

Depression in the elderly of a rural region in Southern Brazil

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Abstract *The aim of this study is to estimate the prevalence of depression and its associated factors in elderly residents of the rural area of Rio Grande/RS. In this cross-sectional population-based study performed with 994 elderly (≥ 60 years), whose sampling was based on the 2010 Demographic Census, the Patient Health Questionnaire 9 (PHQ-9) was used for Major Depressive Episode (EDM) screening. Descriptive, bivariate and multivariate analyses were performed using logistic regression. The overall prevalence for Major Depressive Episode screening was 8.1%. The variables independently associated with depression were: female gender, continuous use of medications, chronic diseases, body mass index and worse health perception. The creation of programs target at the elderly in the rural area, aimed at screening, early diagnosis of depression and maintenance of treatment, encompassing several factors related to health, are important actions that must be fostered by the health system.*

Key words *Depression, Elderly, Rural*

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Introduction

Depression is one of the most common mental disorders around the world, affecting about 350 million people¹. It was the second largest cause of Years Lived with Disabilities (YLDs) in 2013, impairing 5% to 10% of the adult population at a global level². During the aging process, changes such as the loss of loved ones³, the use of medications⁴ and the appearance of several diseases⁵ may impact the elderly's mental health, increasing the susceptibility to depression³.

The prevalence of depression in the elderly varies between geographic regions, as well as between urban and rural centers. Population-based studies conducted in urban areas of different countries found prevalences of depressive symptoms ranging from 8% to 14%⁶, while studies in rural areas found prevalences between 7.8%⁷ and 29.5%⁸. The *Pesquisa Nacional de Saúde* (PNS)⁹, which evaluated populations living in urban and rural areas in Brazil found that 7.6% of individuals older than 18 years were diagnosed with depression, with a higher proportion in the 60-64 years age group (11.1%) and prevalence of 5.6% in rural adults. In addition, Munhoz et al.¹⁰ found a prevalence of 4.1% among Brazilian adults.

According to the World Health Organization¹, depression results from a complex interaction between social, psychological and biological factors. Several factors are associated with depression in the elderly. Research shown that female subjects^{5,10}, with advanced age^{5,11} and low schooling^{12,13} were more likely to develop depression. Among behavioral factors, those most associated with the disorder are smoking¹⁴⁻¹⁶ and sedentary behavior^{17,18}; among health-related characteristics, the most frequent are the presence of other chronic diseases^{19,20}, use of medications^{21,22} and poor health perception^{3,23}.

The world population is aging rapidly, the occurrence of depression at advanced ages is increasing and new health demands are emerging²⁴. The study of elderly's mental health is important to broaden the understanding of the disease-health process at this stage of development and to collaborate with public policies for this population²⁵. The Brazilian studies that address the issue of depression in elderly residents of rural areas are scarce, since the great majority refers to urban areas⁶, pointing out the need to develop Brazilian research on this subject in areas with lower population density²⁶. Thus, the present study aimed to estimate the prevalence

of depression and its associated factors in elderly residents of the rural area of Rio Grande/RS.

Methods

Participants and sample process

Cross-sectional population-based study conducted in the rural area of Rio Grande, Rio Grande do Sul, Brazil, which was conducted between April and October 2017. This study was part of a larger study entitled *Saúde da População Rural Rio Grandina*, which evaluated the health of the elderly, children under 5 years and women at fertile age. The present study focused on the elderly population group. It is estimated that Rio Grande has 210,000 inhabitants, with about 4% of rural residents and approximately 13.1% of these are elderly residents - about 1,080 people aged 60 or over²⁷.

The inclusion criteria to participate in the study were: living in the rural area of the municipality of Rio Grande and being 60 years or older. All individuals institutionalized in nursing homes, hospitals and/or prisons were excluded, as well as those with physical and/or mental incapacity to respond to the interview.

Two sample size calculations were performed, one descriptive and other for associated factors. The parameters for the descriptive calculation were: prevalence of 10%, margin of error of 2p.p., level of significance of 5% and design effect of 1.5, resulting in 721 individuals. In the associated factors calculation, the parameters used were prevalence ratios of 1.5 to 2.0, power of 80%, level of significance of 5%, prevalence in non-exposed of at least 11%, ratio of not exposed to exposed of 5:1 and design effect of 1.5, resulting in 700 individuals. On top of the largest sample number, derived from the descriptive calculation (721), 10% were added to deal with losses and refusals and 15% to deal with confounding factors, obtaining a N of 901.

Sampling was based on the 2010 Demographic Census²⁷. The sampling process consisted in the systematic selection of 80% of the households from the draw of a number between "1" and "5". The number drawn corresponded to the residence considered hop. For example, if the number "3" was drawn, every household of number "3" in a sequence of five households was not sampled, that is, it was skipped. This procedure ensured that four out of five households were sampled. All the seniors were invited to participate in the study.

Data collection

Social, economic, demographic and behavioral questions were collected through the self-report of: sex; age (60-69 years, 70-79 years and 80 years or more); economic class collected according to the *Associação Brasileira de Empresas de Pesquisa* - ABEP, which estimates the purchasing power of Brazilian families²⁸; schooling (full years); marital status (with companion and without companion); use of alcohol in the last week; tobacco use; medication use, number of chronic noncommunicable diseases, body mass index (BMI) and health perception (very good/good, regular and poor/very poor). Questions regarding sedentary behavior were collected using the adapted Measure of Older Adults Sedentary Time (MOST) instrument, which verifies the individual's sedentary behavior time in the last week through nine different situations, in hours or minutes per day²⁹. The variable was categorized into sedentary behavior less than 7 hours/day and more than 8 hours/day³⁰.

The outcome, presence or absence of depression, was identified through Major Depressive Episode (MDE) screening using the Patient Health Questionnaire-9 (PHQ-9) instrument, which assesses the presence of depressive symptoms in the last two weeks, based in the Diagnostic and Statistical Manual of Mental Disorders (DSM-V)³¹. The recommended cutoff point is ≥ 9 , which has good psychometric and operational characteristics, with sensitivity between 77 and 98% and specificity of 75-80%³².

The questionnaires were applied through tablets by previously selected and trained interviewers using the RedCap® program³³. Prior to data collection, a pilot study was conducted in one of the census tracts near the city to verify and correct problems in interpreting questions and timing the questionnaire application time.

Data analysis

Statistical analyses were performed on software Stata IC 13.1 (Stata Corp., College Station, USA). Univariate analysis was conducted to describe the sample in terms of independent variables and also to calculate the prevalence of depression in the population. Bivariate analysis was also performed using the chi-square test for categorical variables and Student's t-test or Wilcoxon Mann-Whitney test for numerical variables (depending on the data distribution). Adjusted analysis was performed through logistic regres-

sion using the presence or absence of Major Depressive Episode as an outcome. Logistic regression was performed considering the hierarchical analysis model (Figure 1)³⁴ constructed for the present study, using the backward selection process and considered p value ≤ 0.20 to keep the variables in the model. The level of significance for all analyses was 5%. This study was approved by the *Comitê de Ética em Pesquisas na Área da Saúde* (CEPAS) of FURG. Participation was voluntary and individuals who accepted participation were asked to sign a free and informed consent form.

Results

The study had a total of 1,130 eligible individuals and 1,030 elderly interviewed, corresponding to a rate of losses and refusals of 8.9%. 994 elderly people in the rural area of Rio Grande responded to PHQ-9 completely, resulting in 10.1% of losses, 1.9% of refusals and a response rate of 88%. The overall prevalence for Major Depressive Episode screening was 8.1%.

Table 1 shows that the sample consisted mostly of male individuals (55.5%), aged between 60 and 69 years (52.5%) and with a companion (63.2%). Half of the individuals were in economy class C (51.9%) and the schooling median was 3 years (IIQ = 1 - 5). Approximately four-fifths of the sample reported the non-use of alcohol in the last week (82.9%), while more than half reported being non-smoker (52.7%) and perceived health as very good or good (58, 0%). 75.6% of the sample reported continuous medication use and 39.1% reported having more than two chronic diseases. In addition, the majority had a sedentary behavior duration of less than 7 hours per day (87.9%), and the mean BMI was 26.5kg/m² (SD = \pm 4.7).

From Table 1, it is possible to observe that the prevalence of depression was higher in female subjects (10.4%) and in continuous medication users (10.3%). Those with poor or very poor health perception had a prevalence of 35.2%, almost five times higher than the general (8.1%). Those who had two or more chronic diseases had a prevalence of 13%, and the mean BMI of individuals with depression was 26.2kg/m², while the mean of those without depression was 26.5kg/m².

Table 2 presents the results from the adjusted analysis for depression. After adjusted analysis, the variables gender, medication use, chronic diseases, BMI and health perception remained

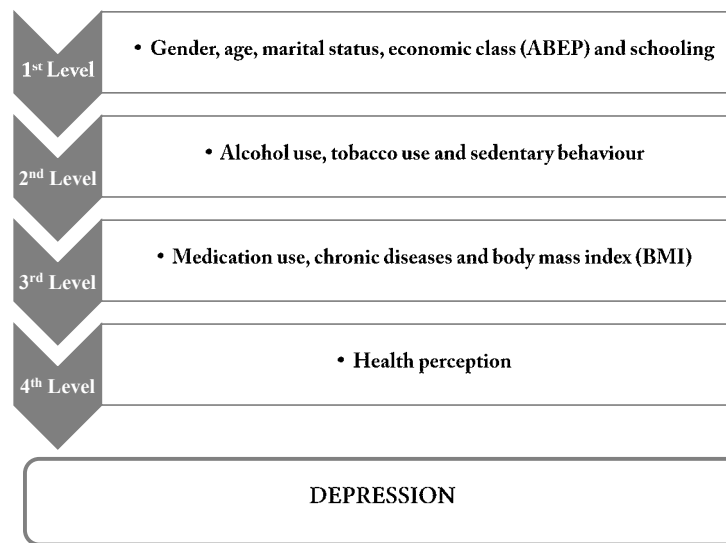


Figure 1. Conceptual analysis model.

associated with the outcome. Thus, the chance of developing depression was higher in female subjects (OR = 1.65, 95%CI = 1.04 - 2.62) and medication users (OR = 5.16, 95%CI = 1.74 - 15.33). In addition, those who perceived their health as poor or very poor presented almost twenty times more chances for the disorder when compared to individuals who considered their health very good/good (OR = 19.6, 95%CI = 8.65-44, 32). It was also observed that the chance of developing depression decreases by 6% in each increased kg/m² in the BMI ($p = 0.04$), and there was a trend between the number of chronic noncommunicable diseases and the chance of developing the disorder (OR = 2.4, 95%CI = 1.11-5.19).

Discussion

This study identified that 8.1% of the elderly in the rural area of Rio Grande (RS) fulfilled the criteria for screening for Major Depressive Episode. The variables gender, continuous medication use, chronic diseases and health perception remained associated after adjusting for potential confounders. In addition, was observed a protection effect at each increase of one kg/m² in body mass index.

The prevalence of depression found in the study (8.1%) was lower when compared to a study carried out with rural elderly in Brazil⁵ and

with elderly residents of rural areas from other countries^{8,35}. A study carried out in Pelotas with elderly residents from the urban area also presented a higher prevalence (15.2%)³⁶. However, the prevalence found in the present study was higher than the one found by the PNS⁹, which investigated adults living in rural areas (5.6%). The result found was also higher when compared to the study by Munhoz *et al.*¹⁰, which found a prevalence of 4.1% among adults in southern Brazil; among the elderly in the southern region, prevalence varied between 5.5% (60-69 years) and 6% (80 years or more). PNS⁹ also found the highest percentage of adults diagnosed with depression in the southern region of Brazil (12.6%). The differences found in prevalence rates may be due the use of different scales to evaluate depression. The correction using the cut-off point of PHQ-9 has sensitivity between 77 and 98%, and specificity of 75 to 80%, favoring the sensitivity of the test³², whereas the Geriatric Depression Scale, used in the majority of studies with elderly, is applied using a smaller cut-off point (≥ 6), being less sensitive when compared to PHQ-9^{5,8,35}.

Regarding the association between MDE and gender, the chance of developing depression was greater among women. This finding is recurrent in the literature: studies conducted in rural areas of Canada³⁷ and India⁷ with seniors goes in the same direction, presenting the female sex as a risk factor for the development of depressive disorder.

Table 1. Description of elderly residents sample from the rural area of Rio Grande with demographic, social, economic, behavioral variables and depression's (Major Depressive Episode) prevalence distribution among the categories. Rio Grande/RS, 2017 (N = 994).

| Variable | Depression | | | p ^a |
|--|-------------|-------------|--------------|---------------------|
| | N (%) | No N (%) | Yes N (%) | |
| | 994 (100) | 913 (91,9) | 81 (8,1) | |
| Gender | | | | 0.02 |
| Female | 442 (44.5) | 396 (89.6) | 46 (10.4) | |
| Male | 552 (55.5) | 517 (93.7) | 35 (6.3) | |
| Age | | | | 0.48 |
| 60-69 years | 521 (52.5) | 474 (91.0) | 47 (9.0) | |
| 70-79 years | 315 (31.7) | 294 (93.3) | 21 (6.7) | |
| 80 or more | 157 (15.8) | 144 (91.7) | 13 (8.3) | |
| Marital Status | | | | 0.60 |
| Companion | 628 (63.2) | 579 (92.2) | 49 (7.8) | |
| No companion | 366 (36.8) | 334 (91.3) | 38 (8.7) | |
| Schooling (years) Median (IQI**) | | | | 0.58 ^b |
| | 3 (1-5) | 3 (1 -5) | 3 (1 - 5) | |
| Economic class (ABEP) | | | | 0.14 ² |
| D-E | 394 (40.1) | 358 (90.9) | 36 (9.1) | |
| C | 510 (51.9) | 470 (92.2) | 40 (7.8) | |
| A-B | 79 (8.0) | 76 (96.2) | 3 (3.8) | |
| Alcohol use | | | | 0.13 |
| Yes | 170 (17.1) | 161 (94.7) | 9 (5.3) | |
| No | 824 (82.9) | 752 (91.3) | 72 (8.7) | |
| Tobacco use | | | | < 0.01 |
| Smoker | 132 (13.3) | 117 (88.6) | 15 (11.4) | |
| Ex smokers | 338 (34.0) | 317 (93.8) | 21 (6.2) | |
| Non-smoker | 523 (52.7) | 478 (91.4) | 45 (8.6) | |
| Health Perception | | | | < 0.01 ² |
| Very good/good | 575 (58.0) | 558 (97.0) | 17 (3.0) | |
| Regular | 345 (34.8) | 307 (89.0) | 38 (11.0) | |
| Poor/very poor | 71 (7.2) | 46 (64.8) | 25 (35.2) | |
| Continuous medication use | | | | < 0.01 |
| Yes | 751 (75.6) | 674 (89.7) | 77 (10.3) | |
| No | 242 (24.4) | 238 (98.3) | 4 (1.7) | |
| Sedentary behavior (h/day) | | | | 0.78 |
| < 7 hours | 872 (87.9) | 800 (91.7) | 72 (8.3) | |
| 8 hours or more | 120 (12.1) | 111 (92.5) | 9 (7.5) | |
| Chronic diseases ¹ | | | | < 0.01 |
| 0 | 272 (27.6) | 259 (95.2) | 13 (4.8) | |
| 1 | 328 (33.3) | 311 (94.8) | 17 (5.2) | |
| 2 or more | 385 (39.1) | 335 (87.0) | 50 (13.0) | |
| Body Mass Index ^c - Mean (SD) | 26.5 (±4.7) | 26.5 (±4.6) | 26.2 (±5.0) | 0.04 [*] |

^a Chi square test. ^b Wilcoxon's (Mann-Whitney) test. ^c Variable with the highest missing value, N= 950. ¹ Hypertension, diabetes, cancer, arthritis/arthrosis, osteoporosis, respiratory disease and kidney disease. ² Chi square test for linear trend. * T test. ** Interquartile interval.

In Greece, however, no differences were found in depression levels between men and women³⁸. Brazilian studies performed with elderly populations corroborate with international data,

finding a higher prevalence of depression among women^{5,36,39}. It is possible that women are more susceptible to the development of depression due to social and biological factors, such as greater

Table 2. Crude and adjusted odds ratios for associations between depression and independent variables. Multivariate analysis conducted with four hierarchical levels through logistic regression. Sample of elderly residents from the rural area. Rio Grande/RS. 2017 (N = 994).

| Variable | Crude Analysis | | Adjusted Analysis ^{1 2} | |
|-----------------------------|----------------------|---------|----------------------------------|---------|
| | OR (CI95%) | p | OR (CI95%) | p |
| Gender | | 0.021 | | 0.034 |
| Female | 1.71 (1.08 – 2.71) | | 1.65 (1.04 – 2.62) | |
| Male | 1 | | 1 | |
| Age | | 0.485 | | 0.362 |
| 60 a 69 years | 1 | | 1 | |
| 70 a 79 years | 0.72 (0.42 – 1.23) | | 0.72 (0.42 – 1.23) | |
| 80 anos or more | 0.91 (0.48 – 1.73) | | 0.69 (0.35 – 1.38) | |
| Marital Status | | 0.601 | | 0.984 |
| Companion | 0.88 (0.55 – 1.41) | | 1.00 (0.61 – 1.65) | |
| No companion | 1 | | 1 | |
| ABEP | | 0.14* | | 0.126* |
| D-E | 1 | | 1 | |
| C | 0.85 (0.53 – 1.35) | | 0.83 (0.52 – 1.33) | |
| A-B | 0.39 (0.12 – 1.31) | | 0.38 (0.11 – 1.28) | |
| Schooling | 0.98 (0.92 – 1.05) | 0.568 | 1.00 (0.93 – 1.08) | 0.989 |
| Tobacco use | | 0.166 | | 0.178 |
| Smoker | 1.36 (0.73 – 2.53) | | 1.75 (0.90 – 3.38) | |
| Ex smoker | 0.70 (0.41 – 1.20) | | 0.96 (0.53 – 1.73) | |
| Non-smoker | 1 | | 1 | |
| Alcohol use | | 0.139 | | 0.401 |
| No | 1 | | 1 | |
| Yes | 0.58 (0.29 – 1.19) | | 0.73 (0.35 – 1.53) | |
| Sedentary behaviour (h/day) | | 0.777 | | 0.815 |
| < 7 hours | 1 | | 1 | |
| 8 hours or more | 0.90 (0.44 – 1.85) | | 1.09 (0.52 – 2.29) | |
| Medication use | | < 0.01 | | < 0.01 |
| No | 1 | | 1 | |
| Yes | 6.80 (2.46 – 18.77) | | 5.16 (1.74 – 15.33) | |
| Chronic diseases | | < 0.01* | | < 0.01* |
| 0 | 1 | | 1 | |
| 1 | 1.09 (0.52 – 2.28) | | 0.90 (0.38 – 2.09) | |
| 2 or more | 2.97 (1.58 – 5.59) | | 2.40 (1.11 – 5.19) | |
| Body Mass Index | 0.95 (0.80 – 0.95) | 0.08 | 0.94 (0.89 – 0.99) | 0.04 |
| Percepção de saúde | | <0.01* | | <0.01* |
| Very good/good | 1 | | 1 | |
| Regular | 4.06 (2.25 – 7.32) | | 33.12 (1.60- 5.12) | |
| Poor/ Very poor | 18.84 (8.98 – 35.41) | | 19.59 (8.65 – 44.32) | |

OR = Odds ratio; CI95% = 95% confidence interval. ¹ Hosmer-Lemeshow's test: p = 0,0980. ² R² final logistic regression model = 20,4%. * p value for linear trend.

sensitivity to potentially stressors events^{10,36} and estrogen deprivation, which may influence the occurrence of depression⁴⁰.

Older people who reported continuous medication use were five times more likely to develop depression. The greater consumption of drugs in this phase of life, often due to the coexistence of

several diseases, can have side effects and a negative perception of health, as well as a decline in the metabolism of pharmaceutical substances⁴¹. The use of several drugs at the same time, also known as polypharmacy, is common during aging and may have negative consequences due to pharmacokinetic and pharmacodynamic chang-

es inherent in the elderly⁴². Longitudinal studies conducted in Belgium²² and in India²¹ with elderly residents of urban areas have found that the diagnosis of depression is significantly associated with the use of several drugs, contributing to the occurrence of polypharmacy. This phenomenon is also associated with both patients' and health system's significant increase in health expenditures⁴³.

Elderly with two or more chronic diseases were twice as likely to present depression. This finding is recurrent in studies carried out with elderly populations in rural areas, where a positive association between morbidities and depressive symptomatology was found^{19,20,44}. However, studies conducted in Brazil with elderly people from urban and rural regions found no association between depression and such variable^{36,45}. Individuals who have chronic diseases are more likely to develop depression than those without other diseases, so the coexistence of these two conditions is very common⁴⁴. Moreover, the relationship between depression and chronic diseases can be two-way, since problems such as chronic pain may lead to a predisposition to depression, so depressive symptoms are associated with negative health outcomes such as heart disease⁴¹.

There was an association between body mass index and depression in the adjusted analysis. Significant association between BMI and depression was observed in studies with elderly populations in Japan, Colombia and United States^{8,15,46}. However, studies with elderly populations in Brazilian urban areas⁴⁵ and in rural areas in Japan¹² did not find an association between the variables. Changes in weight and appetite are symptoms of depression; in this sense such association should be checked with caution because of possible bidirectionality. Loss of weight and appetite are recurrent aspects of old age due to biological alterations from this phase of life⁴⁷ and depression may be one of the causes of BMI change and, at the same time, a consequent associated factor⁴⁶.

An inverse trend was observed between development of depression and health perception among the interviewed elderly. Those who considered their health poor or very poor were twenty times more likely to develop depression compared to the reference group. This finding is consistent with studies carried out with rural elderly populations in the world^{23,48} and in Brazil^{3,36,45}. In this lifetime age, the increase in medication consumption and chronic diseases³⁶, along with a decrease in work, less interaction with others and feelings of disability influence

a worse perception of health and the occurrence of depressive symptoms⁴⁹. In other words, this association may represent a bidirectionality relationship.

The associations found in the present study and the lack of association in certain variables can be explained in part by differences between elderly people living in rural and urban areas. Studies that sought to compare the prevalence of depression in rural and urban areas found that reside in rural areas is considered a protective factor against the development of chronic non-communicable diseases²³ because elderly residents from urban areas are exposed to factors that may contribute to the development of health issues, such as fewer hours of sleep and worse quality of life⁷; in addition, the natural environment, characteristic of the rural area, is responsible for reducing stress levels⁵⁰. Study in Canada³⁷, which sought to compare the prevalence of depression among rural and urban areas, found a higher prevalence of depression among elderly residents of urban areas, compared to those living in predominantly rural areas (11.6% and 9%, respectively); furthermore, a comparative study developed in Japan found that the risk factors for each population differed, with less occurrence of depression in rural areas¹⁹.

A country can present regional differences regarding culture, social and economic conditions, which may result in certain disparities⁵¹. Residents of rural areas may present greater health challenges, both due to difficulties in accessing services and income related issues, so that the factors associated with depression in this context point to general health characteristics⁵². Environmental and socio-cultural issues should also be taken into account, since the mental health of the individual is modeled by the socio-environmental context in which he is inserted, so that the environment itself may increase the risk for the development of a mental disorder⁵⁰. Regarding mental disorders, residents from rural areas are less likely to report the need for treatment, care for the problem and the very existence of mental health problems, when compared to residents from urban areas⁵³.

The cross-sectional design was adequate to respond the main question of this research. However, the possible reverse causality, inherent to cross-sectional studies, should be considered as one of the study's limitation. Moreover, it is possible that the prevalence of depression is underestimated by those individuals who did not respond to PHQ-9 completely and were excluded

ed from the sample. It is important to emphasize that, although PHQ-9 is useful for the disorders screening, it does not replace the diagnosis based on a clinical interview conducted by psychologists and psychiatrists. Thus, regardless of how the instrument is used, the result should be described as a probable diagnosis of MDE.

Among the study's advantages it should be emphasized that this is a population-based study, conducted through a household survey and with a low percentage of losses and refusals when compared to other surveys. In addition, despite several publications about depression in Brazil, few were found addressing the issue in rural regions. Regarding the instrument used for MDE screening, the present study used a validated instrument for the Brazilian population, which has been used in other countries³².

Female elderly, with lower BMI, users of continuous medications, with two or more chronic illnesses and with worse health perception were more likely to have depressive symptomatology. In other words, they are more exposed to the negative effects of depression. The research carried out in the present study is fundamental to understand the peculiarity of the rural space, considering that there is a shortage of studies on the depression subject in rural areas. Thus, our findings highlight the need to implement policies that consider health in a broad way, since several aspects can contribute to the development of mental health problems. Programs' designed targeting elderly in rural areas, screening, early diagnosis of depression and maintenance of treatment, encompassing several factors related to health, are important actions that must be fostered by the health system.

Collaborations

ML Corrêa participated in the conception and project, data collection, analysis and interpretation of results and writing of the article. MX Carpena contributed to data analysis and writing of the article. RD Meucci worked as general coordinator of the research and in the relevant critical review of the article. L Neiva-Silva collaborated in the guidance and relevant critical review of all stages, from conception to the preparation of the article.

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