



ELSEVIER

Contents lists available at ScienceDirect

Journal of Affective Disorders

journal homepage: www.elsevier.com/locate/jad

Research report

Major depressive episode among Brazilian adults: A cross-sectional population-based study



Tiago N. Munhoz*, Iná S. Santos, Alicia Matijasevich

Postgraduate Program in Epidemiology, Federal University of Pelotas, Pelotas, Brazil

ARTICLE INFO

Article history:

Received 5 February 2013

Accepted 19 April 2013

Available online 18 May 2013

Keywords:

Depression

Adult

Mental health

Epidemiology

Depressive disorder

Cross-sectional studies

ABSTRACT

Background: Despite the fact that there is extensive scientific research on depression very few population-based studies have been conducted in Brazilian cities.

Methods: A sampling design of two-stage conglomerates with probability proportional to size. All adults aged 20 or more living in the selected households were invited to participate in the study. Depression was assessed using the Patient Health Questionnaire-9 (PHQ-9) with a cutoff ≥ 9 .

Results: The study sample comprised 2925 respondents. The prevalence of depression in the sample studied was 20.4% (95% CI 18.9;21.8). After adjustment for confounding factors according to a conceptual analysis model the following variables were associated with a higher prevalence of depression: female gender; younger age; white skin color; lower socioeconomic condition; lower education; smoking; being single or separated; being unemployed; and reporting a heart condition. Alcohol use, arterial hypertension, and diabetes mellitus were not found to be associated with depression.

Limitations: The difference in the proportion of males among losses and refusals compared to that in the sample analyzed. Another limitation is reverse causality bias that is a problem inherent to cross-sectional studies.

Conclusions: Our findings support the relevance of depression as a prevalent condition among adults. It also provided evidence of the factors associated with depression, and that some are potentially modifiable risk factors may have implications for policy and health service planning.

© 2013 Elsevier B.V. All rights reserved.

1. Introduction

Depression is a common mental disorder affecting people's mental health worldwide (Andrade et al., 2003; Bromet et al., 2011; Ferrari et al., 2013). A study conducted in 18 low-, middle-, and high-income countries found that the prevalence of a major depressive episode (MDE) for 1-month recall period ranged from 2.2% (95% CI 1.4;3.0) in Japan to 10.4% (95% CI 9.2;11.6) in Brazil (Bromet et al., 2011). Population-based studies in Brazil showed a prevalence of depression in adults ranging between 7.5 (95% CI 5.9;9.1) (Vorcaro et al., 2001) and 16.2% (95% CI 14.3%;18.2%) (Boing et al., 2012). In low- and middle-income countries a significant economic and social burden is placed on families due to lack of or inadequate mental health services; and these families usually experience prejudice and stigmatization (Sartorius, 2007). The World Health Organization (WHO) Atlas Project reported

long-term systematic failure to allocate resources for mental health research, policy and care services especially in low- and middle-income countries (World Health Organization., 2011). Although provision of mental health services increased in Brazil in recent years there is no effective integration between primary care and specialized mental health services (Mateus et al., 2008). The purpose of our study was to contribute to the understanding of social determinants of depression with input for the implementation of public mental health policies at different levels of healthcare. The present study aimed to assess the prevalence of depression and to describe demographic, socioeconomic and behavioral factors associated in adult.

2. Methods

A population-based cross-sectional study was conducted in the urban area of Pelotas, state of Rio Grande do Sul, southern Brazil, between February and June 2012. Pelotas is a city with approximately 328,000 inhabitants according to the 2010 Population Census. Its population is predominantly urban (93.3%).

The sample size for the study of prevalence was calculated considering a 5% alpha error and a design effect of 2. The sample

* Correspondence to: Centro de Pesquisas Epidemiológicas—Universidade Federal de Pelotas, Rua Marechal Deodoro, CEP: 96020-220-Caixa, Postal 464, 1160, Pelotas, RS, Brasil. Tel./fax: +55 53 3284 1300.

E-mail addresses: tyagomunhoz@hotmail.com, tmunhoz@gmail.com (T.N. Munhoz), inasantos@uol.com.br (I.S. Santos), amatija@yahoo.com (A. Matijasevich).

size required given a prevalence of depression of 7.5% in the study population (Vorcaro et al., 2001), an accepted error of 2 percentage points and an additional 10% for losses was 1464 adults. For the study of association considering a power of 80%, a relative risk equal to or greater than 2, a prevalence of 4.4% among the unexposed (socioeconomic condition), a three-to-seven ratio of unexposed to exposed and an additional 10–20% for controlling for confounding factors, the largest sample size needed was 3498 individuals.

A sampling design of two-stage conglomerates with probability proportional to size was used. According to the 2010 Population Census there were 130 primary sampling units. The secondary sampling units were households. All private households with permanent residents as of December 2011 in the census tracts selected were listed. They were then randomly selected by applying probability proportional to size. All individuals aged 20 years or more living in the selected households were invited to participate in this study. Individuals who had cognitive or mental disabilities confirmed by the fieldwork supervisor as well as those institutionalized (hospitals, elderly homes, among others) were excluded.

The following demographic information was collected: gender (male/female); age (20–29, 30–39, 40–49, 50–59, 60–69, 70 or more years); self-reported skin color (White, Black, and other); marital status (married or living with a partner, single or no partner, separated or widowed). Socioeconomic variables included education (0–4, 5–8, 9–11, 12 or more years of schooling); the Brazilian National Economic Index (IEN); and employment status (employed, unemployed). The IEN is a family well-being indicator constructed based on principal components analysis of the ownership of domestic goods (TV set, car, radio, refrigerator, freezer, VCR, washing machine, microwave, telephone line, computer and air conditioner), household characteristics (number of bedrooms and bathrooms), and education of the head of the household. For analyses, the first principal component was used (Barros and Victora, 2005).

As for employment status respondents were considered employed when they reported being employed, self-employed or employers. Information on smoking and self-reported alcohol use was also collected. Smokers were those who reported having smoked at least one cigarette in the prior month (smoking was categorized as never smoked, former smoker and current smoker). Alcohol use (yes/no) was defined as the consumption of any alcoholic beverage in the prior month. Self-rated health (excellent, very good, good, fair, and poor) and reported chronic conditions (yes/no) were also studied.

To assess depression the Patient Health Questionnaire-9 (PHQ-9) was used (Kroenke et al., 2001). This instrument assesses major depressive episodes characterized by 9 symptoms that last 2 weeks or more according to the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) (American Psychiatric Association., 2000). Briefly, the nine symptoms are: depressed mood, anhedonia (loss of interest or pleasure in activities once enjoyed), sleep problems, fatigue or lack of energy, change in appetite or weight, feelings of guilt or worthlessness, reduced ability to concentrate, motor agitation or retardation and suicidal thoughts. The questionnaire also includes an additional question to assess the impact of these symptoms on daily activities (e.g., at work, school). But this variable was not taken into consideration in the assessment of the prevalence of depression. The term depression is used as a synonym for MDE here. The epidemiological and clinical validity of the PHQ-9 was confirmed in studies in many countries. It has been validated in the Brazilian population, and a cutoff ≥ 9 showed the highest sensitivity (77.5%, 95% CI 61.5; 89.2) and specificity (86.7%, 95% 83.0; 89.9) for detecting individuals with MDE. In addition to assessing the crude prevalence, i.e., based on the PHQ-9 cutoff, this

prevalence was corrected for the test's sensitivity and specificity according to the Rogan–Gladen formula: $[CP = (OP + Sp - 1) / (Se + Sp - 1)]$, where CP=corrected prevalence; OP=observed prevalence; Sp=test specificity; and Se=test sensitivity (Rogan and Gladen, 1978).

Trained interviewers visited the selected households to collect data. The study instrument was electronically programmed in Pendragon 6.1 (Pendragon® Software Corporation for Windows, see: <http://pendragonsoftware.com/formsviinfo/index.html>). Notebooks were used for data collection which allowed entry of information directly in the data server and a check for inconsistencies. To determine repeatability of the data collected, 10% of interviews in each randomly selected census tract were repeated by the fieldwork supervisor through a short questionnaire. The Kappa coefficient for the variable tested (consultation with a psychologist or psychiatrist) was 0.75.

Data analysis was performed with the use of Stata/IC® 12.1 for Windows. First, a descriptive analysis of the variables collected was carried out. Taking into account the sampling design, the *svyset* command was used to correct the estimates of intracluster correlation variation. Crude and adjusted analyses were performed using Poisson regression and the *svy* prefix. The results were expressed as prevalence ratios (Barros and Hirakata, 2003).

The adjusted analysis used a previously constructed conceptual model (Victora et al., 1997) (Fig. 1) with three hierarchical levels of depression. The first hierarchical level included demographic and socioeconomic characteristics; the second included behavioral variables; and the third reported chronic conditions and self-rated health. This analysis takes into account the effect of each variable in relation to the outcome of depression controlling for confounding variables at the same level and in upper levels. The adjusted analysis included only those variables with a *p*-value < 0.20 at each level.

Ethical approval was granted by the Research Ethics Committee of the Universidade Federal de Pelotas School of Medicine (protocol 77/2011). All respondents signed a consent form prior to data collection. Individuals who were at risk of suicide or had severe symptoms of depression were home visited by mental health providers or were referred to care services.

3. Results

Of 3379 eligible adults, 2925 were interviewed. The refusal and loss rate was 13.4%. There was a higher proportion of males ($p < 0.001$) among losses and refusals but their age was similar to the study sample (45.7 [s.d.=16.6] in the sample and 45.8

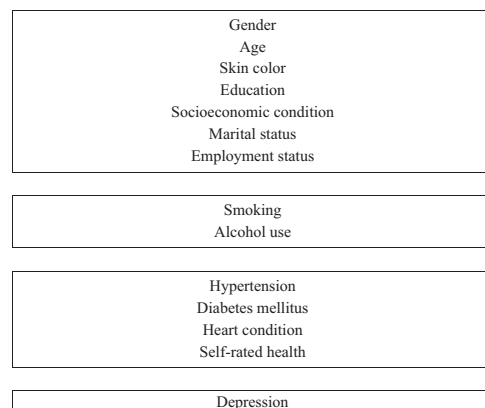


Fig. 1. Conceptual model for the analysis.

Table 1
Sample demographic, socioeconomic and behavioral information.

Variables	Frequency n (%)
Gender	
Male	1.202 (41.1)
Female	1.723 (58.9)
Age (years)	
20–29	612 (20.9)
30–39	540 (18.5)
40–49	594 (20.3)
50–59	514 (17.6)
60–69	385 (13.2)
70 and more	280 (9.6)
Skin color	
White	2.343 (80.1)
Black	354 (12.1)
Other	227 (7.8)
Education (years of schooling)	
0–4	526 (18.0)
5–8	817 (27.9)
9–11	819 (28.0)
≥12	762 (26.1)
Socioeconomic condition (IEN)^a	
1 (lower)	727 (25.0)
2	728 (25.1)
3	727 (25.0)
4 (upper)	723 (24.9)
Marital status	
Married or living with a partner	1.734 (59.4)
Single or no partner	714 (24.4)
Separated	232 (7.9)
Widowed	241 (8.3)
Employment status	
Employed	1.692 (57.9)
Unemployed	1.233 (42.1)
Smoking	
Never smoked	1.695 (57.9)
Former smoker	623 (21.3)
Current smoker	607 (20.8)
Alcohol use	
No	1.690 (57.8)
Yes	1.235 (42.2)
Self-rated health	
Excellent	388 (13.3)
Very good	515 (17.6)
Good	1.229 (42.0)
Fair	658 (22.5)
Poor	135 (4.6)
Arterial hypertension	
No	1.967 (67.3)
Yes	957 (32.7)
Diabetes mellitus	
No	2.695 (92.1)
Yes	230 (7.9)
Heart condition	
No	2.589 (88.5)
Yes	336 (11.5)

^a IEN: Brazilian National Economic Index. Maximum of 22 missing values.

[s.d. = 17.4] among losses and refusals, $p = 0.095$). The prevalence of depression using a cutoff ≥ 9 in the PHQ-9 was 20.4% (95% CI 18.9;21.8) and the prevalence corrected for the test sensitivity and specificity was 11.0% (95% CI 9.9;12.2).

Table 1 shows the characteristics of the study population. Regarding demographic variables, 58.9% of the respondents were female, 39.4% were 20–39 years old, 80.1% self-reported their skin color as White, and 59.4% were married or living with a partner. As for socioeconomic variables, 45.9% had complete middle education (up to 8 years of schooling) and 57.9% were employed. Regarding behavioral variables, 20.7% were smokers and 42.2% reported alcohol consumption in the month preceding the interview. Hypertension was the most frequently reported chronic condition

(32.7%), followed by heart disease (11.5%), and diabetes mellitus (7.9%).

Table 2 shows the crude and adjusted analyses. First, a crude analysis was performed to estimate prevalence rates and confidence intervals for the association between exposure variables and the outcome. In this analysis, only age was not significantly associated with depression. In the adjusted analysis using a hierarchical conceptual model the variables associated with depression were gender, age, skin color, education, socioeconomic condition, marital status, employment status, smoking, self-rated health and heart condition.

The prevalence of depression was twice as high in females as in males (PR=2.26, 95% CI 1.87; 2.73). Less educated respondents, those with lower socioeconomic condition, who were not employed and were smokers had the highest prevalence of depression. Less educated respondents (0–4 years of schooling) showed a 125% higher rate of depression than more educated ones (≥ 12 years). Individuals with higher socioeconomic condition (4th quartile) had a 13% lower rate of depression than those with lower socioeconomic condition (1st quartile). The adjusted analysis showed an inverse relationship between age and depression: the prevalence of depression decreased with age. Respondents who were single or did not have a partner (PR=1.20, 95% CI 1.01; 1.42) and those who were separated (PR=1.32, 95% CI 1.04;1.67) had higher prevalence of depression compared to those married or living with a partner. Respondents who self-reported being Black-skinned showed lower prevalence of depression compared to those White-skinned (PR=0.72, 95% CI 0.56;0.94). Smokers and those who rated their health status as fair or poor had higher prevalence of depression than those who never smoked or who rated their health as excellent. Those who reported a heart condition had a higher prevalence of depression compared to those who did not report it (PR=1.25, 95% CI 1.03;1.53). Alcohol use, self-reported arterial hypertension and diabetes were not associated with depression in our population.

4. Discussion

One of the strengths of the present study lies in its population-based design and use of household interviews. Despite the fact that there is extensive scientific research on depression in Brazil we were able to find only four population-based studies conducted in Brazilian cities (Boing et al., 2012; Bromet et al., 2011; Lopez et al., 2011; Vorcaro et al., 2001). It is noteworthy that the 9-item depression scale of the depression screening tool administered in this study was developed based on internationally accepted criteria (DSM-IV) and have been used in several different countries (Manea et al., 2012) and validated in the Brazilian population. It should also be noted the low proportion of both non-respondents (13.4%) for a population-based study with household interviews and missing information for most variables studied ($< 1\%$). Another strength of this study was the adjusted (multivariate) analysis, which is not usually performed in other population-based studies in Brazil and can affect the magnitude and/or direction of association measures.

A source of weakness in this study is the difference in the proportion of males among losses and refusals compared to that in the sample analyzed (56.4% vs. 41.1%, $p < 0.001$, respectively). This may have affected the results by underestimating the prevalence of depression in our sample since depression is less prevalent in men than women. Taking into account the number of depression cases in the sample and by applying it proportionately to all eligible individuals (1459 males and 1920 females), the prevalence of depression using the PHQ-9 would be 17.4% (95% CI 16.0;18.7) and the corrected prevalence would be 6.3% (95% CI 5.5;7.2).

Table 2
Crude and adjusted analysis.

Variables	Crude analysis		Adjusted analysis	
	PR (95% CI)	p-value	PR (95% CI)	p-value ^b
Level 1				
Gender		<i>p</i> < 0.001		<i>p</i> < 0.001
Male	1		1	
Female	2.38 (1.99–2.85)		2.26 (1.87–2.73)	
Age (years)		<i>p</i> = 0.422		<i>p</i> = 0.004
20–29	1		1	
30–39	1.00 (0.81–1.23)		0.99 (0.81–1.22)	
40–49	0.86 (0.70–1.07)		0.78 (0.62–0.99)	
50–59	0.89 (0.71–1.11)		0.74 (0.58–0.94)	
60–69	1.01 (0.76–1.35)		0.69 (0.51–0.94)	
70 and more	1.13 (0.87–1.48)		0.62 (0.47–0.82)	
Skin color		<i>p</i> = 0.017		<i>p</i> = 0.017
White	1		1	
Black	0.85 (0.65–1.11)		0.72 (0.56–0.94)	
Other	1.33 (1.05–1.69)		1.12 (0.89–1.41)	
Education (years of schooling)		<i>p</i> < 0.001		<i>p</i> < 0.001
0–4	2.23 (1.80–2.77)		2.25 (1.66–3.06)	
5–8	1.59 (1.29–1.95)		1.73 (1.33–2.25)	
9–11	1.53 (1.24–1.89)		1.59 (1.26–2.01)	
≥12	1		1	
Socioeconomic condition (IEN)^a		<i>p</i> < 0.001		<i>p</i> = 0.029
1 (lower)	1		1	
2	0.76 (0.64–0.91)		0.86 (0.72–1.04)	
3	0.57 (0.46–0.69)		0.73 (0.59–0.90)	
4 (upper)	0.55 (0.45–0.68)		0.87 (0.65–1.15)	
Marital status		<i>p</i> = 0.001		<i>p</i> = 0.042
Married or living with a partner	1		1	
Single or no partner	1.20 (1.02–1.42)		1.20 (1.01–1.42)	
Separated	1.46 (1.14–1.86)		1.32 (1.04–1.67)	
Widowed	1.52 (1.18–1.95)		1.06 (0.81–1.39)	
Employment status		<i>p</i> < 0.001		<i>p</i> < 0.001
Employed	1.65 (1.40–1.94)		1.36 (1.14–1.62)	
Unemployed	1		1	
Level 2				
Smoking		<i>p</i> < 0.001		<i>p</i> < 0.001
Never smoked	1		1	
Former smoker	1.08 (0.88–1.31)		1.17 (0.96–1.43)	
Current smoker	1.59 (1.36–1.86)		1.50 (1.28–1.75)	
Alcohol use		<i>p</i> = 0.017		<i>p</i> = 0.837
No	1		1	
Yes	0.82 (0.70–0.97)		1.02 (0.86–1.21)	
Level 3				
Self-rated health		<i>p</i> < 0.001		<i>p</i> < 0.001
Excellent	1		1	
Very good	1.29 (0.82–2.04)		1.30 (0.83–2.02)	
Good	2.15 (1.51–3.06)		2.12 (1.49–3.03)	
Fair	4.97 (3.41–7.24)		4.75 (3.24–6.96)	
Poor	9.55 (6.57–13.88)		8.73 (5.86–13.02)	
Arterial hypertension		<i>p</i> < 0.001		<i>p</i> = 0.819
No	1		1	
Yes	1.41 (1.21–1.64)		1.02 (0.85–1.22)	
Diabetes mellitus		<i>p</i> < 0.001		<i>p</i> = 0.124
No	1		1	
Yes	1.64 (1.32–2.02)		1.18 (0.96–1.46)	
Heart condition		<i>p</i> < 0.001		<i>p</i> = 0.038
No	1		1	
Yes	1.88 (1.54–2.30)		1.25 (1.03–1.53)	

^a IEN: Brazilian National Economic Index. Maximum of 22 missing values.

^b Wald test for heterogeneity.

Another limitation is reverse causality bias that is a problem inherent to cross-sectional studies. A cross-sectional design does not allow to establishing a temporal relationship between some exposures and the outcome, e.g., in the association between variables such as smoking, employment, and marital status and depression.

The prevalence of depression found in our study is higher than that reported in other Brazilian studies. Studies in the city of São

Paulo (Bromet et al., 2011) and Bambuí, Minas Gerais (Vorcaro et al., 2001), included individuals aged 18 or more and used the Composite International Diagnostic Interview (CIDI). The prevalence of MDE for 1-month recall period was 4.7% (95% CI 4.0;5.4) and 7.5% (95% CI 7.4;10.8) in São Paulo and Bambuí, respectively. Another study conducted in the city of Florianópolis, Santa Catarina, with individuals aged 20–59 years asked a question (“Have you ever been told by a doctor or a health provider that

you have depression?”) to identify those who had ever been diagnosed with depression. It was found a prevalence of 16.2% (95% CI 14.3%;18.2%) (Boing et al., 2012). Finally, a study conducted in the city of Pelotas assessed the prevalence of depression among young people aged 18–24 years using the Mini-International Neuropsychiatric Interview (MINI). The authors did not mention either the depressive disorder assessed or the recall period but they reported a prevalence of depression of 12.6% (95% CI 11.0;14.2) (Lopez et al., 2011). The difference between the prevalence of depression found in our study and those reported in other Brazilian studies could be explained by different methodology used to assessed depression. Unfortunately, it was not possible to locate population-based studies that assessed MDE using the PHQ-9 in the Brazilian population.

The PHQ-9 is an instrument that has been used in population-based studies in other countries. In Australia (Pirkis et al., 2009) a sample of 22,251 elderly aged 60 or more was studied using a cutoff ≥ 10 . In Germany (Martin et al., 2006) a sample of 2066 individuals older than 14 was evaluated using the PHQ-9 algorithm. In China (Yu et al., 2012) a sample of 6028 individuals aged 15 years and more was investigated using a cutoff ≥ 5 . In these studies the prevalence of depression was 8.2%, 9.2%, and 17.9%, respectively. However, the age groups studied, response rates, and diagnostic criteria for depression were different from the present study, which together with social and cultural characteristics could explain different prevalence rates between studies.

The results of the present study indicated higher prevalence of depression among women, which is corroborated by other studies worldwide (Andrade et al., 2003; Bromet et al., 2011). A systematic review of 116 prevalence studies and 4 incidence studies have consistently reported this association (Ferrari et al., 2013), though its causal explanations are not yet clear. Piccinelli et al. (Piccinelli and Wilkinson, 2000), in a critical review of the difference in prevalence of depression between men and women, listed a set of explanatory factors. Two of them are here highlighted: family environment and childhood experiences can produce patterns of psychic response to stressors that may affect most females; and women have higher risk of depressive episodes at an early age, which is a major predictor of future depressive episodes.

A number of studies have reported an inverse association between socioeconomic condition and depression (Lorant et al., 2003). The present study found that less educated individuals and those of lower socioeconomic condition had a higher prevalence of depression compared with those more educated and those of higher socioeconomic condition after adjusting for potential confounders. International studies including the WHO World Mental Health Surveys (WMH) (Bromet et al., 2011) with population-based samples from Africa, the Americas, Asia, Oceania, Europe and the Middle East, and the International Consortium in Psychiatric Epidemiology (ICPE) (Andrade et al., 2003) with samples from Brazil, Canada, Chile, Czech Republic, Germany, Japan, Mexico, Netherlands, Turkey and the US found this same association between socioeconomic condition and depression in many countries. They also showed that the onset of mental disorders including depression was earlier in individuals of lower socioeconomic condition (Kawakami et al., 2012). Lorant et al. (2003) conducted a meta-analysis including 56 studies to examine the association between socioeconomic condition and depression and found higher prevalence of depression among population groups of lower socioeconomic condition. A study conducted in the city of Pelotas with 4297 participants from the 1982 Pelotas Birth Cohort (Anselmi et al., 2008) found a higher prevalence of common mental disorders (Self-Reporting Questionnaire, SRQ-20) at the age of 23 among those less educated of lower socioeconomic condition. A study conducted in the USA assessed the relationship between socioeconomic factors and non-adherence to antidepressant treatment with 1652 adults 18–64 years of age and found lower adherence to

psychoactive drug treatment for depression among those with the lowest socioeconomic condition and from minority groups (Jeon-Slaughter, 2012). A study in the city of Pelotas on the use of antidepressants that included 1327 adults younger than 40 found lower drug use among those with lower socioeconomic condition (Garcias et al., 2008). There is a growing body of evidence that individuals of lower socioeconomic condition have higher prevalence of depression and lower psychoactive drug use, which would suggest these population groups are at a disadvantage in the treatment of depression. This evidence along with limited access to care services within the Brazilian national health system (Paim et al., 2011) can plausibly explain the finding of higher prevalence of depression among socially vulnerable populations.

Studies that investigated the association between skin color and depression have reported a higher prevalence of depression among Black-than White-skinned individuals (Anselmi et al., 2008; Santana et al., 2007). Our study showed a protective effect against depression among Black-skinned individuals: their rates of depression was around one-third of that seen among White-skinned individuals even after adjusting for gender, education, and socioeconomic condition. Similar findings were reported in three population-based US studies that assessed the association between skin color and depression. The Third National Health and Nutrition Examination Survey (NHANES III) (Riolo et al., 2005) assessed 8449 individuals aged 17–40 years and found that African Americans were 49% less likely to have a major depressive disorder (MDD) after adjusting for gender, income, marital status, education, and age. The National Epidemiological Survey on Alcohol and Related Conditions (NESARC) (Breslau et al., 2009) assessed 43,093 individuals older than 18 and found a 52% protective effect against MDD among African Americans compared to White-skinned individuals after adjustment for age and gender. The National Survey of American Life (NSAL) (Williams et al., 2007) investigated 6082 individuals older than 18 and found a lower prevalence of MDD among African Americans compared to White-skinned individuals (10.4% vs. 17.9%, $p < 0.001$). We did not find in the literature any consistent similar findings in other countries or explanations about why depression is less prevalent among Black-skinned individuals.

Brazilian population-based studies that examined the association between age and depression have reported inconsistent findings. Vorcaro et al. (2001) in a study in Minas Gerais, showed an increasing prevalence of depression with age. However, Bromet et al. (2011) in a study in São Paulo, reported a lower prevalence of depression among older individuals. In contrast, our study found a higher prevalence of depression among younger individuals. Other studies have found that the prevalence of depression decreases with increasing age. The WMH and ICPE reported that, in high-income countries, depression is more prevalent among younger people while in low- and middle-income countries the prevalence of depression tends to be higher among older people (Andrade et al., 2003; Bromet et al., 2011). Our findings are consistent with those reported in high-income countries.

The association between smoking and depression has been investigated using different study designs. Longitudinal studies allow the assessment of temporality and have offered the strongest evidence of the association between smoking and depression. It has shown that smoking precedes depression, depression precedes smoking, and there is a bidirectional relationship between smoking and depression (Munafò and Araya, 2010). A systematic review by Chaiton et al. (2009) included studies with longitudinal analyses to test the temporal sequence of the association between smoking and depression in adolescents aged 13–19 years, and they have ascertained a bidirectional relationship. Evidence suggest that smoking is a predictor of depression as tobacco may play a role in the dysregulation of the hypothalamic-pituitary-adrenal axis and in increasing cortisol action in the brain (Koob and Le

Moal, 2001). These are typical pathophysiological changes in depression, and thus smoking may increase susceptibility to the development of depressive disorders. On the other hand, the hypothesis supporting the evidence that depression precedes smoking is that smoking may act as a “self-medication” for depressed mood and fatigue, which are depression symptoms (Kendler et al., 1993; Vazquez-Palacios et al., 2005). Another explanation available in the literature is that nicotine may have antidepressant properties and have an action in serotonin neurotransmission that is similar to that of antidepressants (Balfour and Ridley, 2000; Vazquez-Palacios et al., 2005). This study found that smokers had a higher prevalence of depression but the direction of the association could not be ascertained.

5. Conclusions

This study found that nearly one in five adults in the city of Pelotas had depression. A higher prevalence of depression was seen among younger, White-skinned women, those less educated and with lower socioeconomic condition, single or separated, smokers, unemployed and who reported a heart condition. Alcohol use, arterial hypertension and diabetes mellitus were not found to be associated with depression. Our findings support the relevance of depression as a prevalent condition among adults. It also provided evidence of the factors associated with depression, and that some are potentially modifiable risk factors may have implications for policy and health service planning. Improved formal education and improved socioeconomic condition along with better education may reduce the prevalence of depression—one of the major chronic conditions nowadays according to the WHO (World Health Organization., 2009).

Role of funding source

The Post-graduate Program in Epidemiology Research Consortium of Federal University of Pelotas, Brazil, was funded by the Program for Academic Excellence (PROEX) from the Coordination for the Improvement of Higher Education Personnel (CAPES) within the Brazilian Ministry of Education.

Conflict of interest

We declare that we have no conflicts of interest.

Acknowledgments

None.

References

- American Psychiatric Association, 2000. Diagnostic Criteria From DSM-IV-TR. American Psychiatric Association, Washington, D.C.
- Andrade, L., Caraveo-Anduaga, J.J., Berglund, P., Bijl, R.V., De Graaf, R., Vollebergh, W., Dragomirecka, E., Kohn, R., Keller, M., Kessler, R.C., Kawakami, N., Kilic, C., Offord, D., Ustun, T.B., Wittchen, H.U., 2003. The epidemiology of major depressive episodes: results from the International Consortium of Psychiatric Epidemiology (ICPE) Surveys. *International Journal of Methods in Psychiatric Research* 12, 3–21.
- Anselmi, L., Barros, F.C., Minten, G.C., Gigante, D.P., Horta, B.L., Victora, C.G., 2008. Prevalência e determinantes precoces dos transtornos mentais comuns na coorte de nascimentos de 1982, Pelotas, RS. *Revista de Saúde Pública* 42, 26–33.
- Balfour, D.J., Ridley, D.L., 2000. The effects of nicotine on neural pathways implicated in depression: a factor in nicotine addiction? *Pharmacology, Biochemistry, and Behavior* 66, 79–85.
- Barros, A., Hirakata, V., 2003. Alternatives for logistic regression in cross-sectional studies: an empirical comparison of models that directly estimate the prevalence ratio. *BMC Medical Research Methodology* 3, 21.
- Barros, A.J.D., Victora, C.G., 2005. Indicador econômico para o Brasil baseado no censo demográfico de 2000. *Revista de Saúde Pública* 39, 523–529.
- Boing, A.F., Melo, G.R., Boing, A.C., Moretti-Pires, R.O., Peres, K.G., Peres, M.A., 2012. Associação entre depressão e doenças crônicas: um estudo populacional. *Revista de Saúde Pública* 46, 617–623.
- Breslau, J., Borges, G., Hagar, Y., Tancredi, D., Gilman, S., 2009. Immigration to the USA and risk for mood and anxiety disorders: variation by origin and age at immigration. *Psychological Medicine* 39, 1117–1127.
- Bromet, E., Andrade, L.H., Hwang, I., Sampson, N.A., Alonso, J., De Girolamo, G., De Graaf, R., Demeyttenaere, K., Hu, C., Iwata, N., Karam, A.N., Kaur, J., Kostyuchenko, S., Lepine, J.P., Levinson, D., Matschinger, H., Mora, M.E., Browne, M.O., Posada-Villa, J., Viana, M.C., Williams, D.R., Kessler, R.C., 2011. Cross-national epidemiology of DSM-IV major depressive episode. *BMC Medicine* 9, 90.
- Chaiton, M.O., Cohen, J.E., O’loughlin, J., Rehm, J., 2009. A systematic review of longitudinal studies on the association between depression and smoking in adolescents. *BMC Public Health* 9, 356.
- Ferrari, A.J., Somerville, A.J., Baxter, A.J., Norman, R., Patten, S.B., Vos, T., 2013. Global variation in the prevalence and incidence of major depressive disorder: a systematic review of the epidemiological literature. *Psychological Medicine* 43 (03), 471–481.
- Garcias, C.M.M., Pinheiro, R.T., Garcias, G.D.L., Horta, B.L., Brum, C.B., 2008. Prevalência e fatores associados ao uso de antidepressivos em adultos de área urbana de Pelotas, Rio Grande do Sul, Brasil, em 2006. *Cadernos de Saúde Pública* 24, 1565–1571.
- Jeon-Slaughter, H., 2012. Economic factors in of patients' nonadherence to antidepressant treatment. *Social Psychiatry and Psychiatric Epidemiology* 47, 1985–1998.
- Kawakami, N., Abdulghani, E.A., Alonso, J., Bromet, E.J., Bruffaerts, R., Caldas-De-Almeida, J.M., Chiu, W.T., De Girolamo, G., De Graaf, R., Fayyad, J., Ferry, F., Florescu, S., Gureje, O., Hu, C., Lakoma, M.D., Leblanc, W., LEE, S., Levinson, D., Malhotra, S., Matschinger, H., Medina-MORA, M.E., Nakamura, Y., Oakley Browne, M.A., Okoliyski, M., Posada-Villa, J., Sampson, N.A., Viana, M.C., Kessler, R.C., 2012. Early-life mental disorders and adult household income in the World Mental Health Surveys. *Biological Psychiatry* 72, 228–237.
- Kendler, K.S., Neale, M.C., Maclean, C.J., Heath, A.C., Eaves, L.J., Kessler, R.C., 1993. Smoking and major depression. A causal analysis. *Archives of General Psychiatry* 50, 36–43.
- Koob, G.F., Le Moal, M., 2001. Drug addiction, dysregulation of reward, and allostasis. *Neuropsychopharmacology* : Official Publication of the American College of Neuropsychopharmacology 24, 97–129.
- Kroenke, K., Spitzer, R.L., Williams, J.B., 2001. The PHQ-9: validity of a brief depression severity measure. *Journal of General Internal Medicine* 16, 606–613.
- Lopez, M.R.A., Ribeiro, J.P., Ores, L.D.C., Jansen, K., Souza, L.D.D.M., Pinheiro, R.T., Silva, R.A.D., 2011. Depressão e qualidade de vida em jovens de 18 a 24 anos no sul do Brasil. *Revista de Psiquiatria do Rio Grande do Sul* 33, 103–108.
- Lorant, V., Deliege, D., Eaton, W., Robert, A., Philippot, P., Anseau, M., 2003. Socioeconomic inequalities in depression: a meta-analysis. *American Journal of Epidemiology* 157, 98–112.
- Manea, L., Gilbody, S., Mcmillan, D., 2012. Optimal cut-off score for diagnosing depression with the Patient Health Questionnaire (PHQ-9): a meta-analysis. *CMAJ: Canadian Medical Association Journal=Journal de l'Association medicale canadienne* 184, E191–E196.
- Martin, A., Rief, W., Klaiberg, A., Braehler, E., 2006. Validity of the Brief Patient Health Questionnaire Mood Scale (PHQ-9) in the general population. *General Hospital Psychiatry* 28, 71–77.
- Mateus, M.D., Mari, J.J., Delgado, P.G., Almeida-Filho, N., Barrett, T., Gerolin, J., Gohman, S., Razzouk, D., Rodriguez, J., Weber, R., Andreoli, S.B., Saxena, S., 2008. The mental health system in Brazil: policies and future challenges. *International Journal of Mental Health Systems* 2, 12.
- Munafò, M.R., Araya, R., 2010. Cigarette smoking and depression: a question of causation. *British Journal of Psychiatry* 196, 425–426.
- Paim, J., Travassos, C., Almeida, C., Bahia, L., Macinko, J., 2011. The Brazilian health system: history, advances, and challenges. *Lancet* 377, 1778–1797.
- Piccinelli, M., Wilkinson, G., 2000. Gender differences in depression. *Critical review. British Journal of Psychiatry* 177, 486–492.
- Pirkis, J., Pfaff, J., Williamson, M., Tyson, O., Stocks, N., Goldney, R., Draper, B., Snowdon, J., Lautenschlager, N., Almeida, O.P., 2009. The community prevalence of depression in older Australians. *Journal of Affective Disorders* 115, 54–61.
- Riolo, S.A., Nguyen, T.A., Greden, J.F., King, C.A., 2005. Prevalence of depression by race/ethnicity: findings from the National Health and Nutrition Examination Survey III. *American Journal of Public Health* 95, 998–1000.
- Rogan, W.J., Gladen, B., 1978. Estimating prevalence from the results of a screening test. *American Journal of Epidemiology* 107, 71–76.
- Santana, V., Almeida-Filho, N., Roberts, R., Cooper, S.P., 2007. Skin colour, perception of racism and depression among adolescents in urban Brazil. *Child and Adolescent Mental Health* 12, 125–131.
- Sartorius, N., 2007. Stigma and mental health. *Lancet* 370, 810–811.
- Vazquez-Palacios, G., Bonilla-Jaime, H., Velazquez-Moctezuma, J., 2005. Antidepressant effects of nicotine and fluoxetine in an animal model of depression induced by neonatal treatment with clomipramine. *Progress in Neuro-psychopharmacology & Biological Psychiatry* 29, 39–46.
- Victora, C.G., Huttly, S.R., Fuchs, S.C., Olinto, M.T., 1997. The role of conceptual frameworks in epidemiological analysis: a hierarchical approach. *International Journal of Epidemiology* 26, 224–227.
- Vorcaro, C.M., Lima-Costa, M.F., Barreto, S.M., Uchoa, E., 2001. Unexpected high prevalence of 1-month depression in a small Brazilian community: the Bambuí Study. *Acta Psychiatrica Scandinavica* 104, 257–263.

- Williams, D.R., Gonzalez, H.M., Neighbors, H., Nesse, R., Abelson, J.M., Sweetman, J., Jackson, J.S., 2007. Prevalence and distribution of major depressive disorder in African Americans, Caribbean blacks, and non-Hispanic whites: results from the National Survey of American Life. *Archives of General Psychiatry* 64, 305–315.
- World Health Organization, 2009. *Global Health Risks: Mortality and Burden of Disease Attributable to Selected Major Risks*. World Health Organization, Geneva, Switzerland.
- World Health Organization, 2011. *Mental Health Atlas*. World Health Organization, Geneva.
- Yu, X., Tam, W.W., Wong, P.T., Lam, T.H., Stewart, S.M., 2012. The Patient Health Questionnaire-9 for measuring depressive symptoms among the general population in Hong Kong. *Comprehensive Psychiatry* 53, 95–102.