




# BMJ Open Prevalence of self-reported lifetime medical diagnosis of depression in Brazil: analysis of data from the 2019 Brazilian National Health Survey

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## ABSTRACT

**Objectives** To assess the prevalence of and factors associated with the lifetime medical diagnosis of depression in Brazil.

**Design** Population-based, cross-sectional study.

**Setting** Analysis of data from the 2019 Brazilian National Health Survey.

**Participants** 90 846 individuals aged ≥15 years were included.

**Outcome measure** The self-reported medical diagnosis of depression at some point in one's life was the main outcome. Prevalence ratios (PRs) with 95% CIs were calculated by Poisson regression with robust variance. The independent variables included the geographical area of residence, sociodemographic characteristics, current smoking status, alcohol abuse, daily screen time, and the presence of physical disorders and mental health comorbidities.

**Results** The self-reported lifetime prevalence of medical diagnosis of depression was 9.9% (95% CI 9.5% to 10.2%). The probability of having received a medical diagnosis of depression was higher among urban residents (PR 1.23; 95% CI 1.12 to 1.35); females (2.75; 2.52 to 2.99); those aged 20–29 years (1.17; 0.91 to 1.51), 30–39 years (1.73; 1.36 to 2.19), 40–49 years (2.30; 1.81 to 2.91), 50–59 years (2.32; 1.84 to 2.93) and 60–69 years (2.27; 1.78 to 2.90) compared with those under 20 years; white-skinned people (0.69 (0.61 to 0.78) for black-skinned people and 0.74 (0.69 to 0.80) for indigenous, yellow and brown-skinned people compared with white-skinned people); those with fewer years of education (1.33(1.12 to 1.58) among those with 9–11 years, 1.14 (0.96 to 1.34) among those with 1–8 years and 1.29 (1.11 to 1.50) among those with 0 years compared with those with ≥12 years of education); those who were separated/divorced (1.43; 1.29 to 1.59), widowed (1.06; 0.95 to 1.19) and single (1.01; 0.93 to 1.10) compared with married people; smokers (1.26; 1.14 to 1.38); heavy screen users (1.31; 1.16 to 1.48) compared with those whose usage was <6 hours/day; those with a medical diagnosis of a physical disorder (1.80; 1.67 to 1.97); and individuals with

## STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ The nationwide representativeness and the robustness of the methodology are major strengths of this study.
- ⇒ Due to the cross-sectional study design, causality and direction of causality, between variables cannot be established.
- ⇒ Issues regarding the training of health professionals to identify depressive symptoms were not explored in this study, which may have had an impact on the prevalence of the outcome.
- ⇒ The restriction of the sample to domiciled individuals may underestimate the prevalence of the outcome, since populations in situations of extreme vulnerability, including the homeless, the institutionalised, those deprived of liberty and hospitalised people, are at greater risk of being affected by mental health disorders.

a medical diagnosis of a mental health comorbidity (5.05; 4.68 to 5.46).

**Conclusion** This nationwide population-based study of self-reported lifetime medical diagnosis of depression in Brazil showed that the prevalence was almost 10%. Considering the current Brazilian population, this prevalence corresponds to more than 2 million people who have been diagnosed with depression at some point in their lives.

## INTRODUCTION

The lifetime prevalence and course of major depression differ across countries and regions. However, the high prevalence and persistence of depression globally reinforce the worldwide relevance of this condition. Depression is a heterogeneous condition with a variety of symptoms of presentation and is related to increased morbidity,

mortality and health costs. It is one of the main causes of years lived with disability (YLDs) worldwide and has an important impact on patients' and their families' quality of life.<sup>1-4</sup>

Different estimates show that this disorder may affect more than 300 million individuals or 4.4% of the world's population, and recent evidence suggests that its prevalence has increased in recent years. However, depression prevalence differs according to sociodemographic and regional factors. Females, older individuals and those with a lower socioeconomic status are more likely to develop major depression compared with males, younger subjects and those with a high socioeconomic status.<sup>1-4</sup>

Current data on the lifetime prevalence of depression diagnosis in the Brazilian population are scarce. However, results from the 2017 Global Burden of Disease Study, which included findings from 18 studies, showed that the prevalence of depressive disorders in Brazil was 3.30% (95% uncertainty interval (UI): 3.08% to 3.57%). Depressive disorders accounted for 1.239 million (95% UI: 878 911 to 1 689 498) YLDs in Brazil in 2017, with a rate of 543.96 per 100 000 people (95% UI: 386.79 to 740.75), accounting for 5% (95% UI: 4.04% to 6.09%) of all YLDs in the country.<sup>5</sup>

A nationwide population-based study of depression in Brazil, with data from the National Health Survey carried out in 2013 (PNS-2013), identified individuals at greater risk of depression through the use of the Patient Health Questionnaire-9. A total of 60 202 adults were evaluated and the prevalence of positive screening for depression was 4.1% (95% CI: 3.8% to 4.4%).<sup>6</sup> The depression prevalence rate was higher among women, individuals with lower educational levels, older people, those living in urban areas, smokers, and among those with arterial hypertension, diabetes, or heart disorders.<sup>6</sup> On the other hand, a nationwide study on the use of psychotropic drugs for the treatment of self-reported depression among the urban adult Brazilian population, conducted between 2013 and 2014, found a prevalence of self-reported depression of 6.1% (95% CI: 5.6% to 6.6%). The prevalence of depression increased with age and was greater among women and people with chronic multimorbidity (whereas as a single disease, the prevalence of depression was higher among young people).<sup>7</sup>

Recognising and identifying disease prevalence and key factors that determine health status are critical for effective national evidence-based policy.<sup>8</sup> Hence, the objective of this study was to assess the prevalence of and factors associated with the self-reported lifetime medical diagnosis of depression using data from the 2019 Brazilian National Health Survey (PNS-2019).

## METHODS

This cross-sectional study followed the STrengthening the Reporting of OBservational studies in Epidemiology<sup>9</sup> and Checklist for Reporting of Survey Studies statements.<sup>10</sup>

## Study population

This population-based cross-sectional study used data from the PNS-2019 carried out by the Brazilian Institute of Geography and Statistics and the Ministry of Health.<sup>11</sup> Data from the PNS-2019 were collected between August 2019 and March 2020, throughout the national territory, in all five macro-regions of the country, using a probability sample of households. The research sample was obtained from a master sample, using cluster sampling, in three stages. In the first stage, the stratification of the set of census sectors or set of sectors (primary sampling units (PSUs)) was carried out, based on the Integrated System of Household Surveys. In the second stage, a fixed number of private households (secondary units) were selected from the National Register of Addresses for Statistical Purposes. In the third stage, from the list of residents compiled at the time of the survey, one resident aged  $\geq 15$  years was drawn from each permanent private household included in the survey to answer the specific questionnaire (tertiary units). Each of the stages was carried out by simple random sampling. Further details on the study design and methodology can be found in another publication.<sup>12</sup> The interviews were conducted by trained fieldworkers, with the help of mobile data collection devices, programmed to 'jump' questionnaire items and to check the consistency of the variables. The current study was conducted with data from individuals aged  $\geq 15$  years, of both sexes, who answered the specific questionnaire.

The sample size of the PNS-2019 was calculated based on selected indicators of the PNS-2013 data. Of a total of 15 096 PSUs, 108 525 households were selected. More in-depth details on the sampling plan, data collection and weighting process can be found in other publications.<sup>11 12</sup> The total loss rate from non-response estimated at the planning phase of the study was 20% for common issues (general information given by a resident aged  $\geq 18$  years about all residents in the household in regard to level of schooling, occupation, household income, etc) and 27% for specific issues (block of questions aimed at one selected resident aged  $\geq 15$  years). However, losses from non-response in the study were lower than estimated. The total loss rate from non-response was 13.2% for common issues and 16.2% for specific issues.<sup>11 12</sup>

## Study outcome

The outcome of interest, the self-reported medical diagnosis of depression at some point in one's life, was defined by the answer to the question 'Has a doctor or mental health professional (such as a psychiatrist or psychologist) ever diagnosed you with depression?' The answer options were 'yes' and 'no'.

The independent variables included: macro-regions of the country (North, Northeast, South, Southeast or Central-West); geographical area of residence (urban or rural); sex (male or female); age group (15-19, 20-29, 30-39, 40-49, 50-59, 60-69, 70-79 or  $\geq 80$  years old); self-reported skin colour (white, black or others,



**Figure 1** Map of Brazil representing its five macro-regions (dark green: North; blue: Northeast; yellow: Central-West; orange: Southeast and light green: South) and its five major cities (São Paulo, Rio de Janeiro, Brasília, Salvador and Fortaleza).

which included indigenous, yellow and brown); years of schooling (0, 1–8, 9–11 or  $\geq 12$ ); marital status (married, single, widowed or separated/divorced); current smoking status, obtained through the question ‘Do you currently smoke any tobacco products?’, with the answer options ‘yes, daily’, ‘yes, less than daily’ and ‘I do not currently smoke’ (those who answered ‘yes, daily’ were considered as smokers); abusive alcohol consumption, defined as drinking five or more doses on a single occasion, at least once a month, in response to the question ‘In general, on the day you drink, how many doses of alcohol do you consume?’ (one dose of alcoholic beverage is equivalent to a can of beer, a glass of wine, or a shot of *cachaça*, whiskey, or any other distilled alcoholic beverage); screen time, obtained through the question ‘In a day, how many hours of your free time (excluding work) do you usually use a computer, tablet or cell phone for leisure, such as using social media, reading news, watching videos, playing games, etc?’, with the answer options ‘less than 1 hour’, ‘from 1 hour to less than 2 hours’, ‘from 2 hours to less than 3 hours’, ‘from 3 hours to less than 6 hours’, ‘6 hours or more’ and ‘I don’t usually use a computer, tablet or cell phone during my free time’ (heavy screen users in their leisure time were defined as those who answered ‘6 hours or more’); self-reported medical diagnosis of at least one of the following physical disorders: arterial hypertension, diabetes mellitus, heart disease (heart attack, angina, heart failure or other), stroke, asthma (or asthmatic bronchitis), chronic pulmonary disease (emphysema, chronic bronchitis or chronic obstructive pulmonary

disease), arthritis (or rheumatism), work-related musculoskeletal disorder, cancer or chronic kidney failure; and self-reported medical diagnosis of at least one of the following mental health comorbidities: anxiety disorder, panic disorder, schizophrenia, bipolar disorder, psychosis or obsessive compulsive disorder. These variables were selected based on evidence on factors associated with depression.<sup>4–6 13</sup>

### Statistical analysis

The data analysis was carried out using the Stata software, V.12.1 (Stata Corp, College Station, Texas, USA). All analyses were stratified according to the macro-region of the country and carried out using the `svyset` command, which takes into consideration sample weights.<sup>12</sup> Sample weights were defined for the PSUs, households and all residents, as well as for the selected resident. A descriptive analysis was initially carried out, calculating frequencies and their respective 95% CI for the entire country, followed by stratification for the Brazilian macro-regions. The adjusted analysis was performed using Poisson regression,<sup>14</sup> based on a hierarchical model composed of three levels.<sup>15</sup> Variables that presented a p value of 0.20 or less in each level were maintained in the adjusted model. Level one was composed of the geographical area of residence (urban or rural), demographic variables (sex, age, skin colour and marital status) and educational level. Level two included behavioural variables (current smoking status, alcohol use and screen time), and level three comprised the presence of any chronic physical or mental morbidity. The Wald test for heterogeneity and the linear trend test were used to assess associations. P values lower than 0.05 were considered statistically significant.

### Patient and public involvement

None.

## RESULTS

A total of 90 846 individuals were analysed. **Figure 1** contains a map of Brazil with its five macro-regions and the five most populous cities in the country. **Table 1** presents the sample distribution in Brazil and the macro-regions. In the country, the majority (85.9%) lived in urban areas, were female (52.9%), were between 20 and 59 years old (70.4%) and 42.9% self-declared as being of white skin colour. About one in five participants (19.8%) had  $\geq 12$  years of schooling and 5.8% had not received any formal education. The proportion of widowed and separated/divorced participants was 13.2%; 12.2% were current smokers; 4.4% presented abusive consumption of alcoholic beverages; and about 1 in 10 (9.9%) were heavy screen users ( $\geq 6$  hours/day). More than one-third (38.1%) and 6.6% of the respondents reported having a medical diagnosis of at least one physical disorder and of at least one mental health comorbidity, respectively.

As for the distribution of the sample in the macro-regions, the proportion of residents in urban areas was

**Table 1** Sample description of the Brazilian National Health Survey, 2019 (nationally and by region)

| Independent variables          | Regions of Brazil |      |        |      |           |      |           |      |        |      |              |      |
|--------------------------------|-------------------|------|--------|------|-----------|------|-----------|------|--------|------|--------------|------|
|                                | Brazil            |      | North  |      | Northeast |      | Southeast |      | South  |      | Central-West |      |
|                                | N                 | %    | N      | %    | N         | %    | N         | %    | N      | %    | N            | %    |
| Geographical area              |                   |      |        |      |           |      |           |      |        |      |              |      |
| Rural                          | 20 973            | 14.1 | 4840   | 22.4 | 9887      | 25.8 | 2641      | 6.3  | 2149   | 13.5 | 1456         | 9.2  |
| Urban                          | 69 873            | 85.9 | 12 762 | 77.6 | 21 657    | 74.2 | 17 189    | 93.7 | 9323   | 86.5 | 8942         | 90.8 |
| Sex                            |                   |      |        |      |           |      |           |      |        |      |              |      |
| Male                           | 42 799            | 47.1 | 8627   | 48.3 | 14 552    | 46.8 | 9235      | 46.7 | 5537   | 47.6 | 4848         | 47.4 |
| Female                         | 48 047            | 52.9 | 8975   | 51.7 | 16 992    | 53.2 | 10 595    | 53.3 | 5935   | 52.4 | 5550         | 52.6 |
| Age (years)                    |                   |      |        |      |           |      |           |      |        |      |              |      |
| 15–19                          | 4336              | 9.2  | 1196   | 12.2 | 1581      | 10.2 | 740       | 8.4  | 388    | 8.0  | 431          | 9.6  |
| 20–29                          | 13 373            | 17.2 | 3183   | 20.9 | 4712      | 18.0 | 2434      | 16.1 | 1408   | 15.7 | 1636         | 19.2 |
| 30–39                          | 18 150            | 19.8 | 3833   | 21.4 | 6432      | 20.2 | 3636      | 19.3 | 2185   | 20.0 | 2064         | 19.6 |
| 40–49                          | 16 602            | 17.2 | 3275   | 17.5 | 5757      | 17.0 | 3558      | 17.0 | 2011   | 17.0 | 2001         | 18.5 |
| 50–59                          | 15 657            | 16.2 | 2628   | 12.5 | 5326      | 15.1 | 3637      | 17.2 | 2173   | 17.3 | 1893         | 16.0 |
| 60–69                          | 12 555            | 11.5 | 2032   | 8.9  | 4104      | 10.5 | 3166      | 12.5 | 1850   | 12.7 | 1403         | 10.2 |
| 70–79                          | 7157              | 6.2  | 1045   | 4.7  | 2530      | 5.9  | 1845      | 6.6  | 1036   | 6.8  | 701          | 5.0  |
| ≥80                            | 3016              | 2.8  | 410    | 2.0  | 1102      | 3.1  | 814       | 2.9  | 421    | 2.6  | 269          | 1.9  |
| Skin colour                    |                   |      |        |      |           |      |           |      |        |      |              |      |
| White                          | 33 133            | 42.9 | 3338   | 18.5 | 8014      | 24.5 | 9296      | 50.3 | 8 670  | 72.3 | 3815         | 35.5 |
| Black                          | 10 345            | 11.4 | 1869   | 10.1 | 4136      | 14.5 | 2615      | 11.9 | 604    | 5.6  | 1121         | 10.3 |
| Others*                        | 47 358            | 45.7 | 12 394 | 71.5 | 19 390    | 61.0 | 7916      | 37.9 | 2197   | 22.1 | 5461         | 54.3 |
| Education (years of schooling) |                   |      |        |      |           |      |           |      |        |      |              |      |
| 0                              | 7658              | 5.8  | 1651   | 7.3  | 4230      | 11.5 | 800       | 3.2  | 401    | 2.9  | 576          | 5.2  |
| 1–8                            | 35 785            | 37.3 | 6643   | 38.7 | 13 266    | 40.5 | 7398      | 34.4 | 4727   | 40.3 | 3751         | 35.0 |
| 9–11                           | 29 824            | 37.1 | 6225   | 38.5 | 9792      | 34.3 | 6816      | 39.1 | 3558   | 35.5 | 3433         | 37.0 |
| ≥12                            | 17 579            | 19.8 | 3083   | 15.5 | 4256      | 13.6 | 4816      | 23.4 | 2786   | 21.3 | 2638         | 22.9 |
| Marital status                 |                   |      |        |      |           |      |           |      |        |      |              |      |
| Married                        | 35 144            | 41.5 | 5998   | 34.7 | 11 498    | 36.0 | 8650      | 45.5 | 5006   | 44.9 | 3992         | 39.0 |
| Single                         | 40 560            | 45.3 | 9456   | 56.8 | 15 254    | 52.7 | 7108      | 39.7 | 4172   | 40.8 | 4570         | 47.7 |
| Widowed                        | 7628              | 6.5  | 1062   | 4.4  | 2673      | 6.3  | 1985      | 6.9  | 1128   | 7.1  | 780          | 5.9  |
| Separated/divorced             | 7514              | 6.7  | 1086   | 4.1  | 2119      | 5.0  | 2087      | 7.9  | 1166   | 7.2  | 1056         | 7.5  |
| Currently smoking              |                   |      |        |      |           |      |           |      |        |      |              |      |
| No                             | 79 460            | 87.8 | 15 535 | 90.1 | 27 957    | 89.7 | 17 192    | 87.1 | 9766   | 85.6 | 9010         | 87.4 |
| Yes                            | 11 386            | 12.2 | 2067   | 9.9  | 3587      | 10.3 | 2638      | 12.9 | 1706   | 14.4 | 1388         | 12.6 |
| Alcohol abuse                  |                   |      |        |      |           |      |           |      |        |      |              |      |
| No                             | 86 801            | 95.6 | 16 864 | 95.6 | 30 133    | 95.5 | 19 088    | 96.0 | 10916  | 95.3 | 9800         | 94.6 |
| Yes                            | 4045              | 4.4  | 738    | 4.4  | 1411      | 4.5  | 742       | 4.0  | 556    | 4.7  | 598          | 5.4  |
| Screen time (hours)            |                   |      |        |      |           |      |           |      |        |      |              |      |
| <6                             | 83 679            | 90.1 | 16 110 | 90.4 | 29 089    | 90.0 | 18 099    | 89.8 | 10795  | 91.8 | 9586         | 88.9 |
| ≥6                             | 7167              | 9.9  | 1492   | 9.6  | 2455      | 10.0 | 1731      | 10.2 | 677    | 8.2  | 812          | 11.1 |
| Physical disorder              |                   |      |        |      |           |      |           |      |        |      |              |      |
| No                             | 54 660            | 61.9 | 11 769 | 70.4 | 19 394    | 65.4 | 10 855    | 58.8 | 6 295  | 58.6 | 6 347        | 64.6 |
| Yes                            | 36 186            | 38.1 | 5 833  | 29.6 | 12 150    | 34.6 | 8 975     | 41.2 | 5 177  | 41.1 | 4 051        | 35.4 |
| Mental health comorbidity      |                   |      |        |      |           |      |           |      |        |      |              |      |
| No                             | 85 941            | 93.6 | 17 139 | 97.6 | 29 960    | 94.7 | 18 420    | 92.7 | 10 664 | 92.4 | 9 758        | 93.5 |
| Yes                            | 4 905             | 6.4  | 463    | 2.4  | 1 584     | 5.3  | 1 410     | 7.3  | 808    | 7.6  | 640          | 6.5  |

\*Others (indigenous, yellow and brown).

lowest in the North (77.6%) and Northeast (74.2%), and highest in the Southeast (93.7%). In all macro-regions, most individuals were female. In the North region, the proportion of individuals under 40 years of age was higher (54.5%) than in the country overall. In the Southeast and South regions, the proportion of individuals who self-declared as white (50.3% and 72.3%, respectively) and with  $\geq 12$  years of schooling (23.4% and 21.3%, respectively) was higher than in the country overall. The absence of formal education was higher in the North (7.3%) and Northeast regions (11.5%) than in the remaining regions. The percentages of widowed (4.4%) and separated/divorced (4.1%) individuals were lower in the North region.

The proportion of current smokers was highest in the South (14.4%). The Central-West region had the largest proportion of individuals with abusive alcohol consumption (5.4%) and heavy screen users (11.1%). The lowest proportion of individuals who reported having a medical diagnosis of a physical disorder was in the North region (29.6%) and the highest proportions were in the Southeast (41.2%) and South regions (41.1%). The South region also had the highest proportion of individuals with a medical diagnosis of a mental health comorbidity (7.8%).

### Crude prevalence of self-reported medical diagnosis of depression

Table 2 contains the crude prevalence of self-reported medical diagnosis of depression, according to the independent variables, in Brazil and the macro-regions. In the country, the prevalence was 9.9% and the highest prevalence was found among individuals living in urban areas (10.3%); females (14.3%); those aged 40–49 (12.6%), 50–59 (12.9%) and 60–69 (13.0%) years old; self-declared white (12.1%); those with  $\geq 12$  years of schooling (12.0%); separated/divorced individuals (17.9%); current smokers (11.4%); those who did not engage in abusive alcohol consumption (10.6%); those who were not heavy screen users (9.9%); individuals with a medical diagnosis of a physical disorder (15.7%); and individuals with a medical diagnosis of any mental health comorbidity (48.6%).

The prevalence ranged from 4.8% in the North region to 14.8% in the South region. In the South region, the prevalence was higher among females, those aged  $\geq 30$  years old, widowed or separated/divorced individuals, those who did not engage in abusive alcohol consumption, and in individuals who reported a medical diagnosis of any physical disorder or any mental health comorbidity. On the contrary, the North and Northeast regions reported the lowest prevalence, regardless of the characteristics analysed.

The association of self-reported lifelong medical diagnosis of depression with sex (female), separated/divorced individuals, no abusive alcohol consumption and self-reported medical diagnosis of a mental health comorbidity was consistently higher in all regions of the country.

### Adjusted prevalence ratios for self-reported medical diagnosis of depression, nationally and by region

The results of the adjusted analyses are shown in table 3. In the country overall, the probability of having received a medical diagnosis of depression was higher among urban residents (23% higher than among rural residents), females (175% higher than in males), those aged between 40 and 69 years old (about 2.3 times higher than among those under 20 years), white-skinned individuals (about 30% higher than in black, indigenous, yellow and brown people), those with less education (33%, 14% and 29% higher, respectively, among those with 9–11, 1–8 and 0 years of schooling, compared with those with  $\geq 12$  years of schooling), separated/divorced individuals (43% more prevalent than among married people), current smokers (26% higher than in non-smokers), heavy screen users (31% more than among those whose usage was  $< 6$  hours/day), in individuals who reported any medical diagnosis of physical disorders (80% higher than among those without physical disorders), and five times higher in participants who reported any mental health comorbidity than in those without a mental health comorbidity (prevalence ratio (PR)=5.05; 95% CI: 4.68 to 5.46).

In comparison with those living in rural areas, the probability of urban residents having received a medical diagnosis of depression was 33% higher in the Central-West region, followed by 32% higher in the North and 27% higher in the Northeast region. In the Southeast region, black, indigenous, yellow and brown skin-coloured individuals, and black individuals in the Central-West region, had a lower probability of receiving a medical diagnosis of depression than white-coloured individuals. In the Southeast, South and Central-West regions, the probability of separated/divorced individuals having received a medical diagnosis of depression was, respectively, 46%, 37% and 68% higher than for married individuals. In comparison with non-smokers, the smokers living in the Northeast, South and Central-West regions were more likely to have received a medical diagnosis of depression. Except in the Southeast, in all other regions, heavy screen users had a higher probability of having received a medical diagnosis of depression than their counterparts.

The characteristics most strongly associated with the outcome were a self-reported medical diagnosis of any mental health comorbidity, which had an adjusted PR about four times higher than in those without a mental health comorbidity, in all macro-regions (in the North region, the association was even stronger); followed by being female (two or more times higher than in men), a self-reported medical diagnosis of any physical disorder (1.67–2.46 times higher in all macro-regions) and age (more than twice as high in individuals aged 40–69 years old compared with the youngest).

### DISCUSSION

To the best of our knowledge, this is one of the largest studies focused on describing the lifetime prevalence



**Table 2** Crude prevalence of self-reported medical diagnosis of depression, with 95% CI, according to independent variables, nationally and by region

| Independent variables          | Regions of Brazil |      |              |     |     |            |      |     |             |      |      |              |      |      |              |      |      |              |
|--------------------------------|-------------------|------|--------------|-----|-----|------------|------|-----|-------------|------|------|--------------|------|------|--------------|------|------|--------------|
|                                | Brazil            |      | North        |     |     | Northeast  |      |     | Southeast   |      |      | South        |      |      | Central-West |      |      |              |
|                                | N                 | %    | 95% CI       | N   | %   | 95% CI     | N    | %   | 95% CI      | N    | %    | 95% CI       | N    | %    | 95% CI       | N    | %    | 95% CI       |
| Self-reported depression       | 8332              | 9.9  | 9.5 to 10.2  | 936 | 4.8 | 4.2 to 5.3 | 2301 | 6.7 | 6.3 to 7.1  | 2288 | 11.1 | 10.4 to 11.8 | 1732 | 14.8 | 13.9 to 15.7 | 1075 | 10.3 | 9.4 to 11.2  |
| Geographical area              |                   |      |              |     |     |            |      |     |             |      |      |              |      |      |              |      |      |              |
| Rural                          | 1386              | 7.2  | 6.6 to 7.8   | 201 | 3.3 | 2.7 to 3.9 | 513  | 5   | 4.3 to 5.7  | 257  | 9.5  | 7.9 to 11.1  | 303  | 15.4 | 13.2 to 17.7 | 112  | 6.9  | 5.3 to 8.4   |
| Urban                          | 6946              | 10.3 | 9.9 to 10.7  | 735 | 5.2 | 4.5 to 5.9 | 1788 | 7.3 | 6.8 to 7.7  | 2031 | 11.2 | 10.5 to 11.9 | 1429 | 14.7 | 13.7 to 15.7 | 963  | 10.7 | 9.7 to 11.6  |
| Sex                            |                   |      |              |     |     |            |      |     |             |      |      |              |      |      |              |      |      |              |
| Male                           | 1954              | 4.9  | 4.6 to 5.3   | 222 | 2.7 | 2.1 to 3.2 | 488  | 2.9 | 2.6 to 3.3  | 560  | 5.8  | 5.1 to 6.5   | 442  | 7.3  | 6.4 to 8.2   | 242  | 5.3  | 4.3 to 6.2   |
| Female                         | 6378              | 14.3 | 13.7 to 14.9 | 714 | 6.8 | 5.9 to 7.6 | 1813 | 10  | 9.4 to 10.6 | 1728 | 15.8 | 14.6 to 16.9 | 1290 | 21.6 | 20.1 to 23.1 | 833  | 14.9 | 13.5 to 16.2 |
| Age (years)                    |                   |      |              |     |     |            |      |     |             |      |      |              |      |      |              |      |      |              |
| 15–19                          | 174               | 4.8  | 3.8 to 5.9   | 28  | 2   | 1.0 to 3.0 | 55   | 3.1 | 2.1 to 4.1  | 39   | 5.3  | 3.0 to 7.6   | 29   | 6.8  | 3.9 to 9.7   | 23   | 9.5  | 5.7 to 13.3  |
| 20–29                          | 752               | 5.8  | 5.1 to 6.6   | 120 | 3.5 | 2.7 to 4.4 | 185  | 3.5 | 2.8 to 4.2  | 193  | 7.2  | 5.5 to 8.9   | 149  | 8.9  | 7.1 to 10.6  | 105  | 5    | 3.6 to 6.3   |
| 30–39                          | 1371              | 9    | 8.2 to 9.7   | 177 | 4.6 | 3.4 to 5.8 | 406  | 6   | 5.1 to 6.8  | 324  | 9.7  | 8.3 to 11.2  | 281  | 14.2 | 12.1 to 16.3 | 183  | 10.3 | 8.3 to 12.3  |
| 40–49                          | 1747              | 12.6 | 11.6 to 13.6 | 203 | 6.7 | 5.1 to 8.3 | 502  | 8.5 | 7.5 to 9.5  | 493  | 14.7 | 12.6 to 16.7 | 326  | 17.4 | 15.1 to 19.8 | 223  | 12.5 | 10.4 to 14.6 |
| 50–59                          | 1922              | 12.9 | 11.9 to 13.8 | 188 | 5.9 | 4.8 to 7.1 | 532  | 9.8 | 8.7 to 11.0 | 548  | 13.8 | 12.1 to 15.6 | 382  | 17.3 | 15.3 to 19.3 | 272  | 13.7 | 11.4 to 16.0 |
| 60–69                          | 1417              | 13   | 12.0 to 14.1 | 139 | 6.1 | 4.6 to 7.7 | 381  | 9.6 | 8.1 to 11.1 | 404  | 13.7 | 11.8 to 15.6 | 332  | 19.7 | 17.3 to 22.1 | 161  | 11.4 | 8.6 to 14.1  |
| 70–79                          | 705               | 10.7 | 9.5 to 11.9  | 63  | 6.1 | 3.7 to 8.5 | 176  | 7.1 | 5.8 to 8.4  | 212  | 11.2 | 9.0 to 13.4  | 168  | 16.6 | 13.6 to 19.5 | 86   | 10.8 | 7.9 to 13.7  |
| ≥80                            | 244               | 9.3  | 7.5 to 11.0  | 18  | 4   | 1.6 to 6.4 | 64   | 5.5 | 3.6 to 7.3  | 75   | 9.9  | 6.6 to 13.1  | 65   | 16.8 | 11.3 to 22.2 | 22   | 11.3 | 5.8 to 16.7  |
| Skin colour                    |                   |      |              |     |     |            |      |     |             |      |      |              |      |      |              |      |      |              |
| White                          | 3833              | 12.1 | 11.5 to 12.7 | 225 | 5.8 | 4.7 to 6.9 | 661  | 7.6 | 6.7 to 8.4  | 1160 | 12.5 | 11.4 to 13.6 | 1352 | 15.2 | 14.2 to 16.3 | 435  | 11.4 | 10.0 to 12.9 |
| Black                          | 773               | 7.9  | 7.0 to 8.8   | 78  | 5.6 | 2.9 to 8.3 | 276  | 6.1 | 5.0 to 7.2  | 238  | 8.5  | 7.0 to 10.1  | 89   | 15.5 | 11.3 to 19.7 | 92   | 7.2  | 5.0 to 9.4   |
| Others*                        | 3726              | 8.3  | 7.8 to 8.7   | 633 | 4.4 | 3.9 to 4.9 | 1364 | 6.5 | 6.0 to 7.0  | 890  | 10   | 9.0 to 11.1  | 291  | 13.2 | 11.3 to 15.0 | 548  | 10.2 | 9.0 to 11.4  |
| Education (years of schooling) |                   |      |              |     |     |            |      |     |             |      |      |              |      |      |              |      |      |              |
| 0                              | 525               | 8    | 6.9 to 9.1   | 81  | 5.1 | 3.3 to 6.9 | 245  | 6.2 | 5.1 to 7.3  | 79   | 10.4 | 6.9 to 13.8  | 59   | 13.9 | 9.7 to 18.1  | 61   | 12.2 | 8.1 to 16.3  |
| 1–8                            | 3377              | 10.5 | 10.0 to 11.1 | 335 | 4.3 | 3.7 to 4.9 | 1006 | 6.8 | 6.2 to 7.5  | 883  | 12   | 10.8 to 13.2 | 774  | 17.1 | 15.5 to 18.7 | 379  | 9.9  | 8.5 to 11.4  |

Continued

Table 2 Continued

| Independent variables     | Regions of Brazil |      |              |     |      |              |      |      |              |      |      |              |      |      |              |     |      |              |
|---------------------------|-------------------|------|--------------|-----|------|--------------|------|------|--------------|------|------|--------------|------|------|--------------|-----|------|--------------|
|                           | Brazil            |      | North        |     |      | Northeast    |      |      | Southeast    |      |      | South        |      |      | Central-West |     |      |              |
|                           | N                 | %    | 95%CI        | N   | %    | 95%CI        | N    | %    | 95%CI        | N    | %    | 95%CI        | N    | %    | 95%CI        | N   | %    | 95%CI        |
| 9-11                      | 2417              | 8.4  | 7.9 to 9.0   | 277 | 4.5  | 3.4 to 5.7   | 651  | 5.9  | 5.3 to 6.5   | 690  | 9    | 8.0 to 10.1  | 464  | 12.4 | 10.9 to 13.9 | 335 | 9.9  | 8.4 to 11.4  |
| ≥12                       | 2013              | 12   | 11.1 to 12.9 | 243 | 6.4  | 5.2 to 7.7   | 399  | 8.6  | 7.5 to 9.7   | 636  | 13.3 | 11.8 to 14.8 | 435  | 14.5 | 12.7 to 16.2 | 300 | 11.1 | 9.4 to 12.8  |
| Marital status            |                   |      |              |     |      |              |      |      |              |      |      |              |      |      |              |     |      |              |
| Married                   | 3119              | 10.1 | 9.6 to 10.7  | 332 | 5.4  | 4.4 to 6.4   | 807  | 7    | 6.4 to 7.7   | 913  | 10.8 | 9.7 to 11.8  | 687  | 15   | 13.5 to 16.4 | 380 | 9.7  | 8.5 to 10.9  |
| Single                    | 3051              | 7.9  | 7.4 to 8.4   | 413 | 3.8  | 3.2 to 4.4   | 973  | 5.7  | 5.2 to 6.3   | 707  | 9.1  | 8.0 to 10.2  | 567  | 12   | 10.8 to 13.3 | 391 | 8.6  | 7.4 to 9.9   |
| Widowed                   | 1011              | 14.2 | 12.9 to 15.4 | 86  | 8.5  | 5.6 to 11.4  | 269  | 9.2  | 7.7 to 10.6  | 301  | 15.5 | 13.3 to 17.7 | 225  | 19.3 | 16.3 to 22.4 | 130 | 17.2 | 13.2 to 21.2 |
| Separated/divorced        | 1151              | 17.9 | 16.3 to 19.5 | 105 | 9.1  | 6.3 to 11.8  | 252  | 11.3 | 9.4 to 13.2  | 367  | 19.1 | 16.3 to 21.9 | 253  | 24.7 | 21.0 to 28.4 | 174 | 18.8 | 15.3 to 22.3 |
| Currently smoking         |                   |      |              |     |      |              |      |      |              |      |      |              |      |      |              |     |      |              |
| No                        | 7092              | 9.7  | 9.3 to 10.1  | 827 | 4.8  | 4.2 to 5.4   | 2003 | 6.5  | 6.1 to 6.9   | 1933 | 11   | 10.2 to 11.7 | 1436 | 14.5 | 13.5 to 15.5 | 893 | 10.1 | 9.1 to 11.0  |
| Yes                       | 1240              | 11.4 | 10.4 to 12.4 | 109 | 4.4  | 3.2 to 5.6   | 298  | 8.1  | 6.6 to 9.6   | 355  | 11.9 | 10.0 to 13.7 | 296  | 16.6 | 14.4 to 18.9 | 182 | 12.1 | 9.8 to 14.4  |
| Alcohol abuse             |                   |      |              |     |      |              |      |      |              |      |      |              |      |      |              |     |      |              |
| No                        | 7418              | 10.6 | 10.2 to 11.0 | 836 | 5.1  | 4.5 to 5.8   | 2097 | 7.4  | 6.9 to 7.8   | 2006 | 11.8 | 11.0 to 12.6 | 1549 | 15.5 | 14.4 to 16.5 | 930 | 11.3 | 10.3 to 12.4 |
| Yes                       | 914               | 6.4  | 5.7 to 7.0   | 100 | 2.9  | 2.1 to 3.6   | 204  | 3.2  | 2.6 to 3.9   | 282  | 7.7  | 6.4 to 9.0   | 183  | 10.8 | 8.7 to 12.9  | 145 | 6    | 4.8 to 7.3   |
| Screen time (hours)       |                   |      |              |     |      |              |      |      |              |      |      |              |      |      |              |     |      |              |
| <6                        | 7625              | 9.9  | 9.6 to 10.3  | 832 | 4.5  | 4.1 to 5.0   | 2119 | 6.8  | 6.4 to 7.2   | 2081 | 11.2 | 10.5 to 12.0 | 1621 | 14.9 | 13.9 to 15.8 | 972 | 9.7  | 8.9 to 10.6  |
| ≥6                        | 707               | 9.4  | 8.4 to 10.5  | 104 | 7    | 4.2 to 9.9   | 182  | 5.8  | 4.7 to 6.9   | 207  | 9.8  | 7.9 to 11.7  | 111  | 14   | 10.7 to 17.3 | 103 | 14.8 | 11.2 to 18.5 |
| Physical disorders        |                   |      |              |     |      |              |      |      |              |      |      |              |      |      |              |     |      |              |
| No                        | 3124              | 6.3  | 5.9 to 6.7   | 376 | 2.8  | 2.4 to 3.3   | 870  | 4.3  | 3.9 to 4.7   | 840  | 7.2  | 6.4 to 8.0   | 628  | 9.8  | 8.8 to 10.7  | 410 | 6.7  | 5.8 to 7.6   |
| Yes                       | 5208              | 15.7 | 15.0 to 16.4 | 560 | 9.4  | 8.1 to 10.7  | 1431 | 11.2 | 10.4 to 12.0 | 1448 | 16.7 | 15.4 to 17.9 | 1104 | 21.9 | 20.3 to 23.5 | 665 | 16.9 | 15.1 to 18.7 |
| Mental health comorbidity |                   |      |              |     |      |              |      |      |              |      |      |              |      |      |              |     |      |              |
| No                        | 6053              | 7.3  | 6.9 to 7.6   | 740 | 3.8  | 3.4 to 4.3   | 1664 | 4.9  | 4.6 to 5.2   | 1593 | 7.8  | 7.2 to 8.4   | 1290 | 11.7 | 10.9 to 12.6 | 766 | 7.9  | 7.1 to 8.7   |
| Yes                       | 2279              | 48.6 | 46.3 to 50.9 | 196 | 42.2 | 34.0 to 50.5 | 637  | 38.4 | 35.0 to 41.9 | 695  | 53.1 | 49.1 to 57.0 | 442  | 51.9 | 47.0 to 56.8 | 309 | 44.9 | 39.3 to 50.5 |

\*Others (indigenous, yellow and brown).

**Table 3** Adjusted prevalence ratios (PRs), with 95% CI, for medical diagnosis of self-reported depression, according to independent variables, nationally and by region

|                                | Brazil  |               | North   |              | Northeast |              | Southeast |               | South   |              | Central-West |               |
|--------------------------------|---------|---------------|---------|--------------|-----------|--------------|-----------|---------------|---------|--------------|--------------|---------------|
|                                | PR      | 95% CI        | PR      | 95% CI       | PR        | 95% CI       | PR        | 95% CI        | PR      | 95% CI       | PR           | 95% CI        |
| <b>Level 1</b>                 |         |               |         |              |           |              |           |               |         |              |              |               |
| Geographical area              | p<0.001 |               | p=0.020 |              | p=0.003   |              | p=0.583   |               | p=0.449 |              | p=0.020      |               |
| Rural                          | 1       |               | 1       |              | 1         |              | 1         |               | 1       |              | 1            |               |
| Urban                          | 1.23*   | 1.12 to 1.35  | 1.32*   | 1.04 to 1.67 | 1.27*     | 1.08 to 1.49 | 1.05      | 0.88 to 1.27  | 0.94    | 0.80 to 1.10 | 1.33*        | 1.05 to 1.69  |
| Sex                            | p<0.001 |               | p<0.001 |              | p<0.001   |              | p<0.001   |               | p<0.001 |              | p<0.001      |               |
| Male                           | 1       |               | 1       |              | 1         |              | 1         |               | 1       |              | 1            |               |
| Female                         | 2.75*   | 2.52 to 2.99  | 2.39*   | 1.94 to 2.94 | 3.26*     | 2.84 to 3.73 | 2.59*     | 2.23 to 3.00  | 2.94*   | 2.56 to 3.37 | 2.63*        | 2.16 to 3.21  |
| Age (years)                    | p<0.001 |               | p<0.001 |              | p<0.001   |              | p<0.001   |               | p<0.001 |              | p<0.001      |               |
| 15–19                          | 1       |               | 1       |              | 1         |              | 1         |               | 1       |              | 1            |               |
| 20–29                          | 1.17    | 0.91 to 1.51  | 1.57    | 0.88 to 2.79 | 1.09      | 0.74 to 1.62 | 1.33      | 0.82 to 2.15  | 1.31    | 0.81 to 2.10 | 0.51         | 0.31 to 0.85  |
| 30–39                          | 1.73*   | 1.36 to 2.19  | 1.96*   | 1.09 to 3.52 | 1.81*     | 1.25 to 2.62 | 1.73*     | 1.09 to 2.75  | 2.06*   | 1.29 to 3.29 | 1.05         | 0.67 to 1.65  |
| 40–49                          | 2.30*   | 1.81 to 2.91  | 2.77*   | 1.56 to 4.93 | 2.59*     | 1.81 to 3.71 | 2.46*     | 1.56 to 3.90  | 2.37*   | 1.51 to 3.70 | 1.18         | 0.73 to 1.90  |
| 50–59                          | 2.32*   | 1.84 to 2.93  | 2.42*   | 1.39 to 4.22 | 2.99*     | 2.07 to 4.32 | 2.36*     | 1.51 to 3.67  | 2.36*   | 1.50 to 3.71 | 1.31         | 0.82 to 2.09  |
| 60–69                          | 2.27*   | 1.78 to 2.90  | 2.37*   | 1.33 to 4.23 | 2.99*     | 2.01 to 4.44 | 2.19*     | 1.38 to 3.48  | 2.62*   | 1.64 to 4.18 | 0.98         | 0.58 to 1.66  |
| 70–79                          | 1.87*   | 1.44 to 2.42  | 2.14*   | 1.11 to 4.11 | 2.36*     | 1.57 to 3.56 | 1.74*     | 1.06 to 2.83  | 2.30*   | 1.40 to 3.80 | 0.91         | 0.52 to 1.59  |
| ≥80                            | 1.61*   | 1.18 to 2.18  | 1.32    | 0.57 to 3.04 | 1.74*     | 1.05 to 2.89 | 1.53      | 0.88 to 2.67  | 2.35*   | 1.35 to 4.09 | 0.84         | 0.40 to 1.75  |
| Skin colour                    | p<0.001 |               | p=0.097 |              | p=0.252   |              | p=0.002   |               | p=0.349 |              | p=0.048      |               |
| White                          | 1       |               | 1       |              | 1         |              | 1         |               | 1       |              | 1            |               |
| Black                          | 0.69*   | 0.61 to 0.78* | 1.05    | 0.65 to 1.72 | 0.87      | 0.70 to 1.07 | 0.70*     | 0.57 to 0.86* | 0.98    | 0.77 to 1.25 | 0.68*        | 0.49 to 0.92* |
| Other†                         | 0.74*   | 0.69 to 0.80* | 0.81    | 0.65 to 1.01 | 0.90      | 0.78 to 1.03 | 0.87*     | 0.76 to 0.99* | 0.89    | 0.77 to 1.04 | 0.93         | 0.78 to 1.10  |
| Education (years of schooling) | p<0.001 |               | p=0.608 |              | p=0.058   |              | p=0.035   |               | p=0.037 |              | p=0.574      |               |
| 0                              | 1.29*   | 1.11 to 1.50  | 0.99    | 0.6 to 1.46  | 1.21      | 0.97 to 1.49 | 1.16      | 0.80 to 1.67  | 1.28    | 0.95 to 1.72 | 0.82         | 0.57 to 1.17  |
| 1–8                            | 1.14    | 0.96 to 1.34  | 1.05    | 0.66 to 1.67 | 1.15      | 0.9 to 1.44  | 1.00      | 0.67 to 1.48  | 1.04    | 0.77 to 1.41 | 0.85         | 0.57 to 1.28  |
| 9–11                           | 1.33*   | 1.12 to 1.58  | 1.18    | 0.76 to 1.84 | 1.37*     | 1.07 to 1.74 | 1.26      | 0.85 to 1.86  | 1.09    | 0.79 to 1.50 | 0.90         | 0.60 to 1.36  |
| ≥12                            | 1       |               | 1       |              | 1         |              | 1         |               | 1       |              | 1            |               |
| Marital status                 | p<0.001 |               | p=0.009 |              | p=0.106   |              | p<0.001   |               | p<0.001 |              | p<0.001      |               |
| Married                        | 1       |               | 1       |              | 1         |              | 1         |               | 1       |              | 1            |               |
| Single                         | 1.01    | 0.93 to 1.10  | 0.85    | 0.69 to 1.04 | 1.07      | 0.92 to 1.24 | 1.08      | 0.92 to 1.26  | 1.05    | 0.90 to 1.22 | 1.03         | 0.84 to 1.26  |
| Widowed                        | 1.06    | 0.95 to 1.19  | 1.34    | 0.89 to 1.99 | 0.95      | 0.77 to 1.16 | 1.17      | 0.97 to 1.41  | 0.85    | 0.70 to 1.04 | 1.36*        | 1.01 to 1.83  |
| Separated/divorced             | 1.43*   | 1.29 to 1.59  | 1.35    | 0.95 to 1.93 | 1.24*     | 1.03 to 1.50 | 1.46*     | 1.23 to 1.74  | 1.37*   | 1.15 to 1.62 | 1.68*        | 1.35 to 2.08  |
| <b>Level 2</b>                 |         |               |         |              |           |              |           |               |         |              |              |               |
| Currently smoking              | p<0.001 |               | p=0.480 |              | p=0.001   |              | p=0.135   |               | p=0.030 |              | p=0.006      |               |
| No                             | 1       |               | 1       |              | 1         |              | 1         |               | 1       |              | 1            |               |
| Yes                            | 1.26*   | 1.14 to 1.38  | 1.11    | 0.83 to 1.50 | 1.38*     | 1.14 to 1.67 | 1.13      | 0.96 to 1.34  | 1.18*   | 1.02 to 1.37 | 1.34*        | 1.09 to 1.65  |

Continued



**Table 3** Continued

|                                 | Brazil       |              | North        |              | Northeast    |              | Southeast    |              | South        |              | Central-West |              |
|---------------------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
|                                 | PR           | 95% CI       | PR           | 95% CI       | PR           | 95% CI       | PR           | 95% CI       | PR           | 95% CI       | PR           | 95% CI       |
| Alcohol abuse                   | p=0.911      |              | p=0.470      |              | p=0.337      |              | p=0.464      |              | p=0.916      |              | p=0.167      |              |
| No                              | 1            |              | 1            |              | 1            |              | 1            |              | 1            |              | 1            |              |
| Yes                             | 1.01         | 0.81 to 1.27 | 0.80         | 0.43 to 1.47 | 0.83         | 0.56 to 1.22 | 1.15         | 0.79 to 1.67 | 1.02         | 0.73 to 1.41 | 0.77         | 0.53 to 1.12 |
| Screen time (hours)             | p<0.001      |              | p=0.001      |              | p=0.034      |              | p=0.130      |              | p=0.015      |              | p<0.001      |              |
| <6                              | 1            |              | 1            |              | 1            |              | 1            |              | 1            |              | 1            |              |
| ≥6                              | 1.31*        | 1.16 to 1.48 | 1.91*        | 1.31 to 2.77 | 1.25*        | 1.02 to 1.54 | 1.18         | 0.95 to 1.46 | 1.34*        | 1.06 to 1.70 | 1.90*        | 1.49 to 2.42 |
| <b>Level 3</b>                  |              |              |              |              |              |              |              |              |              |              |              |              |
| Physical disorder (any)         | p<0.001      |              | p<0.001      |              | p<0.001      |              | p<0.001      |              | p<0.001      |              | p<0.001      |              |
| No                              | 1            |              | 1            |              | 1            |              | 1            |              | 1            |              | 1            |              |
| Yes                             | 1.80*        | 1.67 to 1.97 | 2.46*        | 1.98 to 3.06 | 1.77*        | 1.55 to 2.01 | 1.72*        | 1.48 to 2.00 | 1.67*        | 1.49 to 1.88 | 2.01*        | 1.68 to 2.40 |
| Mental health comorbidity (any) | p<0.001      |              | p<0.001      |              | p<0.001      |              | p<0.001      |              | p<0.001      |              | p<0.001      |              |
| 1                               | 1            |              | 1            |              | 1            |              | 1            |              | 1            |              | 1            |              |
| 5.05*                           | 4.68 to 5.46 | 7.13*        | 5.80 to 8.77 | 6.11*        | 5.41 to 6.91 | 5.38*        | 4.72 to 6.12 | 3.63*        | 3.20 to 4.11 | 4.31*        | 3.63 to 5.13 |              |

\*Intervals that did not cross 1.

†Others (indigenous, yellow and brown).

of self-reported medical diagnosis of depression using primary representative Brazilian national data. The lifetime prevalence of self-reported diagnosis of depression in Brazil was 9.9%, and it was more prevalent in the South region and less so in the North and Northeast regions. The prevalence was higher in residents of urban areas of the country, females, those aged  $\geq 30$  years, those self-declared as white, separated/divorced individuals, those with higher education, smokers, heavy screen users, and in individuals with a self-reported medical diagnosis of a mental health comorbidity or any chronic physical disease. In the adjusted analysis, the association with educational level was reversed and less educated individuals presented a higher PR for a self-reported lifetime diagnosis of depression than those with 12 years or more of schooling. The strongest and most consistent associations were with a mental health comorbidity, sex, age and the presence of any chronic physical disease.

These prevalence estimates suggest that the prevalence of depression in Brazil is higher than in the world's population (4.4%). However, most studies explore current depression diagnosis or depression diagnosis in the past 12 months in the adult population,<sup>16</sup> whereas our study evaluated self-reported diagnosis throughout the lifetime of individuals aged  $\geq 15$  years old. In a meta-analysis with data from 30 countries, the aggregated lifetime prevalence of depression was 10.8% (7.8% to 14.8%), but the heterogeneity was high.<sup>17</sup> Compared with the 17% lifetime prevalence described in a meta-analysis combining findings from 27 Brazilian studies published up to 2014, which measured the prevalence of depressive symptoms or major depressive disorder in 464 734 adults,<sup>18</sup> our numbers are smaller. However, the aggregated lifetime prevalence of major depressive disorder calculation was based on only four studies conducted with participants from Rio de Janeiro and São Paulo (two metropolitan cities located in the Southeast region), employing different diagnostic criteria, and whose results were very heterogeneous.<sup>18</sup>

The diagnosis of depression depends on the provision of and access to health professionals. The Brazilian Unified Health System is a nationwide public health system that includes mental health assistance.<sup>19</sup> However, this service still cannot attend to the entire population. The macro-regions with the greatest coverage of health facilities are the Southeast and South, while the Northeast and North regions have the lowest.<sup>17</sup> The macro-regions with greater coverage of health facilities had a higher prevalence of self-reported lifelong medical diagnosis of depression.

The evidence is also consistent in describing a higher prevalence of self-reported lifelong medical diagnosis of depression in individuals living in urban areas, compared with rural areas.<sup>6</sup> One of the defining trends of population movement in the last half of the 20th century has been global urbanisation. Urbanisation can lead to depression through several different mechanisms, including overcrowding, social stress, inequality, pollution and lack of greenspace.<sup>20</sup>

Our study also showed that lifetime depression is about 30% higher among white-skinned individuals than in black, indigenous, yellow and brown people. A systematic review on mental disorders, depression, anxiety and race in Brazil identified a greater risk of mental disorders in non-white people when compared with white people.<sup>21</sup> Nonetheless, the same study highlighted the difficulty of associating mental disorders and race, in view of the variability of instruments used for diagnosis and in the way of categorising skin colour.<sup>21</sup> It also suggested that white-skinned people have more or better access to health professionals. The current evidence is that implicit racial/ethnic bias is present in healthcare, thus affecting healthcare outcomes.<sup>22</sup> Additionally, black, indigenous, yellow and brown people have fewer years of education in Brazil,<sup>19</sup> and other studies have found that low levels of education are associated with higher lifetime depression.<sup>23</sup>

Our results were consistent with population-based studies that have shown that major depression is two times higher in females than males.<sup>4 6 24</sup> The reasons for this sex difference are associated with both biological and social factors. Substantial cross-national research, for example, has been based on speculation that larger sex disparities in depression occur in societies with higher levels of gender inequality.<sup>25</sup> The PNS-2013 found more than twice as high a probability of positive screening for depression in females than in males (PR=2.29; 95% CI: 1.99 to 2.65), and a recent meta-analysis reported that women are 25 times more likely to be diagnosed with depression than men.<sup>17</sup>

The prevalence was higher in individuals aged  $\geq 30$  years old (particularly in those 40–69 years old). PRs vary by age and the literature has suggested that the peak occurs in older adulthood.<sup>2 16</sup> In the PNS-2013, the greatest PRs for depression were observed among groups aged more than 40 years old, compared with the younger group (18–29 years old).<sup>6</sup> The nationwide study on the use of psychotropic drugs for the treatment of self-reported depression in Brazil found that the prevalence increased significantly with age, from 3.5% in the under-40s age group to 9.5% in the 60 years or older group.<sup>7</sup>

In terms of marital status, a recent meta-analysis, using data from 26 population-based surveys, reported that compared with married people, the OR for depression among divorced individuals reached 8.2 in India and 19.3 in Lebanon, although the study's wide 95% CI (5.0 to 74.4) means that the real effect size is uncertain.<sup>4</sup>

The association between depression and smoking is consistently reported. A systematic review of longitudinal studies on the association of different aspects of smoking behaviour with depression and anxiety described that the results varied considerably, with evidence for smoking being associated with subsequent depression and vice versa.<sup>26</sup>

Our study found no association with alcohol abuse. Cohort studies on the association between alcohol consumption and subsequent depressive symptoms have

produced inconsistent results,<sup>27</sup> which can be explained by the different methodologies used to assess depressive symptoms, alcohol consumption and variables used in the adjusted analyses.<sup>27</sup> Nonetheless, a recent meta-analysis with 338 426 participants found that heavy drinking does not significantly predict the occurrence of depressive symptoms after adjusting for potential confounders.<sup>27</sup>

With advances in technology, screen time, including watching television, using a computer and playing video games, is becoming a dominant element of daily lives.<sup>28 29</sup> The results of a recent meta-analysis showed that most of the subjects who engaged in more than 2 hours/day of screen time were more likely to have depression.<sup>28</sup> In our results, individuals classified as heavy screen users ( $\geq 6$  hours of screen time in addition to work and study time) were 31% more likely to have had a medical diagnosis of depression than those whose usage was  $< 6$  hours/day.

Individuals with a mental health comorbidity and physical disorders are more likely to have depressive symptoms; however, the common underlying biological mechanisms are still unclear.<sup>2 30 31</sup> Depression can be associated with hormonal and physiological changes in the body systems that increase the chance of the appearance of one or more physical or mental health comorbidities. In this sense, for biological reasons, populations with less experience of depressive events have a lower incidence of chronic diseases.<sup>30–32</sup> In our study, the association with mental health comorbidities was strong (PR=5.05; 95% CI: 4.68 to 5.46 compared with those with no mental health comorbidity). The presence of psychopathology is strongly predictive of the onset of other mental disorders.<sup>32</sup> The findings of the PNS-2013 showed a strong association with other diseases; however, in that study, only three types of physical diseases were included.

This study has strengths and limitations. Among the limitations, characteristics of respondents and non-respondents in the sample could not be compared because data about non-respondents were not available. Due to the cross-sectional study design, causality and the direction of causality, between variables cannot be established. In the present study, this could be seen in the inability to ascertain the direction of the associations between the outcome, behavioural variables, and physical and mental health conditions. Also, household income data were not available in the dataset and the educational level was used as a proxy for this variable. In addition, aspects regarding the training of Brazilian health professionals to identify depressive symptoms (that may affect the prevalence of the outcome) were not available and could not be explored in our study. The restriction of the sample to domiciled individuals underestimates the prevalence of the outcome, since populations in situations of extreme vulnerability (the homeless, the institutionalised, those deprived of liberty and hospitalised people) are at greater risk of being affected by mental disorders. On the other hand, the nationwide representativeness

and the methodological robustness are major strengths of the study.

## CONCLUSION

This nationwide population-based study with more than 90 000 individuals showed that the lifetime prevalence of self-reported medical diagnosis of depression in Brazil was almost 10%. Considering the current Brazilian population, this percentage indicates that more than 2 million people have been diagnosed with depression at some point in their lives. In light of that, depression is ranked among the largest contributors to non-fatal health loss in the country. These results show the importance of a national public health plan for the prevention of mental illness and care of mental health in Brazil.

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