episode and associated problems for the individual and the health system.⁷

The most recent Brazilian National Health Survey (2019) indicated a prevalence of self-reported depression of 12% among those aged 60+ years old.¹¹ A meta-analysis with surveys conducted with Brazilian older adults found a depression rate of 21%, with an increasing trend within cities with lower human development index (25%).¹² Despite the inclusion of 34 surveys

in this meta-analysis, they were conducted up to 2015. Therefore, updated evidence on the prevalence of depressive symptomatology in older adults, including those in socioeconomically vulnerable conditions, is still needed. Also, not much is known about the occurrence of subthreshold symptomatology in older adults, as the only estimate available (9%) is the result of a single study with a small sample.¹³ Thus, this study aims to estimate the rates of depressive and subthreshold depressive symptomatology in a large sample of older adults living in socioeconomically deprived areas of Guarulhos, Brazil. We also investigated the characteristics associated with the different levels of depressive symptomatology.

Methods

Sample and Procedure

This study used data collected during the first wave of the PROACTIVE cluster randomised controlled trial.¹⁴ The trial was conducted in primary care clinics adhering to the Family Health Strategy in Guarulhos, a city in the metropolitan region of Sao Paulo with a population of around 1.4 million,¹⁵ characterised by remarkable social inequities. The Family Health Strategy is a national health model in which primary healthcare demands are met by multidisciplinary teams (Family Health Teams). It covers 65% of the Brazilian population,¹⁶ and the primary care clinics are usually located in the most socioeconomically deprived areas of the municipalities.

Twenty primary care clinics and 80 Family Health Teams (four for each clinic) based in these clinics, were randomly selected and included in the PROACTIVE study. These primary care clinics are located in three of the four health regions of the city, with only the central region not included. The recruitment of participants was conducted using a list of all adults aged 60 years or over living in the catchment areas covered by the 80 Family Health Teams, provided

by the Guarulhos Health Secretariat. The names in this list were first randomly ordered, and then individuals were contacted by an independent research assistant by phone or at home to be invited for a screening assessment, where depressive symptomatology was assessed with the Patient Health Questionnaire-9 (PHQ-9),^{17,18} along with basic sociodemographic information. A suicide risk protocol was activated whenever the individual answered that had suicidal thoughts (based on the 9th question of the PHQ-9) during the two weeks prior to the assessment, and an acute suicide risk (suicide attempt in the same period) was identified. The protocol included informing a family member and the primary care clinic about the situation. Detailed information about recruitment has been previously described.¹⁴

All participants provided written or oral consent to participate. The study was approved by the Ethics Committee of the Universidade de São Paulo (CEP FMUSP number 2.836.569) and authorised by the Guarulhos Health Secretariat. All analyses were carried out in Stata MP 16.1.

Measures

The PHQ-9¹⁷⁻¹⁹ was used to assess depressive symptomatology. It was chosen as it is widely used in research and by primary care professionals, and there is evidence of its validity in the Brazilian population.²⁰ The PHQ-9 includes nine items covering different symptoms of depression. The first two questions are related to depressed mood and anhedonia, the core depressive symptoms. The response options, from 0 (“not at all”) to 3 (“nearly every day”) reflect the frequency with which the respondent has experienced each of those symptoms in the previous two weeks. An overall score ranging from 0 to 27 is then calculated by adding up the responses to all nine items. Scores of 5+ have been proposed to reflect mild depression and scores of 10+ have been found to adequately capture the presence of depression.²¹ As there is no gold standard for defining subthreshold depressive symptomatology using the PHQ-9, we

used the cut-off criteria for mild depression (5+) along with experiencing either depressed mood or anhedonia for at least several days in the past 14 days, addressing both the cut-off point suggested for the instrument¹⁷ and the presence of at least one core depressive symptom.⁸ Depressive symptomatology was defined as a score of 10+, a threshold that has been reported to provide a sensitivity and specificity of 91% and 88%, respectively, among individuals aged 60 years or over.²²

We collected a set of basic demographic, socioeconomic, and health-related characteristics of participants in order to analyse its potential relationship with depressive and subthreshold depressive symptomatology rates. These characteristics were chosen as they are easily available in primary care clinics. These variables were: gender (male versus female); age (categorised as 60-69, 70-79, and 80+ years old); education (categorised as none, 1-4, 5-8, and >8 years of formal education); personal income (categorised as ≤ 1 minimum wage (MW), >1-2 MWs, >2 MWs per month); and self-report of hypertension and diabetes (yes versus no). We also asked about the previous depression diagnosis and current depression treatment (yes versus no) to obtain a snapshot of the diagnostic and treatment coverage in the sample. Depression treatment was defined as either use of antidepressant medication and/or psychotherapy.

Statistical analyses

The characteristics of the sample were described by depressive status: no depressive symptomatology (PHQ-9 score 0-4 or 5-9 but with neither depressed mood nor anhedonia); subthreshold depressive symptomatology (PHQ-9 score 5-9 and at least one core depressive symptom); and depressive symptomatology (PHQ-9 score ≥ 10). Chi-squared tests were

conducted to investigate the univariable associations between each of the characteristics and depressive status, with Cramér's *V* used as a measure of effect size.

To analyse the degree of independent association of each variable with depressive status as the outcome, we used multinomial regression models adjusted for the others. We included the available set of variables using a complete case approach and obtained relative risk ratios (RRR) and 95% confidence intervals (CIs) using the lower severity (no depressive symptomatology) as the reference category. Wald tests were used to derive p-values for categorical predictors with more than two levels.

Results

Between May 2019 and February 2020, 3,356 adults aged 60+ years old were screened for depressive symptomatology. In general, our sample comprised young older adults, with a low socioeconomic background and a high prevalence of chronic diseases. Hypertension was self-reported by two thirds and diabetes by one-third of the sample (Table 1).

A total of 1,020 (30%) older adults showed a score equal to or higher than 10 on the PHQ-9 and thus were considered as having depressive symptomatology, and a further 476 (14%) older adults met the criteria for subthreshold depressive symptomatology. Suicidal ideation was reported by 352 individuals and 42% of them indicated the presence of this symptom nearly every day in the past two weeks. The descriptive analysis of the sample by depressive status, and the inferential tests to ascertain the degree of association between these characteristics and the depressive status, are shown in **Table 1**. All variables explored, except age group, were associated with depressive status. Older adults with depressive and subthreshold depressive symptomatology were more frequently women, less educated, with the lowest levels of personal income, and self-reported hypertension, and diabetes. Moreover, a trend between most

of the variables and the severity of the depressive status was observed, with the depressive subgroup comprising larger proportions of women, older adults with lower income levels, hypertension, or diabetes, than the subthreshold depressive subgroup.

Among those older adults identified as depressive symptomatology in our sample, only 30% reported being diagnosed with depression, and 16% reported receiving treatment for depression. These numbers decreased to 14% and 7% when considering individuals with subthreshold depressive symptomatology, as would be expected.

The results of the multivariable multinomial regression model predicting depressive status are shown in the **Table 2**. After adjusting for the other variables, older women were still at a higher risk of being in the subthreshold depressive group [RRR=1.46 (95% CI: 1.15-1.85)] and in the depressive group [RRR=1.69 (95% CI: 1.41, 2.04)] than in the no depressive group. Similar results were found for having hypertension [RRR_{subthreshold}=1.61 (95% CI: 1.27, 2.04) and RRR_{depression}=1.63 (95% CI: 1.36, 1.96)]. However, income level [RRR_{depression}=0.49 (95% CI: 0.36, 0.66) for highest versus lowest income] and having diabetes [RRR_{depression}=1.41 (95% CI: 1.18, 1.68)] were associated with depressive but not subthreshold depressive symptomatology. We did not find evidence of effect modification between gender and income level (Supplemental Table 1).

Discussion

Among older adults registered in 20 primary care clinics of Guarulhos, depressive symptomatology and subthreshold depressive symptomatology were identified in 30% and 14% of the sample, respectively. Gender, education, personal income, hypertension and diabetes were associated with any level of depressive symptomatology. The multinomial regression model showed that female gender and hypertension were still associated with both

depressive and subthreshold depressive symptomatology, whereas diabetes and personal income were associated with only depressive symptomatology. Only 16% of the participants meeting the criteria for depressive symptomatology reported being under treatment.

The 30% rate of depressive symptomatology we found was higher compared to studies among older adults in Brazil. The prevalence of self-reported depression in the Brazilian National Health Survey 2019 was 12% and studies using depression scales found an average rate of 21%, with higher rates in the Northeast region of the country (27%) and in the lowest level of the human development index (25%). Two studies with similar inclusion criteria as ours (older adults registered with primary care clinics in Sao Paulo and Manaus), identified depressive symptomatology in 8 to 12% of the sample.^{23,24} Sociodemographic characteristics were also similar, however, unlike these studies that used a list provided by the community health workers (names annotated in their handbooks) to screen and recruit participants, we used a list generated by the Guarulhos electronic health system. Thus, all individuals aged 60+ years registered with the 20 participating primary care clinics were included in our the list, which may have allowed us to reach those living in the most socioeconomically disadvantaged areas and who do not often use the health services or are visited by the community health workers. This may explain the higher rates we found, as these individuals were underrepresented in these studies.

Although previous studies reported that individuals with mild depressive symptoms have a higher risk of developing major depression,⁷ little is known about the presence of subthreshold depressive symptomatology in the older population in Brazil. Two studies conducted in Brazil and a study conducted in eight low-and middle-income countries reported similar results as ours (14%). In the PROACTIVE pilot study, which used the same assessment tool as our study, 13% of those older adults registered with primary care clinics met the criteria for subthreshold depressive symptomatology (data not published). A study conducted in two neighbourhood of

Sao Paulo, with only 367 individuals aged 60+ years old, identified a prevalence of subthreshold depression of 9%.¹³ Also, a large study with older adults from eight low- and middle-income countries showed a prevalence of 12%.²⁵

Our findings suggest that women, individuals in lower socioeconomic conditions and who already have chronic conditions (i.e. hypertension and diabetes) are more likely to report having depressive symptomatology. Female gender and hypertension were associated with subthreshold depressive symptomatology. These findings are in line with the literature that showed that psychosocial predictors, life stressors, physical health status and individual vulnerability are associated with a higher risk of depression and subthreshold depression.⁶⁻⁸ We chose to include in our analysis simple clinical and sociodemographic information that primary healthcare professionals usually have access to, thus our results might be useful to identify potential individuals at higher risk of having or developing depressive symptomatology during consultations at the primary care clinic or home visits by community health workers. However, it is important to note that, due to the cross-sectional design of our study, no directionality can be inferred from these results.

Less than a third of the individuals identified with depressive symptomatology reported a previous medical depression diagnosis and 16% reported being under treatment (either medication or psychotherapy). We are unable to draw conclusions about underdiagnosis and undertreatment of depression in our sample, as no diagnostic assessment was undertaken. Nevertheless, both problems have been reported in previous studies among older adults,²⁶ including in Brazil.^{27,28} Limited overall funding for mental health, shortage of specialised professionals, lack of integration of mental healthcare with primary healthcare and inequalities in health access are some of the factors associated with inadequate mental healthcare in Brazil, especially among the population in socioeconomically deprived areas.^{28,29}

This study has some limitations. First, in terms of the sampling, recruitment was mainly conducted at individuals' homes and during office hours; thus the sample possibly included fewer employed and more socioeconomically deprived individuals. However, most people are retired at 60 years old in Brazil, which will have decreased selection bias. The least socioeconomically vulnerable older adults are underrepresented in our study, as they live in areas of the city not covered by Family Health Teams and usually seek private health services. Nevertheless, they represent a small proportion of the older population, as 75% of them use and depend exclusively on the Brazilian public health system.³⁰ Second, this study is the result of the screening process for a pragmatic cluster randomised controlled trial; thus the assessment of sociodemographic and clinical information was limited to those easily available at the primary care clinics. For this reason, we did not include other important characteristics usually associated with depressive symptomatology, such as social support and disabilities in activities of daily life. Third, there is evidence suggesting that the PHQ-9 cut-off point of 10 overestimate the prevalence of depression,³² but the choice to use this cut-off point to present rates of depressive symptomatology was based on previous studies conducted with older adults in Brazil.^{23,24,28,31} Fourth, there is not a gold standard for the assessment of subthreshold depressive symptomatology. This limitation might lead to different classifications of the condition in the studies. We based our classification on the cut-off point suggested for the PHQ-9 tool and the presence of at least one core symptom of depression, considering both psychiatric and somatic manifestations. Finally, this study has been conducted using cross-sectional information; therefore, no directionality can be inferred in the relationships found, as there is room for reverse causation.

This is the first study to assess subthreshold depressive symptomatology in a large sample of older adults in Brazil. We examined an older adult population living in socioeconomically deprived areas of Guarulhos and found an alarming scenario of high rate of depressive

symptomatology. Available information about the situation, as we presented, may be a starting point to create programmes for the management of depression in primary care, as recommended by the World Health Organization.³³ The main Brazilian primary care model (Family Health Strategy) covers more than 65% of the population and regular home visits by community health workers are known as an important health promotion and disease prevention tool. Therefore, Family Health Teams professionals can support simple and feasible programmes to identify and treat depressive and subthreshold depressive symptomatology among the most socioeconomically vulnerable older adults. Ultimately, we assessed depressive and subthreshold depressive symptomatology levels right before the introduction of the COVID-19 pandemic control measures in the country; therefore, future studies may be able to use our results as a foundation for assessing the change in these levels after this period of high stress and social isolation directly affecting older adults.

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Table 1. Relationship between sociodemographic, socioeconomic, and health-related variables and depressive status (N=3,356)

Variable	Depressive status (N=3,356)			χ^2 (df)	p	V
	No depressive symptomatology n=1,860	Subthreshold depressive symptomatology n=476	Depressive symptomatology n=1,020			
Gender, No. (%)				92.85 (2)	<0.001	0.17
Male	814 (43.76)	147 (30.88)	270 (26.47)			
Female	1,046 (56.24)	329 (69.12)	750 (73.53)			
Age group, No. (%)				5.29 (4)	0.258	0.03
60-69	1,209 (65.00)	296 (62.18)	638 (62.55)			
70-79	521 (28.01)	149 (31.30)	294 (28.82)			
80+	130 (6.99)	31 (6.51)	88 (8.63)			
Education level, No. (%)				26.37 (6)	<0.001	0.06
None	285 (15.42)	69 (14.56)	181 (17.85)			
1-4 years	812 (43.94)	240 (50.63)	504 (49.70)			
5-8 years	438 (23.70)	107 (22.57)	209 (20.61)			
>8 years	313 (16.94)	58 (12.24)	120 (11.83)			
Missing	<i>12 [0.65]</i>	<i>2 [0.42]</i>	<i>6 [0.59]</i>			
Personal income, No. (%)				76.79 (4)	<0.001	0.11
≤ 1 MW	1,047 (60.59)	322 (70.77)	731 (75.91)			
> 1 and ≤ 2 MWs	401 (23.21)	86 (18.90)	161 (16.72)			
>2 MW	280 (16.20)	47 (10.33)	71 (7.37)			
Missing	<i>132 [7.10]</i>	<i>21 [4.41]</i>	<i>57 [5.59]</i>			
Has hypertension diagnosis, No. (%)				66.83 (2)	<0.001	0.14
No	754 (40.73)	139 (29.20)	269 (26.42)			
Yes	1,097 (59.27)	337 (70.80)	749 (73.58)			
Missing	<i>9 [0.48]</i>	<i>0 [0.00]</i>	<i>2 [0.20]</i>			
Has diabetes diagnosis, No. (%)				29.06 (2)	<0.001	0.09
No	1,293 (70.04)	318 (66.81)	612 (60.12)			
Yes	553 (29.96)	158 (33.19)	406 (39.88)			
Missing	<i>14 [0.75]</i>	<i>0 [0.00]</i>	<i>2 [0.20]</i>			
Has depression diagnosis, No. (%)				-	-	-
No	1,697 (91.93)	409 (86.11)	709 (70.13)			
Yes	149 (8.07)	66 (13.89)	302 (29.87)			
Missing	<i>14 [0.75]</i>	<i>1 [0.21]</i>	<i>9 [0.88]</i>			
Receives depression treatment, No. (%)				-	-	-
No	1,768 (95.83)	440 (92.83)	846 (83.93)			
Yes	77 (4.17)	34 (7.17)	162 (16.07)			
Missing	<i>15 [0.81]</i>	<i>2 [0.42]</i>	<i>12 [1.18]</i>			

Note. df: degrees of freedom; MW: minimum wage; V: Cramér's V effect size. Percentages between parentheses are calculated by columns, excluding missing cases; italicised values represent number and percentage of missing cases. χ^2 tests were computed excluding the missing cases.

Table 2. Results of the multinomial regression model (depressive status as outcome)

Variable	Multinomial regression model (ref.: No depressive symptomatology)					
	Subthreshold depressive symptomatology			Depressive symptomatology		
	RRR (95% CI)	Wald test, χ^2 (df)	<i>p</i>	RRR (95% CI)	Wald test, χ^2 (df)	<i>p</i>
Female gender	1.46 (1.15, 1.85)		0.002	1.69 (1.41, 2.04)		<0.001
Age group (ref. 60-69)		1.18 (2)	0.555		1.39 (2)	0.500
70-79	1.07 (0.84, 1.36)			0.92 (0.76, 1.11)		
80+	0.83 (0.53, 1.31)			1.10 (0.80, 1.51)		
Education level (ref. None)		6.02 (3)	0.111		6.47 (3)	0.091
1-4 years	1.37 (1.00, 1.88)			1.05 (0.83, 1.32)		
5-8 years	1.17 (0.81, 1.69)			0.82 (0.62, 1.08)		
>8 years	1.00 (0.65, 1.54)			0.82 (0.60, 1.13)		
Personal income (ref. ≤ 1 MW)		5.20 (2)	0.074		27.68 (2)	<0.001
> 1 and ≤ 2 MWs	0.80 (0.60, 1.05)			0.68 (0.55, 0.85)		
>2 MW	0.70 (0.48, 1.00)			0.49 (0.36, 0.66)		
Having hypertension	1.61 (1.27, 2.04)		<0.001	1.63 (1.36, 1.96)		<0.001
Having diabetes	1.08 (0.86, 1.36)		0.492	1.41 (1.18, 1.68)		<0.001

Note. All models are adjusted for the clustered design. The sample size of the multinomial regression model is 3,138. CI: confidence interval; MW: minimum wage; RRR: relative risk ratio.

Supplemental Table 1. Results of the multinomial regression model (depressive status as outcome), adding the interaction between gender and personal income

Variable	Multinomial regression model (ref.: No depressive symptomatology)					
	Subthreshold depressive symptomatology			Depressive symptomatology		
	RRR (95% CI)	Wald test, χ^2 (df)	<i>p</i>	RRR (95% CI)	Wald test, χ^2 (df)	<i>p</i>
Female gender	1.36 (1.01, 1.84)		0.042	1.61 (1.28, 2.03)		<0.001
Age group (ref. 60-69)		1.23 (2)	0.540		1.37 (2)	0.505
70-79	1.07 (0.84, 1.36)			0.92 (0.76, 1.11)		
80+	0.82 (0.52, 1.29)			1.09 (0.79, 1.50)		
Education level (ref. None)		6.28 (3)	0.099		6.54 (3)	0.088
1-4 years	1.37 (1.00, 1.88)			1.05 (0.83, 1.33)		
5-8 years	1.17 (0.81, 1.69)			0.82 (0.62, 1.08)		
>8 years	0.99 (0.65, 1.52)			0.82 (0.60, 1.13)		
Personal income (ref. ≤ 1 MW)		4.22 (2)	0.121		27.04 (2)	<0.001
> 1 and ≤ 2 MWs	0.80 (0.52, 1.23)			0.61 (0.43, 0.87)		
>2 MW	0.56 (0.35, 0.91)			0.47 (0.32, 0.70)		
Female gender * personal income (ref. ≤ 1 MW)		2.62 (2)	0.269		0.60 (2)	0.739
> 1 and ≤ 2 MWs	0.97 (0.55, 1.69)			1.19 (0.76, 1.86)		
>2 MW	1.76 (0.86, 3.62)			1.06 (0.57, 1.97)		
Having hypertension	1.62 (1.28, 2.06)		<0.001	1.63 (1.35, 1.95)		<0.001
Having diabetes	1.09 (0.86, 1.37)		0.482	1.41 (1.19, 1.69)		<0.001

Note. All models are adjusted for the clustered design. The sample size of the multinomial regression model is 3,138. CI: confidence interval; MW: minimum wage; RRR: relative risk ratio.