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Association between depression and chronic diseases: results from a population-based study

ABSTRACT

OBJECTIVE: To assess the association between depression and chronic diseases in adults.

METHODS: Population-based cross-sectional study with a sample of 1,720 adults aged 20 to 59 years conducted in the city of Florianópolis, southern Brazil, in 2009. Multistage sampling was used and census tracts were the primary sample unit. Subjects were interviewed at home, and reported being diagnosed with depression (outcome) and 11 other chronic diseases (exploratory variable) by a health provider. They were grouped into those with no chronic disease, one, and two or more diseases. Gender, age, marital status, income, physical activity, hospitalization and medical visits were confounders. Poisson regression analysis was used to estimate prevalence ratios and related 95% confidence intervals.

RESULTS: The prevalence os depression was 16.2% (95%CI 14.3;18.2). It was higher in women, older individuals, widowed or divorced, and poor ones. Those who reported no leisure-time physical activity and medical visits in the last two weeks, and who were hospitalized in the last year also showed higher prevalence of depression and chronic diseases. Even after adjustment for confounders the prevalence of depression was 1.44 (95%CI 1.09;1.92) times higher among those reporting one chronic disease and 2.25 times higher among those reporting two or more diseases than among those with no diseases.

CONCLUSIONS: The prevalence of depression is much higher among people with higher burden of chronic diseases. Health professionals, health services, and policy makers must target specific strategies to this group.

DESCRIPTORS: Depression, epidemiology. Chronic Disease, epidemiology. Comorbidity. Cross-Sectional Studies.

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INTRODUCTION

The high and increasing prevalence of depression in populations of all continents and the serious impacts that it produces make the disease be one of the most serious public health problems of the beginning of the 21st century. It is estimated that depression was the third main cause of years of life lost due to disability (disability-adjusted life year – DALY) in the whole world (4.3%) in 2004 and it ranked first among the causes of years lived with disability, affecting more women (13.4%) than men (8.3%).[25]

People with depression present higher health expenditures,[20] work disability,[20] lower adherence to prescribed medical treatments[9] and higher risk of mortality after heart surgery.[4] The economic impacts of depression on the society are also

considered to be serious, reaching 118 billion Euros in Europe in 2004 (equivalent to 1% of the continent's economy).[21]

The prevalence of depression is unequally distributed in the population: it is more common among women,[22] younger individuals,[3] those who have poorer economic conditions[10] and those who live without a partner.[22] It is associated with the existence of chronic diseases: people with depression can present biological alterations that can increase the risks of developing them. In addition, people with chronic diseases can present limitations in their daily life that increase their odds of having depression.[13]

Despite the important relationship between depression and chronic diseases, there are no Brazilian population-based studies that aimed to test the association between these factors. A search in databases with the descriptors "depression", "chronic diseases" and "Brazil" found only studies with hospitalized patients or with specific diseases.

The present study aimed to analyze the association between depression and chronic diseases in adults.

METHODS

Population-based cross-sectional study carried out with 2,016 adults aged 20 to 59 years in the city of Florianópolis (Southern Brazil), in 2009. This study was part of a research called EpiFloripa 2009, which aimed to analyze different health conditions and the exposure to risk factors of the urban adult population of the municipality. The reference population was composed of 249,530 people.

The formula to determine prevalence in the program EpiInfo 6.04 was used to calculate sample size. The parameters used were 95% confidence level and sample error of 3.5 percentage points. As diverse outcomes were investigated in the large research, an expected prevalence of the phenomenon of 50% was used to obtain the largest sample size. A design effect (deff) of 2 was considered. A total of 10% was added considering estimated losses and 15% to control for confounders, resulting in a sample of 1,979 people. The largest sample calculated in the broad inquiry that analyzed diverse health outcomes was considered (n = 2,016). It was possible to calculate *a posteriori* the sample's statistical power. The sample enabled to identify a minimum relative risk of 1.47, considering power of 80%, alpha error of 5%, non-exposed:exposed ratio of 2:3 (chronic disease distribution) and prevalence in the non-exposed of 9.9%.

Cluster sampling was used and the census tracts were the primary sample unit. The municipality's territorial network was formed by 420 urban census tracts, which were stratified in deciles in ascending order, according to the income of the head of the family (R$ 192.80 to R$ 13,209.50). Sixty of these tracts were systematically drawn (sampling fraction equal to seven, six tracts selected in each income decile).

The units of the second stage were the households. The number of inhabited and permanent private units in each drawn tract initially varied from 61 to 810. Such variation, caused by the temporal distance in relation to the last census conducted in Brazil, led to the division of the largest tracts and to the grouping of the smallest ones (respecting their contiguity and income deciles). This procedure led to the formation of 63 tracts, which resulted in a coefficient of variation in the number of households in the tracts of 32%. Thirty-two households were systematically drawn in each one of the 63 tracts, totaling 1,134 selected units. All the adults aged between 20 and 59 years at the moment of the interview and residing in these households were potential participants in the study. The individuals who did not have physical or psychological conditions to answer the questionnaire were excluded.

Losses were considered the households that were visited at least four times, including weekends and the evening period, without the interviewer being able to locate the person. Refusal was considered when the research subject decided not to participate in the study.

Data collection was performed between September/2009 and January/2010 by 35 interviewers appropriately trained to use personal digital assistants. The interviews were individually conducted at the homes of the drawn individuals. A pre-test (n = 30) and a pilot-study were carried out in two census tracts that were not included in the study.

Approximately 15% of the subjects (n = 248) were interviewed for the second time by telephone and answered the reduced questionnaire with ten questions. Concordance was high, with the lowest kappa value equaling 0.56 (use of dental prosthesis). Concordance was 97.6% for self-reported diabetes.

The dependent variable was self-reported depression at some moment of the subject's life. The question that was used had been employed in the health supplements of the *Pesquisa Nacional por Amostra de Domicílios*[a] (PNAD – National Household Sample Survey) of 2003 and 2008: "Has some doctor or health professional ever told you that you have depression?" The independent variable of main interest was the number of chronic

diseases. The structure of the questions about the existence of the chronic disease was the same one that was used for depression, substituting the disease in question. Data were obtained about the existence of problem in the spine or on the back, arthritis or rheumatism, cancer, diabetes, bronchitis or asthma, hypertension, heart disease, chronic renal failure, tuberculosis, tendinitis or tenosynovitis and cirrhosis. The variable was categorized as (1) inexistence of any chronic disease, (2) existence of only one chronic disease and (3) presence of two or more chronic diseases.

The following variables were utilized for control: sex, age, marital status, *per capita* family income in reais (in tertiles), alcohol abuse (score > 7 points in the Alcohol Use Disorder Identification Test [AUDIT]),[2] leisure-time physical activity in the last three months, hospitalization in the last 12 months and medical consultation in the last two weeks.

Poisson's multiple regression analysis was carried out in the statistical program Stata 9, and the prevalence ratios (PR) and their respective 95%CI were obtained as association measures. The design effect and the individual weights were incorporated into the analysis in all the estimates. The crude analysis of the outcome (depression) was performed with each one of the independent variables. Those that presented p-value < 0.20 were included in the multiple model according to the stepwise forward method, when the association between depression and chronic diseases was adjusted by all the independent variables. Those with p < 0.20 or that adjusted the measures obtained from another investigated dimension remained in the analysis.

The project was approved by the Ethics Committee of Research with Human Beings of *Universidade Federal de Santa Catarina* (Process n° 351/08).

RESULTS

A total of 1,720 people were interviewed (85.3% of the estimated sample of 2,016). The participants were mostly women (55.6%), adults aged between 20 and 39 years (55.6%), married or with a partner (60.1%). Approximately 60.0% reported at least one chronic disease and the major part did not practice leisure-time physical activity (53.1%). The prevalence of depression was 16.2% (95%CI 14.3%;18.2%) in the general population. The highest point values were observed among women (22.2%), older individuals (22.7%), widowed or separated individuals (30.7%), poor individuals (18.1%), among those with two or more chronic diseases (29.1%), those who did not practice leisure-time physical activity (19.2%), those who consulted a doctor in the last two weeks (23.2%), and those who were hospitalized in the last year (32.7%) (Table 1). The most prevalent chronic disease was problem in the

spine or on the back (31.0%), followed by tendinitis/tenosynovitis (18.0%), hypertension (14.3%) and bronchitis/asthma (13.8%).

Differences in the prevalences of depression were statistically significant between at least two categories in the analyzed variables, except in the variable income (p = 0.059) and alcohol abuse (p = 0.340) in the crude analysis (Figure). The most expressive ratio differences in the prevalence of depression were between those who reported two or more chronic diseases and those without diseases (PR = 3.09; 95%CI 2.42;3.95), between widowed/separated individuals and married/in a stable union (PR = 2.88; 95%CI 2.00;4.14), between people aged 50 to 59 years and people aged 20 to 29 years (PR = 2.52; 95%CI 1.81;3.50), and between women (PR = 2.53; 95%CI 1.99;3.22) and men.

People with one chronic disease presented a prevalence of depression that was 1.58 times higher compared to those without diseases in the unadjusted model (Table 2). In the subsequent models, with the adjustments of the demographic, socioeconomic, behavioral and health services use variables, the magnitude of the PR decreased, but the prevalence
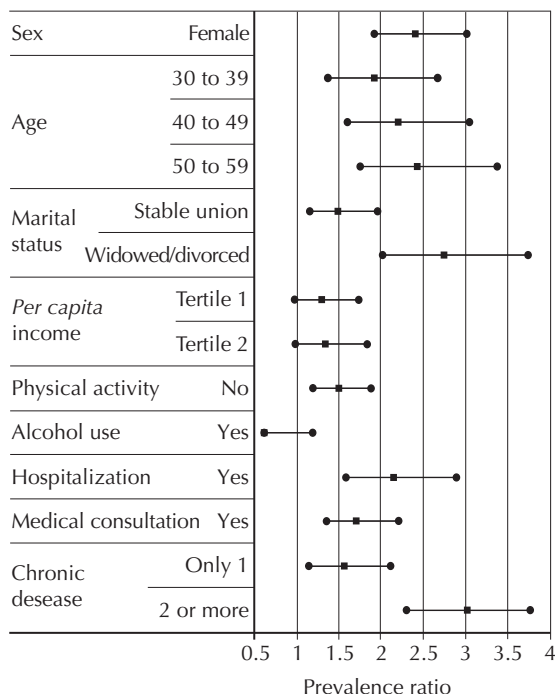
Reference categories: sex (male), age (20 to 29), marital status (single) *per capita* income (tertile 3), physical activity (yes), alcohol abuse (no), hospitalization (no), medical consultation (no), chronic disease (none).

Figure. Unadjusted prevalence ratios obtained by means of Poisson regression between self-reported depression and demographic, socioeconomic, behavioral, health services use characteristics and number of chronic diseases in the adult population (20 to 59 years) of Florianópolis, SC, 2009.

Table 1. Sample distribution and prevalence of depression in adults aged 20 to 59 years according to sociodemographic variables, utilization of health services, behaviors associated with health and number of chronic diseases. Florianópolis, SC, 2009.

Variable	n	Sample % (95%CI)	Prevalence of depression (95%CI)
Sex	1,720	44.4 (42.3;46.6)	8.8 (6.7;10.9)
Male	761	55.6 (53.4;57.7)	22.2 (19.5;24.9)
Female	959		
Age (years)	1,720		
20 to 29	540	32.7 (28.2;37.2)	9.0 (6.5;11.6)
30 to 39	392	22.9 (20.3;25.5)	17.6 (14.2;21.0)
40 to 49	438	25.0 (21.8;28.1)	19.4 (15.3;23.4)
50 to 59	350	19.4 (17.0;21.9)	22.7 (18.1;27.3)
Marital status	1,720		
Married or with partner	1043	60.1 (56.5;63.6)	16.6 (14.1;19.1)
Single	503	29.9 (26.3;33.5)	10.6 (8.0;13.2)
Widowed or divorced/separated	174	10.0 (8.2;11.8)	30.7 (22.4;39.0)
Per capita income *(reais)*	1,685		
Tertile 1 (zero to 566.90)	564	32.6 (26.1;39.0)	18.1 (14.0;22.1)
Tertile 2 (567.00 to 1,300.00)	562	33.3 (29.6;36.9)	17.6 (14.1;21.1)
Tertile 3 (1,300.00 to 33,333.00)	559	34.1 (27.8;40.4)	13.6 (10.7;16.4)
Leisure-time physical activity	1,718		
Yes	806	46.9 (42.5;51.2)	12.8 (10.6;15.1)
No	912	53.1 (48.8;57.4)	19.2 (16.3;22.1)
Alcohol abuse	1,720		
Yes	317	18.5 (15.6;21.5)	14.3 (10.1;18.5)
No	1403	81.5 (78.5;84.4)	16.7 (14.5;18.9)
Hospitalization in the last 12 months	1,717		
Yes	115	6.7 (5.4;8.0)	32.7 (23.2;42.3)
No	1602	93.3 (92.0;94.6)	15.1 (13.0;17.1)
Medical consultation in the last 2 weeks	1,717		
Yes	481	6.5 (5.1;7.8)	23.2 (18.8;27.6)
No	1236	93.5 (92.2;94.8)	13.5 (11.4;15.6)
Chronic disease	1,716		
None	685	40.9 (37.8;44.0)	9.9 (7.7;12.2)
One	564	32.8 (30.2;35.5)	15.4 (12.6;18.3)
Two or more	467	26.3 (23.9;28.6)	29.1 (24.2;34.1)

was 44% higher in the group exposed to at least one chronic disease (p = 0.025). The increase in the number of diseases also increased the prevalence of depression. In comparison with people without any chronic diseases, the adults with two or more diseases presented a prevalence of depression that was 209% higher in the unadjusted analysis. The prevalence ratio decreased in the model when all the control variables had been introduced, but people with two or more chronic diseases present a prevalence of depression that is 125% higher compared to that of the people who did not report any chronic diseases (p < 0.001).

DISCUSSION

Individuals with one or more chronic diseases presented higher prevalence of depression, even after adjustment by the demographic, socioeconomic and health services use variables. This result is consistent with the literature. Moussavi et al[16] analyzed data concerning people older than 18 years in 60 countries from all continents and observed that the prevalence of depression in the whole sample was 3.2%, but it reached 9.3% among those who reported diabetes, 10.7% among those who had arthritis and 18.1% among asthmatic individuals. There is evidence that patients with chronic respiratory[18]

Table 2. Poisson multiple regression analysis between self-reported depression (yes/no) and number of chronic diseases in the adult population (20 to 59 years). Florianópolis, SC, 2009.

Models[a]	Number of chronic diseases			p
	None	One PR (95%CI)	Two or more PR (95%CI)	
Unadjusted model	Reference	1.58 (1.18;2.11)	3.09 (2.42;3.95)	< 0.001
Model 2	Reference	1.54 (1.16;2.03)	2.78 (2.16;3.56)	< 0.001
Model 3	Reference	1.46 (1.10;1.93)	2.44 (1.90;3.15)	< 0.001
Model 4	Reference	1.48 (1.12;1.96)	2.46 (1.92;3.15)	< 0.001
Model 5	Reference	1.48 (1.12;1.97)	2.41 (1.85;3.13)	< 0.001
Model 6	Reference	1.50 (1.12;1.99)	2.40 (1.84;3.13)	< 0.001
Model 7	Reference	1.45 (1.09;1.92)	2.30 (1.76;2.99)	< 0.001
Model 8	Reference	1.44 (1.09;1.92)	2.25 (1.72;2.94)	< 0.001

[a]Model 2: Number of chronic diseases + sex
Model 3: model 2 + age
Model 4: model 3 + marital status
Model 5: model 4 + *per capita* income
Model 6: model 5 + leisure-time physical activity
Model 7: model 6 + hospitalization in the last 12 months
Model 8: model 7 + medical consultation in the last 2 weeks

and cardiovascular[5] diseases present higher prevalence of depression, but many studies have not adjusted the association by possible confounders.

Depression can be associated with hormonal and physiological changes in the organism that increase the odds of developing certain chronic diseases, i.e. depression would be a risk exposure for the development of other chronic diseases. The relationship between depressive episodes and a decrease in the heart rate variability has already been reported,[7] and also the relationship to high levels of cortisol,[6] not to mention that it has an impact on the autonomic nervous system, on metabolic factors and on the hypothalamic-pituitary axis.[13] Depression can also modulate behaviors, as it can lead to insomnia and to shorter sleep duration, which would act as modulators of the occurrence of hypertension.[11] For biological reasons, populations with less experience in depressive events can present lower odds of developing chronic diseases.

The relationship between depression and chronic diseases can be bidirectional. People who suffer from chronic diseases report worse self-rated health, as shown by Alves & Rodrigues[1] through a population-based study conducted in São Paulo. Having four or more chronic diseases has been associated with odds that are ten times higher of negative self-perception of health among men. Quality of life is also directly associated with the presence of chronic diseases, being lower among those with more chronic diseases, in a clear dose-response effect.[24] However, diseases like lumbar pain, knee osteoarthritis and cancer seem to present a larger impact on quality of life than diabetes and hypertension.[24] People with chronic diseases can present limitations, like those concerning mobility, eating, physical activity and limitations in the performance of the daily activities of personal life, social life or at work. The problems and implications that are inherent in these restrictions can lead to mood disorders and depression.

Independently of the direction in which the association between depression and chronic diseases occurs, the combination of the two implies worse handling of the diseases and worse outcome. A meta-analysis carried out by De Groot et al[8] showed that depression is associated with complications in patients with diabetes, like retinopathy, neuropathy, nephropathy, sexual dysfunction and macrovascular complications. Depression has also been associated with lower adherence to drug therapy, special diets and health expenses.[15]

The self-report of a previous diagnosis of the analyzed diseases may be a limitation of the study. The prevalences may be underestimated due to absence of recent symptoms in the cases in which the disease does not express clinical manifestation, when the health services are not used for the diagnosis or due to memory bias. On the other hand, the presence of symptoms in a period close to the interview may lead the person to refer the disease, even without the professional diagnosis. However, studies have indicated the validity of self-reported depression[19] and other chronic diseases[12] in different contexts, a practicable and reliable way of obtaining data about the prevalence of morbidities in epidemiological studies.

People who use more the health services are more likely to receive a diagnosis of some chronic disease. In the present study, this factor was controlled through

adjusting the analysis by the prevalence of medical consultations in the last two weeks and hospitalization in the last 12 months. However, some residual confounding may have happened, as in any association. Nevertheless, the magnitude of the association of interest was quite expressive. As it is a cross-sectional study, it is also not possible to establish the chronology of the events, i.e., whether people with depression have higher odds of developing chronic diseases or whether people, because they have a greater amount of diseases, present higher prevalence of depression.

Despite the limitations, the study had a high response rate and similar distribution among the income deciles of the primary sample units. Furthermore, the age and sex composition observed in the sample was similar to the one estimated by the IBGE to the municipality in 2009.

In light of the epidemiological scenario that was verified – strong association between depression and chronic diseases and the evidence that people with depression present worse outcomes for these diseases – it is essential that professionals and health services structure specific policies and actions for this population. Interventions like telephonic counseling targeted at these patients,[17] patients' proper follow-up by primary care professionals[23] or drug administration when indicated[14] seem to present positive results in the handling of chronic diseases.

ACKNOWLEDGMENTS

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