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ORIGINAL ARTICLE

Sociodemographic, behavioral, and health-related risk factors for depression among men and women in a southern Brazilian city

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Objective: To assess the prevalence of depression and sociodemographic, behavioral, and health-related risk factors therefor in a southern Brazilian city.
Methods: Population-based, cross-sectional study of adults from Rio Grande, state of Rio Grande do Sul, Brazil. Individuals (n=1,295) were selected using a multistage sampling procedure. The Patient Health Questionnaire-9 (PHQ-9) was used to screen for major depressive episodes (MDEs). We used a conceptual causal framework to organize and assess risk factors for MDE and calculated prevalence ratios (PR) using regression models.
Results: The prevalence of MDE was 8.4% (95%CI 6.0-10.7) for men and 13.4% (95%CI 11.0-15.8) for women. For men, physical inactivity (PR 2.34, 95%CI 1.09-5.00) and perceived stress (PR 20.35, 95%CI 5.92-69.96) were associated with MDE. In women, MDE prevalence was higher among those in the first tertile of economic index (PR 2.61, 95%CI 1.53-4.45), with 0-8 years of schooling (PR 2.25, 95%CI 1.24-4.11), alcohol users (PR 1.91, 95%CI 1.21-3.02), those physically inactive (PR 2.49, 95%CI 1.22-5.09), with the highest perceived stress (PR 9.17, 95%CI 3.47-24.23), with another mental disorder (PR 1.85, 95%CI 1.32-2.59), and with more noncommunicable diseases (PR 1.85, 95%CI 1.06-3.22).
Conclusion: Women had a higher prevalence of depression, and socioeconomic disadvantages were important for the occurrence of MDE; however, for men, only physical inactivity and stress were important predictors, suggesting possible different causal pathways for each sex.

Keywords: Depression; mood disorders; epidemiology; mental health; sex

Introduction

Worldwide, the mean prevalence of major depressive episodes (MDEs) is around 4.7%, with an annual incidence of 3%.[1] It is the leading cause of years lost to disability worldwide and a major contributor to the overall global burden of disease.[2-4] The prevalence of depression is not equally distributed worldwide; it seems to be high in low- and middle-income settings, especially in Latin America.[2,3,5] In addition, given the multifactorial nature of depression, it has been proposed that its prevalence differs across studies because of factors such as period of analysis, sex, year of study, depression subtype, survey instrument, age, and region, and high-quality estimates from low- and middle-income countries are scarce.[1]

According to the Brazilian National Health Survey (Pesquisa Nacional de Saúde [PNS]), the countrywide prevalence of depression is 4.1%.[6] However, MDE prevalence is different among geographical regions; it is higher in more populated regions, such as southern Brazil, and the burden could be even greater in major cities such as São Paulo (annual prevalence 10.4%).[5] In São Paulo, depression was associated with an annual increase of R$ 308.28 in health expenditure and loss of 10.37 days of normal activity.[7]

Adequate characterization of risk factors for depression in each specific setting is of the utmost importance. A better understanding of its determinants, especially modifiable factors, could mitigate or stabilize its impact. Given the high prevalence of depression in the southern region of Brazil[6] and the context mentioned above, this study was designed to investigate the occurrence of depression and associated risk factors in adult men and women living in the urban area of Rio Grande, state of Rio Grande do Sul, Brazil.

Methods

This population-based cross-sectional study was carried out in Rio Grande, a southern Brazilian city of approximately

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207,000 habitants. A predominantly industrial city, it is one of the richest in the southern region of Rio Grande do Sul and has one of the largest ports in Brazil.

The target population were individuals aged 18 years or older living in the urban area of the city. The exclusion criteria were being institutionalized or physically or cognitively unable to complete the survey. Sampling was conducted in two stages. First, all 77,835 households in the urban area of Rio Grande were listed in decreasing order of average monthly income of the head of household.[8] To identify the corresponding census tract, we randomly selected the first household followed by every subsequent 1,080th household, for a total of 72 census tracts. In so doing, 32,711 households were skipped. Thirty neighborhoods were covered; two census tracts were excluded because no households were drawn from them. Additional details on sampling methodology can be found elsewhere.[9] Data were collected between April and July 2016.

Screening for MDE was performed using the Patient Health Questionnaire-9 (PHQ-9), in its version validated for the Brazilian population.[10] The PHQ-9 is a nine-item scale which explores depressive symptoms during the 2 weeks preceding interview. Possible answers for each item are scored on a four-point Likert-type scale (0 = never; 1 = less than once a week; 2 = once a week or more; 3 = almost every day). If the individual responded once a week or more (2 points) or almost every day (3 points), the item/question was considered positive, except for symptom 9 (suicidal thoughts), for which any non-zero value was coded as positive. MDE was defined by the presence of five or more of the nine symptoms, at least one being depressive mood and/or anhedonia. Based on the literature about depression epidemiology, we created a conceptual framework (Figure 1, available as online-only supplementary material) and collected the following independent variables: biological sex, age (18-39 years; 40-59 years; $\geqslant$ 60 years), marital status (married; single; separated; widowed), economic index (based on reported assets, categorized into tertiles), educational attainment (0-8; 9-11; $\geqslant$ 12 years of schooling), current smoking status, alcohol abuse in the past 30 days, physical inactivity at leisure time, perceived stress, self-reported number of noncommunicable diseases (NCDs), and mental disorders other than depression.

Alcohol abuse in the past 30 days was defined as drinking five or more doses for men and drinking four or more doses for women on a single occasion.[11] Physical inactivity was defined as fewer than 150 minutes of physical activity during leisure time per week (self-reported on the International Physical Activity Questionnaire – IPAQ[12]), according to World Health Organization recommendations.[13] Perceived stress was assessed using the Perceived Stress Scale (PSS-14),[14] with scores ranging from 0 to 56; participants were categorized into tertiles of perceived-stress scores.

We used the chi-square test for bivariate analysis, and Poisson regression with robust variance adjustment[15] in crude and adjusted multivariable models to calculate prevalence ratios (PR). We used a conceptual framework[16] to conduct the analysis and control for confounders in adjusted models, and a stepwise approach with backward input of variables; variables with $p < 0.20$ were included in the final model. The svy prefix was used to take into account the design effect in the analyses. We tested the interaction of the variable sex with all final variables included in our multivariable models, using Poisson regression for the interaction term to be significant ($p < 0.10$). Analyses were performed in STATA version 14.0.

The project was approved by the Universidade Federal do Rio Grande (FURG) research ethics committee in March 2016 (20/2016) and performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments. All participants provided written informed consent.

Results

We analyzed 1,295 individuals (response rate 90.6%); 56.6% were women, 39.3% were aged 18-39 years, 46.3% were single, and 41.8% had no more than 8 years of education. In addition, 17.9% were currently using tobacco, 11.8% had abused alcohol in the preceding 30 days, 22.3% were physically active in their leisure time, 55.8% reported no NCDs, and 16.4% reported a diagnosis of mental disorders other than depression (Table 1).

The proportion of nonresponses was higher among men (12.3%) than women (6.9%) ($p < 0.001$).

The prevalence of MDE was 11.2% overall (95% confidence interval [95%CI] 9.3-13.1). It was significantly higher among women (13.4%, 95%CI 11.0-15.8) than among men (8.4%, 95%CI 6.0-10.7) ($p = 0.002$).

The variables sex, economic index, educational attainment, leisure-time physical activity, perceived stress, number of NCDs, and other mental disorders were independently associated with depression (Figure 2, available as online-only supplementary material). However, when we tested for interaction between sex and independent variables, all p-values were < 0.10.

Table 2 shows that, in the final adjusted model for men, those physically inactive had a prevalence 2.34 times higher of MDE (PR = 2.34, 95%CI 1.09-5.00), while those in the highest tertile of perceived-stress score had a prevalence 20.35 times higher (PR = 20.35 95%CI 5.92-69.96) compared to those in the lowest level. For women, final adjusted models showed that MDE was 2.61 and 1.78 times more prevalent among those in the first and second tertiles of economic index than among those in the highest category, respectively; it was 2.25 times higher among women with 0-8 years of schooling compared to those with 12 or more years of schooling; 1.91 times more prevalent among those who abused alcohol; 2.49 times more prevalent among those who were not physically active during leisure time; 9.17 and 3.89 times more prevalent among those in the third and second tertiles of perceived stress, respectively, when compared to those in the lowest tertile; 1.85 times more prevalent among those with another mental disorder; and 1.85 times more prevalent in those with two or more NCDs.

Discussion

The prevalence of MDE in our sample seems high in comparison to other studies. It has been proposed that

Table 1 Sociodemographic, behavioral, and health information for the overall sample and stratified by sex, Rio Grande, Brazil, 2017

	Men	Women	Total
Age (years)			
18-39	231 (41.1)	227 (37.8)	508 (39.3)
40-59	209 (37.2)	268 (36.6)	477 (36.8)
60 or older	122 (21.7)	188 (25.6)	310 (23.9)
Marital status			
Married	233 (41.5)	242 (33.0)	475 (36.7)
Single	273 (48.5)	327 (44.6)	600 (46.3)
Separated or widowed	56 (10.0)	164 (22.4)	220 (17.0)
Economic index (tertile)			
1 (lowest)	189 (33.6)	255 (34.9)	444 (34.3)
2	183 (32.6)	234 (32.0)	417 (32.2)
3 (highest)	190 (33.8)	143 (33.2)	433 (33.5)
Education (years of schooling)			
0-8	242 (43.1)	299 (40.8)	514 (41.8)
9-11	177 (31.6)	220 (30.1)	397 (30.7)
12 or more	142 (25.3)	213 (29.1)	355 (27.5)
Current smoker			
No	447 (79.5)	616 (84.0)	1,063 (82.1)
Yes	115 (20.5)	117 (16.0)	232 (17.9)
Alcohol abuse			
No	454 (80.9)	686 (93.8)	1,140 (80.2)
Yes	107 (19.1)	45 (6.2)	152 (11.8)
Leisure-time physical activity			
Active	143 (25.6)	145 (19.9)	288 (22.3)
Inactive	416 (74.4)	585 (80.1)	1,001 (77.7)
Perceived stress (tertile)			
1 (lowest)	238 (42.4)	200 (27.3)	438 (33.8)
2	198 (35.2)	277 (37.8)	475 (36.7)
3 (highest)	126 (22.4)	256 (34.9)	382 (29.5)
Noncommunicable diseases*			
0	328 (59.4)	382 (53.0)	710 (55.8)
1	143 (25.9)	201 (27.9)	344 (27.0)
2 or more	81 (14.7)	138 (19.1)	219 (17.2)
Other mental disorder			
No	511 (90.9)	572 (78.0)	1,083 (83.6)
Yes	51 (9.1)	161 (22.0)	212 (16.4)
Depression (MDE)			
No	515 (91.6)	635 (86.6)	1,150 (88.8)
Yes	47 (8.4)	98 (13.4)	145 (11.2)
Total	562 (43.4)	733 (56.6)	1,295 (100.0)

Data presented as n (%).
MDE = major depressive episode.
* Variable with highest number of missing data points (n=1,273).

the prevalence of major depression shows high variance due to epidemiological issues inherent to depression and methodological differences between studies. A systematic review of the literature showed that period of analysis, sex, educational attainment, depression subtype, research instrument, age, and region explained 57.7% of the variance in reported prevalence of major depressive disorder.[1] In Brazil, a meta-analysis concluded that the overall mean prevalence of depressive symptomatology in the population was 14%.[17] We found a slightly lower prevalence in the general population, but the rate cited in the aforementioned meta-analysis was based on a review of several studies carried out in various regions of Brazil using different instruments, making comparison difficult. On the other hand, the prevalence found in our study was more than twice the 4.9% reported for a southern Brazilian sample using the same instrument (PHQ-9 algorithm).[6] Other studies in young-adult populations from the same region have also found a high prevalence of MDE[18,19]; however, ours was still higher. It has been shown that higher income at the individual and country levels is a protective factor for depression. However, our

Table 2 Crude and adjusted Poisson analysis of association between depression and independent variables among men and women

	Men (n=562)					Women (n=733)				
		Crude analysis		Adjusted analysis			Crude analysis		Adjusted analysis	
Variable	MDE (%)	PR (95%CI)	p	PR (95%CI)	p	MDE (%)	PR (95%CI)	p	PR (95%CI)	p
Age (years)			0.484		0.902			0.085		0.222
18-39	10.0	1		1		10.1	1		1	
40-59	7.2	0.72 (0.40-1.29)		0.87 (0.41-1.84)		16.0	1.59 (1.06-2.38)		1.26 (0.76-2.12)	
60 or older	7.4	0.74 (0.36-1.51)		0.98 (0.40-2.43)		14.4	1.42 (0.82-2.45)		0.86 (0.47-1.58)	
Marital status			0.117		0.152			0.065		0.209
Married	6.4	1		1		12.0	1		1	
Single	10.6	1.65 (0.94-2.88)		2.53 (0.88-2.67)		11.3	0.94 (0.57-1.57)		0.91 (0.56-1.49)	
Separated/widowed	5.4	0.83 (0.27-2.58)		0.74 (0.23-2.40)		19.5	1.63 (0.96-2.76)		1.38 (0.82. 2.31)	
Economic index (tertile)			0.045*		0.070*			< 0.001*		< 0.001*
1 (lowest)	10.1	2.12 (1.04-4.31)		2.00 (0.97-4.11)		21.2	3.43 (2.02-5.82)		2.61 (1.53-4.45)	
2	10.4	2.19 (1.12-4.30)		2.17 (1.09-4.32)		12.4	2.01 (1.13-3.56)		1.78 (1.00-3.12)	
3 (highest)	4.7	1		1		6.2	1		1	
Education (years of schooling)			0.224*		0.478*			< 0.001*		0.005*
0-8	9.9	1.56 (0.75-3.28)		1.32 (0.59-2.96)		19.4	3.18 (1.79-5.65)		2.25 (1.24-4.11)	
9-11	7.9	1.25 (0.54-2.87)		1.10 (0.48-2.53)		12.3	2.01 (1.09-3.72)		1.66 (0.91-3.02)	
12 or more	6.3	1		1		6.1	1		1	
Current smoker			0.135		0.457			0.008		0.101
No	7.6	1		1		11.8	1		1	
Yes	11.3	1.49 (0.88-2.51)		1.24 0(.70-2.19)		21.4	1.80 (1.17-2.77)		1.42 (0.93-2.16)	
Alcohol abuse			0.472		0.317			0.135		0.006
No	8.8	1		1		13.0	1		1	
Yes	6.5	0.74 (0.33-1.69)		0.66 (0.29-1.50)		20.0	1.54 (0.87-2.73)		1.91 (1.21-3.02)	
Leisure-time physical activity			0.030		0.029			0.003		0.013
Active	4.2	1		1		4.8	1		1	
Inactive	9.9	2.35 (1.09-5.08)		2.34 (1.09-5.00)		15.6	3.22 (1.52-6.84)		2.49 (1.22-5.09)	
Perceived stress (tertile)			< 0.001*		< 0.001*			< 0.001*		< 0.001*
1 (lowest)	1.3	1		1		2.0	1		1	
2	4.0	3.20 (0.81-12.60)		3.07 (0.76-12.39)		8.7	4.33 (1.51-12.39)		3.89 (1.39-10.92)	
3 (highest)	28.6	22.7 (6.94-73.98)		20.35 (5.92-70.0)		27.3	13.7 (5.07-36.84)		9.17 (3.47-24.23)	
Noncommunicable diseases			0.718*		0.979*			< 0.001*		
0	8.5	1		1		8.4	1		1	< 0.001*
1	7.0	0.82 (0.43-1.55)		0.84 (0.43-1.63)		15.9	1.90 (1.14-3.16)		1.39 (0.85-2.30)	
2 or more	11.1	1.30 (0.57-2.95)		1.07 (0.44-2.59)		22.5	2.68 (1.57-4.59)		1.85 (1.06-3.22)	
Mental disorders			0.024		0.335			< 0.001		0.001
No	7.6	1		1		10.1	1		1	
Yes	15.7	2.05 (1.10-3.82)		1.36 (0.72-2.55)		24.8	2.45 (1.71-3.51)		1.85 (1.32-2.59)	

95%CI = 95% confidence interval; MDE = major depressive episode; PR = prevalence ratio.
*p-value of tendency test.

sample is from one of the highest-income cities in the region, the higher prevalence of depression could be explained by greater social inequality, which is especially common in high-income cities in low- and middle-income countries.[20] Hence, this finding corroborates the high prevalence of depression in the Brazilian population, especially in the southern region.

In this sample, the prevalence of MDE was higher among women than among men. Even after adjusting for socioeconomic variables, we found that women were more likely to have a MDE than men. Moreover, we found that sex modified the effect of other variables over MDE, suggesting that the casual pathways for depression might be different for men and women in our sample. This sex difference in the occurrence of depression has been observed consistently in several other studies and reports.[1,2,5,6,17] The association between depression and female sex is apparently similar in high, medium, and low-income countries; in Brazil, Ukraine, and Italy, the odds of suffering from depression were almost three times higher for women than men.[5]

Review studies indicate that sex differences in occurrence of depression may be associated with biopsychosocial factors, such as hormonal differences between males and females (due to menarche, pregnancy, menopause, and contraceptive use), family environment, childhood stressors, and sociocultural factors.[21-23] Furthermore, sociocultural factors, such as the stress associated with traditional female roles, may contribute to the higher prevalence of depression among women.[21]

In addition, sociodemographic characteristics, such as education and economic index, were also associated with MDE only among women in our sample. In general, these associations appear to be constant across cultures[24]; however, whether they are different for men and women has not been well explored in the literature. Women are socioeconomically disadvantaged in relation to men, having lower educational attainment, fewer work opportunities, and lower individual income, especially in low- and middle-income countries. This places them in a situation of vulnerability and could make them more prone to several forms of victimization, including violence, discrimination, and submission to traditional female roles,[25] and thus more likely to experience depression.[26-28] Past research has highlighted some of these differences; for example, in a sample from the state of Bahia in northeast Brazil, women – but not men – from the lowest social class showed an increased risk of depression, and being a woman was not associated with depression in upper-middle socioeconomic strata.[28] However, further research on sex-specific pathways of depression is still needed.

Although men are more likely than women to abuse alcohol in Brazil,[29] we only found an independent association between depression and alcohol abuse among females. An analysis of data from the Brazilian Nationwide Survey on Alcohol Intake Patterns (Levantamento Nacional Sobre os Padrões de Consumo do Álcool) suggested that depression symptoms were 46% higher among individuals reporting alcohol dependence than their peers, and after adjustments, depression was only associated with excessive alcohol use in women,[30] corroborating our findings. This could be due to the fact that women use alcohol to deal with negative affect; furthermore, it is clear that some factors that are associated with depression in women are not thus associated in men.[31]

We should acknowledge that variables such as other mental disorders and NCDs might be associated with MDE only in women due to the different nature and burden they carry for this groups. The most common "other mental disorders" in women are essentially internalizing problems (e.g., anxiety), which are most likely to be associated with depression; in men, externalizing problems are more common and less likely to be associated with major depression.[32] In addition, a review study concluded that many cases of depression could be attributed to the stress caused by chronic illnesses.[33] On this basis, the direct association between major depression and number of NCDs found in our study might be due to the effects of NCD-related stress on depressive symptoms. A similar hypothesis could be applied to the observed association between MDE and other mental disorders.

Strong associations between MDE, leisure-time physical activity, and perceived stress with depression were found regardless of sex. The possibility of reverse causality notwithstanding (i.e., higher levels of physical activity might predict lower depressive symptoms), there is consistent evidence from randomized clinical trials that physical activity contributes to reducing the symptoms of depression and may have other long-term health benefits (e.g., reducing cognitive decline and preventing NCDs).[34-37]

In men, stress increased the risk of MDE in more than 20 times, whereas for women the effect size was less than half; even so, this is an important associated variable for both sexes. This may suggest that, for men, the burden of MDE is associated essentially with stress, while in women, this burden appears to be scattered among other various predictors. Therefore, the stress-attributable burden of depression in women is lower, and other variables, such as education and economic index, have an individually smaller but still important impact on the risk of MDE.

Potential limitations of this study include the fact that the nonrespondents were predominantly men, the failure to carry out clinical diagnostic interviews to confirm positive screening results, and reverse causality. Considering the higher nonresponse rate among men than among women, two scenarios were simulated to determine whether the observed sex difference in prevalence of MDEs would still have been found if 30 and 20% of these cases represented people with depression. A chi-square test was performed for each situation and indicated that sex differences in MDE prevalence would still have been observed if 30% ($p = 0.04$) or 20% ($p = 0.02$) of the nonresponding men and women had depression. Therefore, the disproportionate number of male nonresponders did not influence our results. The use of a screening scale to identify people with major depression may lead to misclassification of cases (both false positives and negatives). Diagnostic interviews are required to confirm the results of screening tests, but due to a lack of resources and because our study was part of a larger project, this was not feasible. Finally, in a limitation inherent to

cross-sectional studies, we cannot make inferences about causality in the relation between the outcome and modifiable variables. In addition, given the specific economic and social characteristics of the study setting, extrapolating our findings or assuming a similar point prevalence of MDE for other Brazilian or Latin American contexts could be inadequate.

The strengths of this study include the representative sample, a multivariable model which included modifiable factors, and the sex-stratified analysis, which revealed important sex interaction effects.

In conclusion, we have found a high prevalence of depression and sex differences in the epidemiology of the disorder. For this southern Brazilian population, and, probably, in other similar samples, the effect of stress and other risk factors were different for men and women. Presenting overall results would have masked or misrepresented some of the associations found in our study, as previously explained in this section. The observed effect modification by sex suggests that there are different causal pathways involved in the development of depression in men and women from southern Brazil. Most evidence in the literature has already shown that social factors, such as socioeconomic indicators, alcohol abuse, physical activity, stress, and other NCDs or mental disorders, are associated with depression; however, most of these have not been sex-stratified in analyses or even tested for a possible interaction by sex.[1,5,6,17,29,34-36,38,39] If the roots of depression are as different by sex as they appear to be, so might our ways of preventing and treating it. This phenomenon is not necessarily discussed in the literature, and might be of great importance.

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Disclosure

The authors report no conflicts of interest.

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