Article published online: 2025-04-22

Original Article

Predictors and Factors Associated with Insomnia in a Brazilian Sample: A Cross-Sectional Study

Isabela Mayumi Nishino Aizawa[1] Felipe Alckmin-Carvalho[2] Helder Sergio Lira Soares Filho[1] Rosa Hasan[3] Andrea Cecilia Toscanini[3] Renatha El Rafihi-Ferreira[1,4]

[1] Department of Psychiatry, University of São Paulo, São Paulo, Brazil
[2] Department of Psychology and Education, Faculty of Social and Human Sciences, University of Beira Interior, Covilhã, Portugal
[3] Ambulatório do Sono, Hospital das Clínicas, University of São Paulo, São Paulo, Brazil
[4] Department of Clinical Psychology, University of São Paulo, São Paulo, Brazil

Address for correspondence Renatha El Rafihi-Ferreira (e-mail: rerafihi@usp.br).

Sleep Sci

Abstract

Objective Chronic insomnia is associated with various functional and mental health impairments. The present study aimed to evaluate variables potentially associated with insomnia in a Brazilian sample.

Materials and Methods The study was conducted in a psychiatric hospital of a public medical school in the city of São Paulo, Brazil. The sample included 1,435 adults with a mean age of 38.3 years. Participants were divided into two groups: one with individuals diagnosed with insomnia (according to the Diagnostic and Statistical Manual of Mental Disorders, 5th edition and the Insomnia Severity Index) and a comparison group without the diagnosis. The Hospital Anxiety and Depression Scale (HADS) was used to assess psychopathological variables (anxiety and depression) and sociodemographic and anthropometric questionnaires to provide further characterization of the sample. Multivariable binary logistic regression analyses were performed.

Results Male sex and lacking a university degree were associated with increased odds of insomnia, with average increases of 1.93 and 1.89, respectively. Each additional year of age and each additional point on the depression and anxiety increased the likelihood of insomnia by averages of 1.05, 1.18, and 1.40, respectively.

Conclusion This study provides evidence of associations between biopsychosocial factors and insomnia, suggesting the potential for developing preventive and treatment protocols for this condition.

Keywords
- insomnia
- mental health
- psychopathology
- sleep deprivation
- patient health questionnaire anxiety and depression scale

Introduction

Insomnia is one of the most prevalent sleep disorders among adults, and is characterized by difficulty falling asleep, maintaining sleep continuity, or waking up much earlier than desired. When these symptoms occur more than three times a week for at least three months, chronic insomnia may be diagnosed.[1]

This disorder can negatively affect daily life by reducing functional capacity and impairing executive functions.[2,3] These impairments typically manifest as increased irritability and anxiety, diminished attention, compromised ability

received
April 9, 2024
accepted
February 17, 2025

DOI https://doi.org/10.1055/s-0045-1806953.
ISSN 1984-0659.

Thieme Revinter Publicações Ltda., Rua Rego Freitas, 175, loja 1, República, São Paulo, SP, CEP 01220-010, Brazil

to sustain focus on activities, and memory changes. Such changes render individuals more prone to making mistakes and becoming involved in accidents.[1,4] Insomnia also impairs functional capacity in terms of both the time spent working and the quality of activities performed. These alterations ultimately diminish quality of life and productivity.[1,5]

Araújo et al.[6] analyzed indicators of sleep problems in a sample of 94,114 individuals using data from the National Health Survey[7] conducted in Brazil. They found a 35.1% prevalence of general sleep problems. Sergipe (41.60%), Piauí (38.45%), and Espírito Santo (38.43%) had the highest prevalence rates. These figures surpass those from the 2013 National Health Survey, in which 28.9% of respondents reported sleep problems.[8] Another Brazilian study evaluated the prevalence of insomnia in 1,101 individuals aged between 20 and 80 years, living in the city of São Paulo, the most populous city in South America (Castro et al., 2013).[9] The authors found a prevalence of 15% in the evaluation using validated questionnaires based on Diagnostic and Statistical Manual of Mental Disorders, 4th edition (DSM-IV) and 32% using polysomnography (Castro et al., 2013).[9] Patients with insomnia diagnosed by polysomnography were more likely to be female, to have higher body mass index (BMI), to be older, widowed, housewives, and retired or unemployed, and to have lower socioeconomic status and lower levels of education compared to the group of good sleepers. The high prevalence of sleep disorders and the extensive damage from their chronification underscore the necessity for early diagnosis and prompt treatment.

Recent studies indicate a higher prevalence of insomnia in women, approximately double that of men.[6,10] Several hypotheses have been proposed to explain this disparity. Physiological factors, such as decreased estrogen post-menopause, may contribute.[8,11] Social factors also play a role, particularly the multiple responsibilities women in Western societies have, including childcare, household duties, and work obligations. Furthermore, the well-established higher incidence of depression and anxiety in women may be a contributing factor, considering the likely bidirectional relationship between these conditions and insomnia.[10,12]

Recently, the American Heart Association[13] included sleep health as the eighth and newest component of cardiovascular health.[13] One review provided evidence for increased rates of cardiovascular diseases, including hypertension, coronary heart disease, and heart failure, as well as metabolic diseases, such as obesity and diabetes, among individuals with insomnia.[14,15] Moreover, chronic sleep disturbances have been associated with neurodegenerative diseases, including Alzheimer's, Parkinson's, and multiple sclerosis. Furthermore, sleep deprivation weakens the immune system, rendering the body more vulnerable to infections.[16,17]

Physiological, social, and psychological factors play a crucial role in modulating sleep. Anxiety, depression, stress, dysfunctional beliefs about sleep, and excessive worry contribute to the persistence and worsening of insomnia.[10,13,18] In the social domain, evidence suggests that moderate physical activity enhances sleep quality.[19,20] Additionally, working double or alternating shifts has been linked to reduced sleep duration and quality, potentially impacting mental health.[21,22] Variables related to family composition, such as marital status and parenthood, may also contribute to the development or exacerbation of insomnia symptoms. Recent research indicates that being single may worsen insomnia symptoms, as marriage may often provide greater financial and emotional stability. Conversely, having children, particularly newborns, can exacerbate insomnia due to altered family dynamics and compromised sleep duration and quality.[11,21,23]

Although studies have explored the prevalence and factors associated with insomnia,[24,25] research with Brazilian samples remains limited. Understanding these aspects in a national sample is crucial for developing and planning preventive and interventional measures tailored to individuals with sleep problems in Brazil.[10] The objective of our study was to investigate possible associations between sociodemographic and clinical variables and the presence of insomnia. We assessed the following sociodemographic variables: age, sex, educational level, marital status, employment status, parenthood, ethnicity, body mass index, physical activity, depression, and anxiety. Our primary hypotheses, informed by prior research conducted in developed countries, are that several variables may be associated with an increased risk of insomnia in the evaluated sample. These variables include being female, advanced age, lack of higher education, sedentary lifestyle, mental health issues, overweight or obesity, and single marital status.

Materials and Methods

Study Design and Setting

The present cross-sectional study was conducted at a psychiatric hospital of a public medical school in São Paulo, Brazil. Management of the study utilized Research Electronic Data Capture (REDCap – Vanderbilt University, Nashville, TN, USA), a secure web-based platform for constructing and managing databases and online surveys.

Ethical Considerations

This research project was approved by the Research Ethics Committee of Universidade de São Paulo, under number: 4.582.587, CAAE: 65743917.2.0000.0068, dated March 19, 2021). All participants completed a free and informed consent form.

Recruitment of Participants

Participants were recruited through advertisements on the social media sites of the institution where the study took place in 2021 and 2022. Interested volunteers accessed the REDCap web platform and completed a screening questionnaire to assess their eligibility according to the study's established selection criteria. Two calls for participation were issued: one targeting volunteers with insomnia (clinical group) and another for volunteers without sleep-related complaints (control group).

Clinical group: Eligibility for the clinical group required meeting the following inclusion criteria: (a) to be aged 18 to 59 years and (b) to have been diagnosed with chronic insomnia (DSM-5), which includes (i) difficulty initiating and/or maintaining sleep, characterized by a latency-to-sleep onset and/or

waking $\geq$ 30 minutes after sleep onset; (ii) experiencing insomnia for over three nights per week and lasting more than three months; (iii) the sleep disorder (or associated daytime fatigue) causes significant distress or impairment in social, occupational, or other functional areas, with a score of $\geq$ 11 on the Insomnia Severity Index (ISI). We chose this cutoff point because it was indicated in the study conducted by Morin et al.,[26] which presented high sensitivity (97%) and perfect specificity (100%) for clinical samples. Participants indicating illiteracy or reading difficulties on the screening questionnaire were excluded.

Control group: The inclusion criteria for eligibility in the control group were as follows: (a) aged 18 to 59 years, (b) no sleep-related complaints, (c) not fulfilling the DSM-5 criteria for chronic insomnia and (d) a score of $\leq$ 10 on the ISI. Participants who reported illiteracy or reading difficulties on the identification questionnaire were excluded.

Instruments

Sociodemographic/Anthropometric Information

The information collected included sex, age, weight, height, BMI, marital status, occupation, education level, parental status, ethnicity, and frequency of weekly physical activity.

Evaluation of Insomnia Complaints

The insomnia interview was based on the revised version of the Structured Clinical Interview for DSM-5 Sleep Disorders – Revised (SCISD-R; Taylor et al.[27]). Examples of parameters from this instrument are as follows: "Difficulty in initiating sleep"; "Difficulty maintaining sleep, characterized by frequent awakenings or problems returning to sleep after awakenings"; "Early-morning awakening with inability to return to sleep"; "The sleep difficulty occurs at least three nights per week"; and "The sleep difficulty is present for at least three months".

Insomnia Severity Index (ISI)

Developed by Morin[26,28] and validated in Portuguese by Castro,[29] the ISI is a seven-item retrospective scale that assesses the nature, intensity, and impact of insomnia during the last month. The instrument measures difficulties in initiating or maintaining sleep, early morning awakening, degree of satisfaction with sleep, daytime impairment, perception of sleep problems by others, and degree of worry about sleep problems. All items are assessed using a 5-point Likert scale (0 = no severity to 4 = high severity), resulting in a total score ranging from 0 to 28. The scores are classified as follows: no insomnia (0–7), mild insomnia (8–14), moderate insomnia (15–21), or severe insomnia (22–28). A score of $\geq$ 11 indicates clinical insomnia.[10] The ISI scale has good internal consistency (Cronbach's $\alpha = 0.865$) and convergent validity (correlation with the Pittsburgh Sleep Quality Inventory $r = 0.75$).

Hospital Anxiety and Depression Scale (HADS)

The HADS consists of 14 items divided into 2 subscales to evaluate anxiety and depression. These items are exclusively concerned with emotional states and omit somatic symptoms. Each subscale has a scoring range of 0 to 21, in which 0 to 8 suggests an absence of anxiety or depression and scores $\geq$ 9 indicate their presence.[30] Botega et al.[31] translated and validated the Brazilian version, reporting Cronbach's alpha values of 0.68 for anxiety and 0.77 for depression.

Procedure

All volunteers meeting the inclusion criteria outlined in the research project accessed the REDCap platform and signed the informed consent form. Subsequently, they provided the sociodemographic and anthropometric data mentioned previously. Finally, they completed the assessment instruments for diagnosing insomnia based on the DSM-5, ISI, and HADS.

Data Analysis

Data analysis was conducted using the Jamovi program, version 2.3 (open source). The selection of the correlation method depended on the relationships tested: tetrachoric correlation for binary and categorical variables with more than two levels, point-biserial correlation for two binary variables, and Pearson's correlation for pairs of continuous variables.

The regression model investigated the relationship between predictor variables—including sex, ethnicity, marital status, parenthood, occupation, level of education, physical activity, BMI, and HADS scores for anxiety and depression—and age, as well as a combination of DSM-5 criteria and ISI scores, to determine the absence (0) or presence (1) of insomnia.

We began by examining the model for outliers, finding none based on a Cook's distance threshold of 0.92. We also assessed multicollinearity and determined that all predictors had a variance inflation factor of less than 2, indicating low correlation.[32] We fitted a binary logistic model (estimated with ML) to predict insomnia, incorporating the presence/absence of children, age, marital status, sex, education level, and levels of anxiety and depression as covariates. According to Tjur's method,[33] this model demonstrated substantial explanatory power (Tjur's $R^2 = 0.47$).

Results

Sample Characteristics

The study comprised 1,435 participants with an average age of 38.35 years (standard deviation [SD]: $\pm$ 9.87; range 18–59). The majority were female, held a university degree, and were employed. ►**Table 1** presents the means, SDs, and frequencies of the sociodemographic characteristics, anxiety and depression scale scores, and physical activity practices for the entire sample.

Factors Associated with Insomnia

Multivariable binary logistic regression analyses revealed significant positive associations between severe insomnia and several variables: sex, education level, age, depression, and anxiety (►**Table 2**). Specifically, being male and lacking a university degree were found to elevate the likelihood of insomnia, with odds ratios of 1.93 and 1.89, respectively. Furthermore, the data indicated that each additional year of age and each incremental point on the HADS depression and

Table 1 Descriptive analysis of the sample

Variables	Sample
Age (years), mean (SD)	38.37 (9.77)
Sex, n (%)	
Female	1,153 (80%)
Male	282 (20%)
Education level, n (%)	
Higher education	1,112 (77%)
Basic and secondary	323 (23%)
Marital status, n (%)	
Not married	753 (52%)
Married/partnered	682 (48%)
Children, n (%)	
No	846 (59%)
Yes	589 (41%)
Paid employment, n (%)	
No	310 (21%)
Yes	1,125 (79%)
Ethnicity, n (%)	
White	1,030 (72%)
Black and Latino	278 (19%)
Asian	127 (9%)
BMI, mean (SD)	26.30 (5.64)
Physical activity, n (%)	
$< 2\times$/week	657 (46%)
$\geq 2\times$/week	778 (54%)
Anxiety score (HADS-A), mean (SD)	9.76 (4.99)
Depression score (HADS-D), mean (SD)	7.96 (4.77)

Abbreviations: BMI, body mass index; HADS-A, Hospital Anxiety and Depression Scale-Anxiety; HADS-D, Hospital Anxiety and Depression Scale-Depression; SD, standard deviation.

anxiety scales corresponded to average increases in the odds of insomnia by factors of 1.05, 1.18, and 1.40, respectively. ►**Tables 3** and **4**, presented in the Supplementary Materials, present results of the binomial logistic regression analysis and results to check for multicollinearity among the predictor variables in the model.

Discussion

In the current study, we evaluated factors associated with the presence of insomnia in Brazilian adults. Our hypotheses were partially confirmed. Age, education level, depression, and anxiety were associated with insomnia complaints, independent of other associated factors. These findings are in line with what was reported in the Brazilian epidemiological study by Castro et al.,[9] which found a higher prevalence of insomnia in individuals with low socioeconomic status, older people and those with lower schooling levels.

Our findings indicate that the risk of insomnia increases over time for both men and women. These results align with the biomedical literature that reports an increased risk of insomnia with age.[34–36] There is substantial evidence of changes in sleep patterns throughout life, associated with the process of senescence of the central nervous system, which begins around the age of 30.[37,38] These changes correlate with a decline in the function of the hypothalamic suprachiasmatic nucleus. Over time, this structure becomes less efficient in regulating the sleep-wake cycle and modulating sleep phases, leading to a reduction of the slow wave phases and an increase in phases I and II, which are characterized by more superficial sleep.[39] For some individuals, particularly those with additional risk factors for sleep disturbances, the aging of the central nervous system increases the likelihood of receiving a formal diagnosis of insomnia.[38] In our study, we excluded individuals over the age of 60 because distinguishing between signs and symptoms of insomnia and typical changes associated with aging can be challenging. Furthermore, we suggest that beyond the age of 60, an increased prevalence of physical and mental health comorbidities may compromise sleep and be indirectly linked to an insomnia diagnosis, thereby complicating the analysis with additional confounding variables.

Contrary to our hypothesis, which was based on previous studies suggesting a higher risk of insomnia among women,[6,8,11,12] the sample evaluated indicated that being male nearly doubled the risk of insomnia. However, this result should be interpreted with caution, as confounding variables related to participant recruitment may explain it, at least in part. In the current study, we selected both good sleepers and individuals with sleep complaints, with a majority of the men included in the latter group. Additionally, in Latin American culture, men are less likely to seek health services, both primary care and specialized services, compared to women.[40,41] When they do seek help, they generally present with higher levels of functional impairment and clinically significant distress, often exacerbated by the chronification of physical and/or mental health issues.[40,41] Atumane[41] suggested that one of the main factors contributing to the reluctance of Latin American men to seek health services may be related to the phenomenon of sexism, which remains deeply ingrained in Brazilian culture. This cultural characteristic not only discourages self-care behaviors among men throughout childhood and adolescence but also stigmatizes those who engage in self-care, equating it with weakness and vulnerability.[41] Therefore, our hypothesis is that the men with insomnia who sought treatment had greater insomnia severity than the women. This may explain why, despite having fewer men in the sample, they show greater severity.

Our results indicate that self-reported signs and symptoms of anxiety increased the risk of insomnia by 1.4 times. This finding is consistent with previous research that has identified a link between insomnia and anxiety.[42,43] Epidemiological studies have shown that the prevalence of clinical-level anxiety ranges from 24 to 36% in individuals with insomnia.[44,45] Similarly, the assessment of insomnia in the context of anxiety disorders has been discussed, pointing to a likely bidirectional relationship between the two phenomena.[46]

Table 2 Factors associated with the presence of insomnia.

Variables	With insomnia (n = 1,032)	Without insomnia (n = 403)	Multivariable model OR (95% CI)	*p*
Age (years), mean (SD)	39.01 (9.97)	36.72 (9.04)	1.05 (1.03–1.07)	< 0.001*
Sex, n (%)			1.93 (1.25–2.98)	0.003*
Female	804 (70%)	349 (30%)		
Male	228 (81%)	54 (19%)		
Education level, n (%)			1.89 (1.16–3.07)	0.011*
Higher education	763 (69%)	349 (31%)		
Basic and secondary	269 (83%)	54 (%)		
Marital status, n (%)			1.14 (0.80–1.63)	
Not married	559 (74%)	194 (26%)		0.473
Married/partner	473 (69%)	209 (31%)		
Children, n (%)			0.86 (0.57–1.30)	
No	581 (69%)	265 (31%)		0.469
Yes	451 (77%)	138 (33%)		
Paid employment, n (%)			0.70 (0.44–1.11)	0.127
No	234 (75%)	76 (25%)		
Yes	798 (77%)	234 (23%)		
Ethnicity, n (%)			1.19 (0.78–1.82)	
White	734 (71%)	296 (29%)	0.73 (0.41–1.30)	
Black and Latino	210 (76%)	68 (24%)		0.408
Asian	88 (69%)	39 (31%)		0.281
BMI, mean (SD)	26.72 (5.91)	25.22 (4.72)	1.00 (0.97–1.03)	0.871
Physical activity, n (%)				0.461
< 2 ×/week	506 (77%)	151 (23%)	1.14 (0.81–1.59)	
≥ 2 ×/week	526 (68%)	252 (32%)		
Anxiety score (HADS-A), mean (SD)	11.61 (4.28)	5.02 (3.23)	1.40 (1.33–1.48)	< 0.001*
Depression score (HADS-D), mean (SD)	9.53 (4.38)	3.94 (3.05)	1.18 (1.12–1.25)	< 0.001*

Abbreviations: BMI, body mass index; CI, confidence interval; HADS-A, Hospital Anxiety and Depression Scale-Anxiety; HADS-D, Hospital Anxiety and Depression Scale-Depression; OR, odds ratio; SD, standard deviation.

We also found an association between self-reported signs and symptoms of depression and insomnia. Our results indicate that each additional point on the HADS depression scale increased the likelihood of an individual developing insomnia. Research has demonstrated a bidirectional relationship between depression and insomnia, as pathophysiological changes in the mood regulation centers of the central nervous system are affected by sleep deprivation, potentially exacerbating existing depressive symptoms. Similarly, insomnia is a prevalent symptom in cases of depression, with over 90% of individuals diagnosed with major depressive disorder reporting it.[47] Moreover, individuals with insomnia may develop depression more frequently than those who sleep well.[48] Chronic insomnia is considered a significant predictor of depression relapse and can contribute to adverse clinical outcomes.[49] Our study's findings support the bidirectional relationship of these conditions.

The combination of insomnia, anxiety, and depression symptoms was also found in a Swedish study conducted by

Table 3 Binomial logistic regression.

Model fit measures					
Model	Deviance	AIC	BIC	R^2_{McF}	R^2_T
1	983	1,009	1,077	0.423	0.468

Abbreviations: AIC, ; BIC, .

Table 4 Assumption checks.

Collinearity statistics		
	VIF	Tolerance
Sex	1.03	0.975
Ethnicity	1.01	0.992
Marital status	1.13	0.882
Children	1.27	0.788
Occupation	1.16	0.864
Education level	1.15	0.867
BMI	1.05	0.954
Physical activity	1.05	0.956
HADS depression score	1.19	0.839
HADS anxiety score	1.18	0.847
Age	1.31	0.765

Abbreviations: BMI, body mass index; HADS, Hospital Anxiety and Depression Scale.

McCracken et al.[16] that found 45% of the assessed participants met the criteria for diagnosis of depression, anxiety, and insomnia. Other factors negatively related to these variables included age, education, income, the number of young children at home, and self-perception of general health status. Generally, preexisting vulnerability factors, such as poor self-perceived general health and a history of mental health problems, contributed more to the variance explained in depression, anxiety, and insomnia.[16]

Our results revealed no association between marital status and insomnia. Epidemiological studies, however, have reported a higher risk of insomnia among divorced, single, and widowed individuals.[21,50,51] This result is similar to that reported in the epidemiological study by Castro et al.[9] Social factors suggest that married individuals or those in stable unions generally experience better sleep health, characterized by greater sleep efficiency and fewer insomnia symptoms.[52] This may be attributed to a larger support network and increased emotional and financial stability.[51] Conversely, single, divorced, and widowed individuals generally face a higher risk of insomnia, potentially linked to a smaller social support network and the challenges in overcoming bereavement among widowers.[51]

Contrary to our hypotheses, which were based on international studies and the clinical impressions of the researchers, we found no increased risk of insomnia among individuals engaged in unpaid work. Conversely, the literature indicates a direct correlation between insomnia and factors such as low wages, inadequate income, excessive working hours, informal employment, and unemployment.[21,22] In these instances, the stress of precarious working conditions, coupled with uncertainties regarding financial stability and the future, may provoke chronic worry. This heightened anxiety can, in turn, impair sleep quality and regularity.[42,43,46]

Unlike several studies that indicate the relationship between insomnia and the presence of children,[11,23,53] our findings did not demonstrate this relationship. This discrepancy may be because we did not investigate children's ages, as the majority of parental insomnia cases are associated with newborns and infants.[22] Having fewer year of formal education (lacking a college degree) nearly doubled the likelihood of experiencing insomnia, a finding supported by the literature.[54,55] We postulate that low level of schooling heightens the risk of insomnia through two primary mechanisms: the first pertains to a potential deficit in awareness regarding the significance of adequate, high-quality sleep as well as sleep hygiene practices conducive to this outcome. The second mechanism concerns the high probability that limited formal education correlates with lower income, which is, in turn, frequently associated with insomnia. Conducted in São Paulo, one of the world's most densely populated urban areas, our study is set against a backdrop of pronounced social disparities and other social issues characteristic of large cities in developing countries. One such issue is the tendency of low and middle-income workers to live in the outskirts of the city, away from the central districts with greater job opportunities.[56] Consequently, extended commuting times reduce the opportunity for adequate sleep time as well as less time for self-care routines that both directly and indirectly affect sleep quality.[57] In addition, fewer years of schooling and lower income in one of the world's most expensive cities often correlate with precarious housing situations that may not provide conditions conducive to quality sleep, such as appropriate temperature, air circulation, silence, and light control. Furthermore, the common practice among large, low-income families of sharing sleeping quarters tends to elevate the risk of insomnia.

Most of the literature suggests that regular physical activity is a protective factor against insomnia.[19,20] However, this association was not identified in our study. This result should be analyzed with caution, since we did not use a validated instrument to assess physical activity. We believe that the criteria we used to classify physically active individuals—performing some physical activity at least twice a week—may have been insufficient to produce positive outcomes in terms of improving sleep quality and preventing insomnia.

Although the literature suggests a higher risk of insomnia among overweight and obese individuals,[58,59] our results did not indicate a higher frequency of overweight or obese individuals in the group of patients diagnosed with insomnia. In our study, on average, there were slightly overweight participants in both groups, those diagnosed with insomnia and those who did not have sleep problems, which may not be enough to cause clinical changes, such as sleep apnea, commonly associated with insomnia and worse sleep quality.

Our study has limitations that warrant caution in interpreting our findings. First, sleep variables were solely self-reported, which may be susceptible to reporting bias. Future studies should incorporate objective sleep measures, such as actigraphy, to complement self-report instruments and provide a more detailed evaluation of sleep characteristics in this population. Second, the lack of a clinical interview precludes discussion of our data in terms of insomnia disorder diagnosis. Third, the associations identified in this study

may be confounded by other variables that were not assessed and consequently not adjusted for. Fourth, the cross-sectional design precludes causal inferences. Longitudinal cohort studies are needed to investigate the directionality of the effects observed here and to evaluate the causal relationships between sociodemographic variables, lifestyle habits, mental health, and insomnia among adult Brazilians. Fifth, our study predominantly included participants with high education and white ethnicity, which is not representative of the Brazilian population. Finally, although we evaluated a significant number of participants, our sample was not selected using probabilistic criteria, and we did not perform a sample size calculation to enhance the internal validity of the research. Moreover, we only included participants who had access to the internet and social networks. Therefore, the results should not be generalized, as this is not a sample representative of the Brazilian population. We hypothesize that the association between sociodemographic variables, working conditions, housing, mental health, and insomnia could be even stronger among populations with low and very low income. Further studies are recommended to investigate these variables.

Despite the acknowledged limitations, we believe we have achieved our objectives. The principal findings of the study suggest that, within the evaluated sample, being male, lacking a university degree, advanced age, and the presence of self-reported anxiety and depression symptoms increased the risk of insomnia. These findings provide evidence to support the understanding that insomnia seems to be the result of a complex interaction between sociodemographic,[21,52,55,60,61] clinical, and psychiatric variables.[47,49,62]

Given the acute and chronic harm that insomnia can inflict on physical and mental health, quality of life, and productivity, timely screening for this condition is crucial, particularly in older populations with low education levels and indications of depression and anxiety. Early detection of insomnia is associated with a better treatment prognosis through cognitive-behavioral therapies for insomnia, the efficacy of which is well-established in the literature, including among the Brazilian population.[63,64] Moreover, appropriate treatment of insomnia not only prevents complications related to sleep deprivation but also tends to alleviate depression and anxiety, reflecting the likely bidirectional relationship between these conditions. Therefore, we suggest that Brazilian primary health care services conduct periodic screening for insomnia, especially targeting key populations at increased risk for the condition, such as those identified in this study. Given that it is a quick, effective, and low-cost measure, its implementation is justified in secondary and tertiary care services within the Brazilian public health system.

Funding Source
Isabela Mayumi Nishino Aizawa and Renatha El Rafihi-Ferreira received research support from Fundação de Amparo à Pesquisa do Estado de São Paulo – FAPESP under grant numbers 23/03073-0 and 2018/19506-5, respectively].

Conflict of Interests
The authors have no conflict of interests to declare.

Acknowledgments
The authors would like to thank all participants and M. Carmo for his statistical advising and contribution.

References

1 American Psychiatric Association (APA) Manual diagnóstico e estatístico de transtornos mentais: DSM -5 -TR. 5, texto revisado. Porto Alegre: Artmed Editora LTDA; 2023
2 Hashim H, Ng JS, Ngo JX, Ng YZ, Aravindkumar B. Lifestyle factors associated with poor sleep quality among undergraduate dental students at a Malaysian private university. Sleep Sci 2022;15(04): 399–406. Doi: 10.5935/1984-0063.20220070
3 Islam Z, Hsan K, Islam S, Gozal D, Hossain M. Assessment of sleep quality and its association with problematic internet use among university students: a cross-sectional investigation in Bangladesh. Sleep Sci 2021;14(Spec 1):8–15. Doi: 10.5935/1984-0063.20200069
4 Morin CM, Jarrin DC. Epidemiology of Insomnia: Prevalence, Course, Risk Factors, and Public Health Burden. Sleep Med Clin 2022;17(02):173–191. Doi: 10.1016/j.jsmc.2022.03.003
5 Bollu PC, Kaur H. Insomnia and Sleep. Mo Med 2019;116(01): 68–75
6 Araújo MFS, Souza TA, Medeiros AA, Souza JC, Barbosa IR. Factors associated with sleep problems and sleeping pill use in Brazilians. Rev Saude Publica 2022;56:68. Doi: 10.11606/s1518-8787.2022056004088
7 Brazilian Institute of Geography and Statistics. National Health Survey (PNS 2019): perception of health status, lifestyles, chronic diseases and oral health: Brazil and major regions. IBGE, Work and Income Coordination [uptodate 2019; cited 2024 Jan 19]. Available from: https://www.ibge.gov.br/estatisticas/sociais/saude/9160-pesquisa-nacional-de-saude.html
8 Gajardo YZ, Ramos JN, Muraro AP, Moreira NF, Ferreira MG, Rodrigues PRM. Problemas com o sono e fatores associados na população brasileira: Pesquisa Nacional de Saúde, 2013. Cien Saude Colet 2021;26(02):601–610. Doi: 10.1590/1413-81232021262.08412020
9 Castro LS, Poyares D, Leger D, Bittencourt L, Tufik S. Objective prevalence of insomnia in the São Paulo, Brazil epidemiologic sleep study. Ann Neurol 2013;74(04):537–546. Doi: 10.1002/ana.23945
10 El Rafihi-Ferreira R, do Brasil do Carmo MMI, Bassolli L, Hasan R, Aizawa IMN, Toscanini AC. Cognitive and psychological factors associated with severe insomnia in Brazilian women: a cross-sectional study. Psicol Reflex Crit 2022;35(01):39. Doi: 10.1186/s41155-022-00243-x
11 Peng YT, Hsu YH, Chou MY, Chu C-S, Su C-S, Liang C-K, et al. Factors associated with insomnia in older adult outpatients vary by gender: a cross-sectional study. BMC Geriatr 2021;21(01):681. Doi: 10.1186/s12877-021-02643-7
12 Zeng LN, Zong QQ, Yang Y, Zhang L, Xiang Y-F, Ng CH, et al. Gender Difference in the Prevalence of Insomnia: A Meta-Analysis of Observational Studies. Front Psychiatry 2020;11:577429. Doi: 10.3389/fpsyt.2020.577429
13 Lloyd-Jones DM, Allen NB, Anderson CAM, Black T, Brewer LC, Foraker RE, et al; American Heart Association. Life's Essential 8: Updating and Enhancing the American Heart Association's Construct of Cardiovascular Health: A Presidential Advisory From the American Heart Association. Circulation 2022;146(05):e18–e43. Doi: 10.1161/CIR.0000000000001078
14 Javaheri S, Barbe F, Campos-Rodriguez F, Dempsey JA, Khayat R, Javaheri S, et al. Sleep Apnea: Types, Mechanisms, and Clinical

Cardiovascular Consequences. J Am Coll Cardiol 2017;69(07): 841–858. Doi: 10.1016/j.jacc.2016.11.069
15 Jackson CL, Walker JR, Brown MK, Das R, Jones NL. A workshop report on the causes and consequences of sleep health disparities. Sleep 2020;43(08):zsaa037. Doi: 10.1093/sleep/zsaa037
16 McCracken LM, Badinlou F, Buhrman M, Brocki KC. Psychological impact of COVID-19 in the Swedish population: Depression, anxiety, and insomnia and their associations to risk and vulnerability factors. Eur Psychiatry 2020;63(01):e81. Doi: 10.1192/j.eurpsy.2020.81
17 de Oliveira MPB, de Castro AEF, Miri AL, Lima CR, Truax BD, Probst VS, et al. The impact of the COVID-19 pandemic on neuropsychiatric and sleep disorders, and quality of life in individuals with neurodegenerative and demyelinating diseases: a systematic review and meta-analysis of observational studies. BMC Neurol 2023;23(01):150. Doi: 10.1186/s12883-023-03176-9
18 Lancee J, Effting M, van der Zweerde T, van Daal L, van Straten A, Kamphuis JH. Cognitive processes mediate the effects of insomnia treatment: evidence from a randomized wait-list controlled trial. Sleep Med 2019;54:86–93. Doi: 10.1016/j.sleep.2018.09.029
19 Youngstedt SD, Ito W, Passos GS, Santana MG, Youngstedt JM. Testing the sleep hygiene recommendation against nighttime exercise. Sleep Breath 2021;25(04):2189–2196. Doi: 10.1007/s11325-020-02284-x
20 McGovney KD, Curtis AF, McCrae CS. Associations between objective afternoon and evening physical activity and objective sleep in patients with fibromyalgia and insomnia. J Sleep Res 2021;30 (01):e13220. Doi: 10.1111/jsr.13220
21 Kawata Y, Maeda M, Sato T, Maruyama K, Wada H, Ikeda A, Tanigawa T. Association between marital status and insomnia-related symptoms: findings from a population-based survey in Japan. Eur J Public Health 2020;30(01):144–149. Doi: 10.1093/eurpub/ckz119
22 Marthinsen GN, Helseth S, Småstuen M, Bjorvatn B, Bandlien SM, Fegran L. Sleep patterns and psychosocial health of parents of preterm and full-born infants: a prospective, comparative, longitudinal feasibility study. BMC Pregnancy Childbirth 2022;22(01): 546. Doi: 10.1186/s12884-022-04862-1
23 Roskam I, Mikolajczak M. Gender differences in the nature, antecedents and consequences of parental burnout. Sex Roles 2020;83(7-8):485–498. Doi: 10.1007/s11199-020-01121-5
24 Staner L. Comorbidity of insomnia and depression. Sleep Med Rev 2010;14(01):35–46. Doi: 10.1016/j.smrv.2009.09.003
25 Stuck BA, Maurer JT, Schlarb AA, Schredl M, Weeß H Practice of sleep medicine: Sleep disorders in children and adults. Switzerland: Springer; 2021:77–109
26 Morin CM, Belleville G, Bélanger L, Ivers H. The Insomnia Severity Index: psychometric indicators to detect insomnia cases and evaluate treatment response. Sleep 2011;34(05):601–608. Doi: 10.1093/sleep/34.5.601
27 Taylor DJ, Wilkerson A, Pruiksma KE, Dietch JR, Wardle-Pinkston S. 2019Structured clinical interview for sleep disorders-revised (SCISD-R). Retrieved from: https://insomnia.arizona.edu/SCISD
28 Morin CM. Insomnia: Psychological assessment and management. New York: Guilford Press; 1993
29 Castro LS. Adaptação e validação do Índice de Gravidade de Insônia (IGI) [Dissertação de Mestrado]. São Paulo: Universidade Federal de São Paulo; 2011
30 Zigmond AS, Snaith RP. The hospital anxiety and depression scale. Acta Psychiatr Scand 1983;67(06):361–370. Doi: 10.1111/j.1600-0447.1983.tb09716.x
31 Botega NJ, Bio MR, Zomignani MA, Garcia C Jr, Pereira WAB. Transtornos do humor em enfermaria de clínica médica e validação de escala de medida (HAD) de ansiedade e depressão. Rev Saude Publica 1995;29(05):355–363. Doi: 10.1590/s0034-89101995000500004
32 James G, Witten D, Hastie T, Tibshirani R. An introduction to statistical learning: with applications in R. New York: Springer; 2013:205–259
33 Tjur T. Coefficients of Determination in Logistic Regression Models. A New Proposal: The Coefficient of Discrimination. Am Stat 2009;63(04):366–372. Doi: 10.1198/tast.2009.08210
34 Brewster GS, Riegel B, Gehrman PR. Insomnia in the Older Adult. Sleep Med Clin 2022;17(02):233–239. Doi: 10.1016/j.jsmc.2022.03.004
35 Patel D, Steinberg J, Patel P. Insomnia in the Elderly: A Review. J Clin Sleep Med 2018;14(06):1017–1024. Doi: 10.5664/jcsm.7172
36 Sexton CE, Sykara K, Karageorgiou E, Zitser J, Rosa T, Yaffe K, Leng Y. Connections between insomnia and cognitive aging. Neurosci Bull 2020;36(01):77–84. Doi: 10.1007/s12264-019-00401-9
37 Liu RM. Aging, cellular senescence, and Alzheimer's disease. Int J Mol Sci 2022;23(04):1989. Doi: 10.3390/ijms23041989
38 Rosso AL, Studenski SA, Chen WG, Aizenstein HJ, Alexander NB, Bennett DA, et al. Aging, the central nervous system, and mobility. J Gerontol A Biol Sci Med Sci 2013;68(11):1379–1386. Doi: 10.1093/gerona/glt089
39 Kostin A, Alam MA, McGinty D, Alam MN. Adult hypothalamic neurogenesis and sleep-wake dysfunction in aging. Sleep 2021;44 (02):173. Doi: 10.1093/sleep/zsaa173
40 da Costa Santos EC, Dórea FS, de Souza SR, da Silva GM, Santos ACS, de Andrade AFSM, et al. Evidências científicas das barreiras e ações à saúde do homem no contexto da Atenção Primária. Revista Eletrônica Acervo Saúde 2022;15(09):e10926. Doi: 10.25248/reas.e10926.2022
41 Atumane AMA. Aspectos socioculturais relacionados à saúde do homem. São Paulo: Dialética; 2022
42 Jansson-Fröjmark M, Lindblom K. A bidirectional relationship between anxiety and depression, and insomnia? A prospective study in the general population. J Psychosom Res 2008;64(04): 443–449. Doi: 10.1016/j.jpsychores.2007.10.016
43 Choueiry N, Salamoun T, Jabbour H, El Osta N, Hajj A, Rabbaa Khabbaz L. Insomnia and Relationship with Anxiety in University Students: A Cross-Sectional Designed Study. PLoS One 2016;11 (02):e0149643. Doi: 10.1371/journal.pone.0149643
44 Ramsawh HJ, Stein MB, Belik SL, Jacobi F, Sareen J. Relationship of anxiety disorders, sleep quality, and functional impairment in a community sample. J Psychiatr Res 2009;43(10):926–933. Doi: 10.1016/j.jpsychires.2009.01.009
45 Serdari A, Manolis A, Tsiptsios D, Vorvolakos T, Terzoudi A, Nena E, et al. Insight into the relationship between sleep characteristics and anxiety: A cross-sectional study in indigenous and minority populations in northeastern Greece. Psychiatry Res 2020; 292:113361. Doi: 10.1016/j.psychres.2020.113361
46 Batterham PJ, Glozier N, Christensen H. Sleep disturbance, personality and the onset of depression and anxiety: prospective cohort study. Aust N Z J Psychiatry 2012;46(11):1089–1098. Doi: 10.1177/0004867412457997
47 Seow LSE, Verma SK, Mok YM, Kumar S, Chang S, Satghare P, et al. Evaluating DSM-5 Insomnia Disorder and the Treatment of Sleep Problems in a Psychiatric Population. J Clin Sleep Med 2018;14 (02):237–244. Doi: 10.5664/jcsm.6942
48 Nutt D, Wilson S, Paterson L. Sleep disorders as core symptoms of depression. Dialogues Clin Neurosci 2008;10(03):329–336. Doi: 10.31887/DCNS.2008.10.3/dnutt
49 Fang H, Tu S, Sheng J, Shao A. Depression in sleep disturbance: A review on a bidirectional relationship, mechanisms and treatment. J Cell Mol Med 2019;23(04):2324–2332. Doi: 10.1111/jcmm.14170
50 Sutton DA, Moldofsky H, Badley EM. Insomnia and health problems in Canadians. Sleep 2001;24(06):665–670. Doi: 10.1093/sleep/24.6.665
51 Dollander M. [Etiology of adult insomnia]. Encefalo 2002;28; (6 Pt 1):493–502

52 Kim Y, Ramos AR, Carver CS, Ting A, Hahn K, Mossavar-Rahmani Y, et al. Marital Status and Gender Associated with Sleep Health among Hispanics/Latinos in the US: Results from HCHS/SOL and Sueño Ancillary Studies. Behav Sleep Med 2022;20(05):531–542. Doi: 10.1080/15402002.2021.1953499
53 Zreik G, Asraf K, Haimov I, Tikotzky L. Maternal insomnia and depressive symptoms and early childhood sleep among Arab and Jewish families in Israel. Sleep Med 2022;100:262–268. Doi: 10.1016/j.sleep.2022.08.015
54 Hirotsu C, Bittencourt L, Garbuio S, Andersen ML, Tufik S. Sleep complaints in the Brazilian population: Impact of socioeconomic factors. Sleep Sci 2014;7(03):135–142. Doi: 10.1016/j.slsci.2014.08.001
55 Rocha FL, Guerra HL, Lima-Costa MF. Prevalence of insomnia and associated socio-demographic factors in a Brazilian community: the Bambuí study. Sleep Med 2002;3(02):121–126. Doi: 10.1016/s1389-9457(01)00119-8
56 Ribeiro TF. Gentrificação: aspectos conceituais e práticos de sua verificação no Brasil. Revista de Direito da Cidade 2018;10(03): 1334–1356. Doi: 10.12957/rdc.2018.31328
57 Slovic AD, Tomasiello DB, Giannotti M, Andrade Mde Fatima, Nardocci AC. The long road to achieving equity: Job accessibility restrictions and overlapping inequalities in the city of São Paulo. J Transp Geogr 2019;78:181–193. Doi: 10.1016/j.jtrangeo.2019.06.003
58 Hayes BL, Vabistsevits M, Martin RM, Lawlor DA, Richmond RC, Robinson T. Establishing causal relationships between sleep and adiposity traits using Mendelian randomization. Obesity (Silver Spring) 2023;31(03):861–870. Doi: 10.1002/oby.23668
59 Rodrigues GD, Fiorelli EM, Furlan L, Montano N, Tobaldini E. Obesity and sleep disturbances: The “chicken or the egg” question. Eur J Intern Med 2021;92:11–16. Doi: 10.1016/j.ejim.2021.04.017
60 Sayre GM. The costs of insecurity: Pay volatility and health outcomes. J Appl Psychol 2023;108(07):1223–1243. Doi: 10.1037/apl0001062
61 Wong WS, Fielding R. Prevalence of insomnia among Chinese adults in Hong Kong: a population-based study. J Sleep Res 2011; 20(1 Pt 1):117–126. Doi: 10.1111/j.1365-2869.2010.00822.x
62 Riemann D, Krone LB, Wulff K, Nissen C. Sleep, insomnia, and depression. Neuropsychopharmacology 2020;45(01):74–89. Doi: 10.1038/s41386-019-0411-y
63 El Rafihi-Ferreira R, Morin CM, Toscanini AC, Lotufo F, Brasil IS, Gallinaro JG, et al. Acceptance and commitment therapy-based behavioral intervention for insomnia: a pilot randomized controlled trial. Br J Psychiatry 2021;43(05):504–509. Doi: 10.1590/1516-4446-2020-0947
64 El Rafihi-Ferreira R, Morin CM, Hasan R, Brasil IS, Ribeiro JHZ, Cecília Toscanini A. A pilot randomized controlled trial (RCT) of acceptance and commitment therapy versus cognitive behavioral therapy for chronic insomnia. Behav Sleep Med 2023;21(02): 193–207. Doi: 10.1080/15402002.2022.2071272

