

Prevalence of binge drinking among medical students in Brazil: A systematic review and meta-analysis

Prevalência de binge drinking entre estudantes de medicina no Brasil: revisão sistemática e metanálise

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ABSTRACT

Introduction: Binge drinking consists of an alcohol consumption pattern that is dangerous for the drinkers and for society. Undergraduate medical students are often exposed to stressful situations, increasing the propensity for psychoactive substance use including excessive alcohol consumption.

Objective: The aim of this study was to develop a systematic review and meta-analysis to estimate the pooled prevalence of binge drinking practiced by Brazilian medical students.

Methods: The search was performed in a standardized way, involving two researchers, and by consulting the PubMed/Medline, SciELO and LILACS databases. A meta-analysis was carried out to estimate the pooled prevalence of binge drinking and 95% Confidence Intervals (95% CI).

Results: We identified 206 records and included 14 studies in the review. The combined prevalence was estimated by the random effect method. Despite the substantial heterogeneity among the studies, the pooled analysis indicated that binge drinking is practiced by 47% of medical students as a whole, in Brazil (95% CI: 38%; 57%), and by 65% (95% CI: 50%; 78%) and 47% (95% CI: 34% to 59%), considering men and women, respectively.

Conclusion: Binge drinking is practiced by almost half of the contingent of our future doctors. These results provide insights as to the choices and decisions that these students make regarding the consumption of potentially dangerous substances for the human health. Despite the high heterogeneity, the magnitude of the binge-drinking problem estimated in this meta-analysis demands an effective involvement of medical schools in Brazil.

Keywords: Binge Drinking; Alcohol Drinking; Students; Medical; Prevalence; Systematic Review.

RESUMO

Introdução: Binge Drinking é um padrão de consumo de álcool perigoso para quem bebe e para a sociedade. Estudantes de medicina são expostos a situações estressantes aumentando a propensão para o uso de drogas psicoativas incluindo o uso excessivo de álcool.

Objetivo: desenvolver uma revisão sistemática e meta-análise para estimar uma medida sumária de prevalência de binge drinking entre estudantes de medicina no Brasil.

Métodos: as buscas foram realizadas de modo padronizado, envolvendo dois pesquisadores, e consultando as bases MEDLINE/PubMed, SciELO e LILACS. A meta-análise foi realizada para estimar a prevalência sumária de binge drinking e os intervalos de confiança (IC) de 95%.

Resultados: Nós identificamos 206 registros e incluímos 14 estudos na revisão. A prevalência combinada foi estimada por efeito randômico. Apesar da substancial heterogeneidade entre os estudos, a prevalência combinada indicou que binge drinking é praticado por 47% (IC 95%: 38%; 57%) dos estudantes de medicina como um todo, no Brasil, e por 65% (IC 95%: 50%; 78%) e 47% (IC 95%: 34% a 59%), considerando homens e mulheres, respectivamente. A heterogeneidade foi alta e não explicada na análise de subgrupos.

Conclusão: binge drinking é praticada por quase metade do contingente de nossos futuros médicos. Esses resultados fornecem indícios sobre as escolhas e decisões que estes estudantes estão fazendo com respeito ao consumo de substâncias potencialmente perigosas para a saúde humana. A despeito da alta heterogeneidade, a magnitude estimada de beber em binge demanda por um efetivo envolvimento das escolas médicas, no Brasil.

Palavras-Chave: Consumo Excessivo de Bebidas Alcoólicas. Consumo de Bebidas Alcoólicas. Estudantes de Medicina. Prevalência. Revisão Sistemática.

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INTRODUCTION

Binge drinking consists of an alcohol consumption pattern that is dangerous for the drinkers and for the society. In 2004, the National Institute on Alcohol Abuse and Alcoholism defined binge drinking based on the minimum number of doses consumed by women (four doses) and men (five doses), during a two-hour interval, a volume that is able to bring one's blood alcohol level to at least 0.08 g/dL¹.

Excessive alcohol consumption is a problem, especially among individuals of college age. Cultural, social, and developmental factors are featured in transition from youth to adulthood and are potentially influenced by the college environment. College attendance increases the risk of binge drinking as a common practice. In this situation, college students experience alcohol use disorders (AUD) that, in turn, result in physical, emotional, social, cognitive and legal consequences².

Undergraduate medical courses shown certain features, such as high workload and medical content, which may affect medical students' quality of life. During the learning phase, medical students are often exposed to stressful situations that may lead to depression and anxiety manifestations³. Under these conditions, they are at risk to start using psychoactive drugs or alcohol or maintaining their previously initiated habits³. It has been reported, for example, that negative internal motivations induce alcohol abuse as a coping mechanism in almost 20% of medical students at five Korean medical schools⁴. A study that investigated psychoactive drug use in four medical schools in Rio de Janeiro estimated a 19.8% prevalence of alcohol abuse and warned that such behavior could be a coping strategy to deal with the medical school demands⁵.

By acknowledging a propensity for psychoactive substance use, including alcohol abuse, during the undergraduate medical education period³, we believe that a national estimate can aid in understanding the magnitude of binge drinking in Brazil, thereby encouraging the implementation of preventive measures, involving Brazilian universities. No meta-analysis addressing the prevalence of binge drinking among medical students in Brazil is, however, available. In this context, the aim of this study was to estimate the pooled prevalence of binge drinking practiced by Brazilian medical students.

METHODS

A systematic review and meta-analysis was designed to answer the research question, phrased in the PICO format⁶, (P = population or medical condition; I = intervention or exposure; C = comparison; O = outcome): "What is the prevalence (O) of binge drinking (E) among medical students in Brazil (P)?"

This review protocol was registered at the International Prospective Register of Systematic Reviews (PROSPERO) under

CRD number 42019138036. Database consultation started in January and ended in June 2020, with a final update performed in June 2021. This systematic review followed the Guidelines for Preferred Reporting Items for Systematic Reviews and Meta-Analyses⁷ and was carried out according to the Measurement Tool to Assess Systematic Reviews-2 (AMSTAR2)⁸.

Information sources and search strategies

The searches were performed at the PubMed/Medline (Medical Literature Analysis and Retrieval System Online), SciELO (Scientific Electronic Library Online) and LILACS (Latin American and Caribbean Literature in Health Sciences) databases. The search strategy included terms in both English and Portuguese and was guided by combinations such as ((binge drinking [All Fields]) OR (alcoholic intoxication [All Fields]) OR (alcoholism [All Fields]) AND (students, medical [All Fields] Fields)) AND (Brazil [All Fields])) at the Medline database via PUBMED, (binge drinking [Words] OR alcoholism [Words] AND medical students [Words]) at LILACS and (binge drinking [All Indices] OR (intoxication) alcoholic [All ratings] OR (alcoholism [All ratings]) AND (medical students [All ratings]) and (Binge Drinking [All ratings]) OR (Alcoholic intoxication [All ratings]) OR (Alcoholism [All indices] AND (Medical students) at the SciELO database, in both Portuguese and English. To address gray literature, the first 200 Google Scholar records were searched using a more flexible search strategy. To complete the search, the reference lists of articles read in full were also screened, and e-mail messages were sent to experts in the alcoholism area asking for non-retrieved records.

Eligibility Criteria

As the primary result for this review comprised the prevalence of binge drinking practiced by medical students, the inclusion criteria for the primary studies were based on providing (i) the absolute number of students participating in the study; and (ii) the absolute number of students practicing binge drinking. When necessary, the authors were contacted to obtain data not directly available in the published articles.

Studies addressing medical students along with students from other health area careers or undergoing medical treatment, and those that measured binge drinking using a definition not consistent with the pattern based on the number of alcohol doses were excluded from the analysis.

Data collection and variables of interest

Two researchers were responsible for the study selection and data extraction, which were carried out independently. Data selection was performed in two stages, initially by reading the titles and abstracts and, later, by full article reading.

Disagreements observed at any stage were solved by consensus. The entire process was supervised by a third researcher, whose opinion settled any inconsistencies and disagreements. The searches were not restricted by language.

We selected data from the study identification (author, year, journal), medical school characteristics (administrative category, location), student features (gender, course period, alcohol use patterns) and measurement instruments. All data were recorded in a form created specifically for this study.

Quality assessment of the included studies

Quality assessment followed the criteria developed by Loney et al (1998) to specifically assess incidence and prevalence studies⁹. This questionnaire consists of eight items and the total score ranges from zero to eight. The same reviewers also independently performed the quality assessment of the selected studies.

Statistical analyses

The procedures for obtaining summary measures via random effects models, in addition to fixed effects modeling, were employed using the metaprop package¹⁰. Metaprop is designed to develop a proportion meta-analysis and 95% confidence intervals (CI) using the R Platform, version 4.0.3, following a hands-on tutorial¹¹.

Statistical heterogeneity was assessed by Cochran's Q statistic, interpreted via chi-square statistics and p values (5% significance level). The I² statistic provides the degree of inconsistency among studies and was used as recommended by Higgins et al (2003)¹² to obtain the proportion of the total variation not attributed to chance. The measure ranges from 0 to 100% and was interpreted considering cutoff points of 25% (small), 50% (moderate) and 75% (high).

Assuming sex-differentiated binge drinking behaviors, additional sex-stratified meta-analyses were conducted. Possible heterogeneity sources were assessed by analyzing subgroups considering medical school features (location and administrative category), as well as the year of study publication (up to 2015 and after 2015).

The effect of publication bias was evaluated by constructing and interpreting a funnel graph and by Egger's test, using the metabias command available in the R Platform.

RESULTS

Study selection and inclusion

This review identified 206 publications using the search strategy at the MEDLINE (n=72), LILACS (n=26), SCIELO (n=33) and CAPES thesis and dissertation (n=63) databases and following a

manual search in the reference lists (n=7) and at other sources, such as Google Scholar (n=5). After excluding duplicates (n=11), ineligible publications (n=156) were discarded according to their titles and abstracts. Complementary reading was indicated for 39 selected texts, but one could not be retrieved, despite requests to the author. Of the retrieved studies, 24 were excluded due to the following reasons: alcohol use definition incompatible with binge drinking (n=18) or incompatibility of the study population (n=6). A total of 14 publications were analyzed in the subsequent steps of this review (Figure 1).

The studies included in this review were conducted in the North (n=1), Northeast (n=4), Southeast (n=7) and South (n=2) regions of Brazil. Together, the studies analyzed 4,256 medical students. The sample size ranged from 111 to 571 students, with six studies reporting over 300 participants, five studies assessing a sample size from 200 to 300 and only three studies reporting the participation of fewer than 200 students. Students were enrolled in educational institutions located in the state capital (n=5), state interior (n=8) and in both locations (n=1). Regarding binge drinking prevalence, a considerable variation in frequencies reported in the selected studies were individually noted, ranging from 19% (13%; 26%)²⁶ to 74% (70%; 78%)²⁴. This indicates the need for the implementation of more in-depth assessments in this regard. Despite the importance of epidemiological measures stratified by sex, the frequencies of binge drinking in men and women were provided in only six studies (Table 1).

Qualitative aspects of the included studies

In general, some data regarding the sampling procedures were not provided in detail. The mean score of the selected studies was 4.5 points, ranging from 2 to 6.5. No study obtained the maximum score (8 points). The best-scoring item concerned the use of a validated measuring instrument, which was positively reported in all 14 studies. On the other hand, item 7, concerning the confidence intervals of the prevalence measures, exhibited the worst scores, given the absence of this information in all included studies. Furthermore, no publications reported financial support or funding sources, with the exception of the Espírito Santo Research Support Foundation (FAPES), cited by Pereira et al (2008)²⁶. Finally, a declaration on conflicts of interest statement was reported by seven^{13-16,18,24,25} studies, but was not even mentioned by the authors of the remaining investigations (Chart 1).

Combined binge drinking prevalence

As we expected statistical (and clinical) heterogeneity to be high, the combined binge drinking prevalence was

estimated by the random effects method. The pooled analysis of all 14 studies indicated that binge drinking is practiced by 47% of medical students in Brazil (95% CI: 38%; 57%),

reaching a pooled prevalence of 65% among men (6 studies, 95% CI: 50%; 78%) and 47% among women (6 studies, 95% CI: 34% to 59%) (Chart 2).

Figure 1. Flowchart of study selection and inclusion.

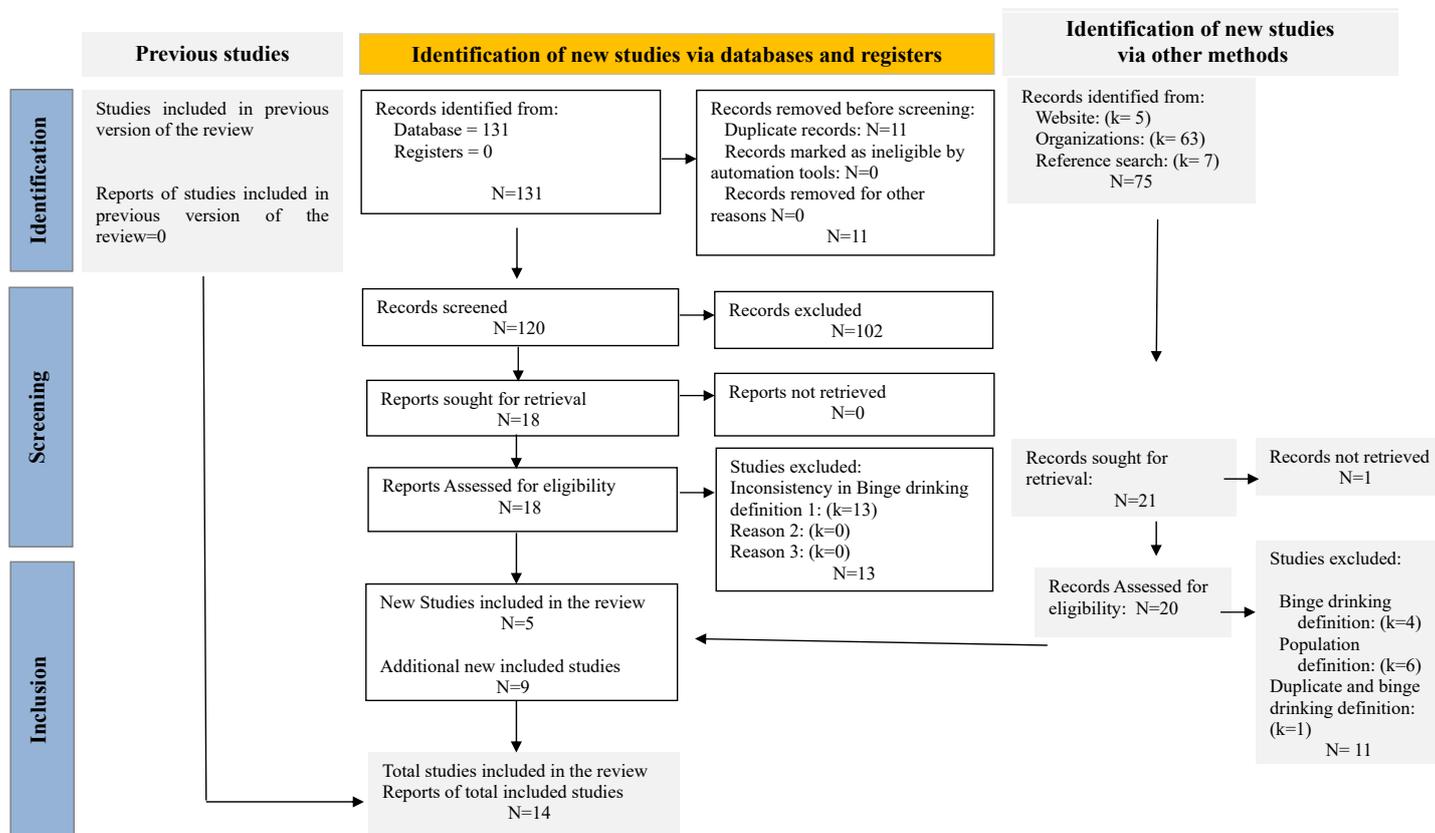


Table 1. Synthesis of the studies included in the meta-analysis.

Identification	Higher Education Institution			Methodological characteristics			Prevalence of binge drinking			
	Authors/ Year	Administration type	Location	Region	Design	Tool	Course semester	Students (n)	Total (%)	Male sex (%)
Scapim et al; 2021 ¹³	Public	Capital	Northeast	Cross sectional	VIGITEL ^a	from 1 st to 8 th	556	36.0	39.0	32.0
Abreu et al; 2018 ¹⁴	Public	Interior	Southeast	Cross sectional	AUDIT ^b	from 1 st to 10 th	201	53.7	69.6	40.4
Aguiar et al; 2018 ¹⁵	Public	Both	Southeast	Cross sectional	AUDIT	3 rd , 6 th and 11 th	371	60.1	NA ^c	NA
Gomes et al; 2018 ¹⁶	Private	Interior	Southeast	Cross sectional	AUDIT	from 1 st to 8 th	265	48.7	58.9	42.9
Pereira HC; 2018 ¹⁷	Public	Interior	Northeast	Cross sectional	AUDIT	from 1 st to 12 th	281	48.8	NA	NA
Pelicioli et al; 2017 ¹⁸	Private	Interior	South	Cross sectional	AUDIT	NI ^d	111	68.5	NA	NA
Maia et al; 2017 ¹⁹	Private	Capital	Northeast	NI	AUDIT	from 1 st to 8 th	291	48.8	61.4	36.3
Mendonça AKRH; 2017 ²⁰	Both	Capital	Northeast	Cross sectional	AUDIT	from 1 st to 12 th	210	55.2	NA	NA
Silva et al; 2017 ²¹	Private	Interior	South	Cross sectional	AUDIT	from 1 st to 12 th	343	63.6	73.7	59.7
Machado et al; 2015 ²²	Both	Interior	Southeast	Cross sectional	AUDIT	from 1 st to 8 th	146	41.1	NA	NA
Ribeiro et al; 2015 ²³	Public	Capital	North	Cross sectional	AUDIT	from 1 st to 12 th	306	27.8	NA	NA
Carneiro et al; 2012 ²⁴	Private	Interior	Southeast	Survey	AUDIT	from 1 st to 8 th	436	74.1	82.4	68.1
Rocha et al; 2011 ²⁵	Both	Interior	Southeast	Cross sectional	AUDIT	from 1 st to 8 th	571	21.7	NA	NA
Pereira et al; 2008 ²⁶	Public	Capital	Southeast	Cross sectional	WHO ^e	from 1 st to 12 th	168	19.0	NA	NA

^aVIGITEL – *Vigilância de Fatores de Risco e Proteção para Doenças Crônicas por Inquérito Telefônico*.

^bAUDIT – Alcohol Use Disorders Identification Test. ^cNA – Not Applicable. ^dNI – Not Informed.

^eWHO – World Health Organization.

Chart 1. Qualitative evaluation of the studies included in the meta-analysis.

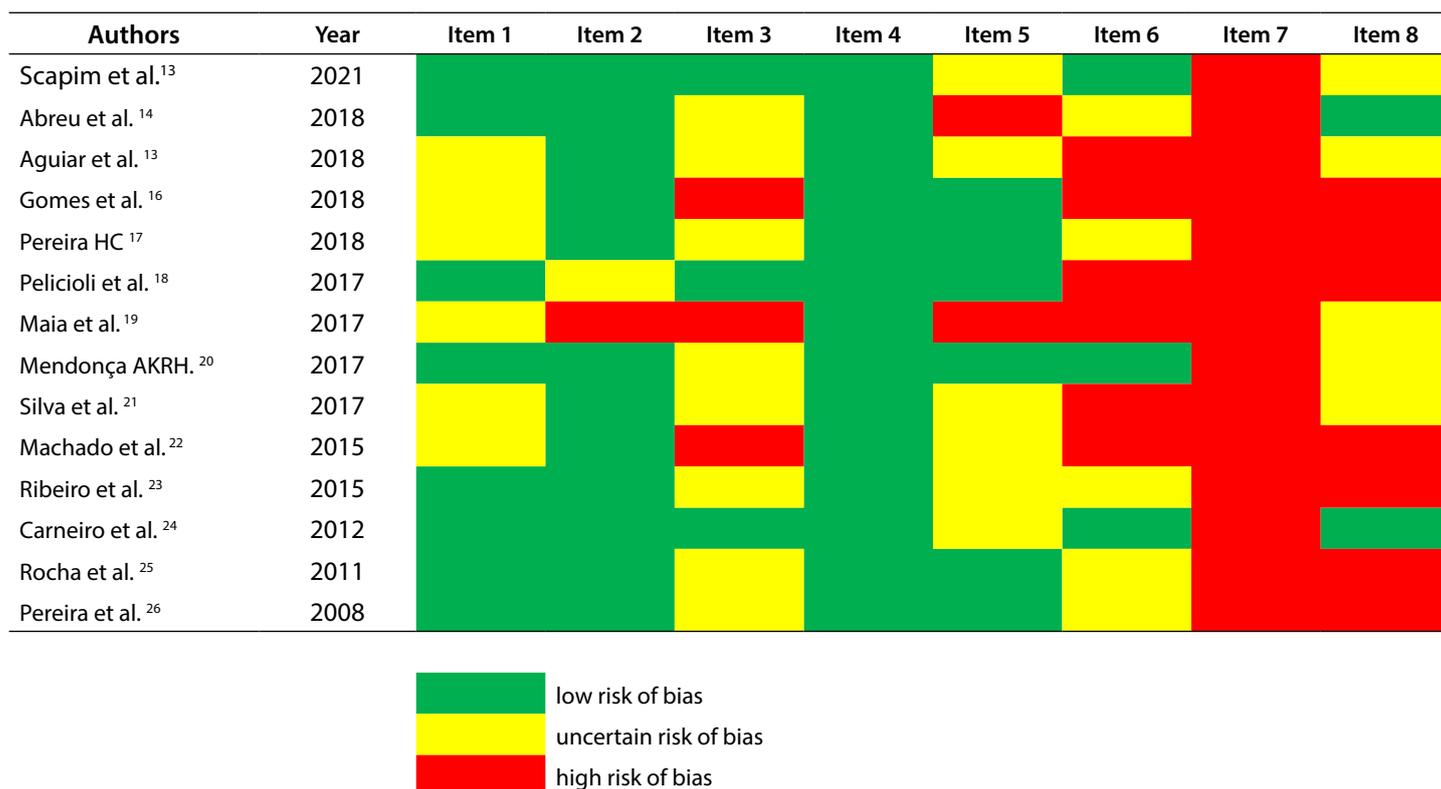
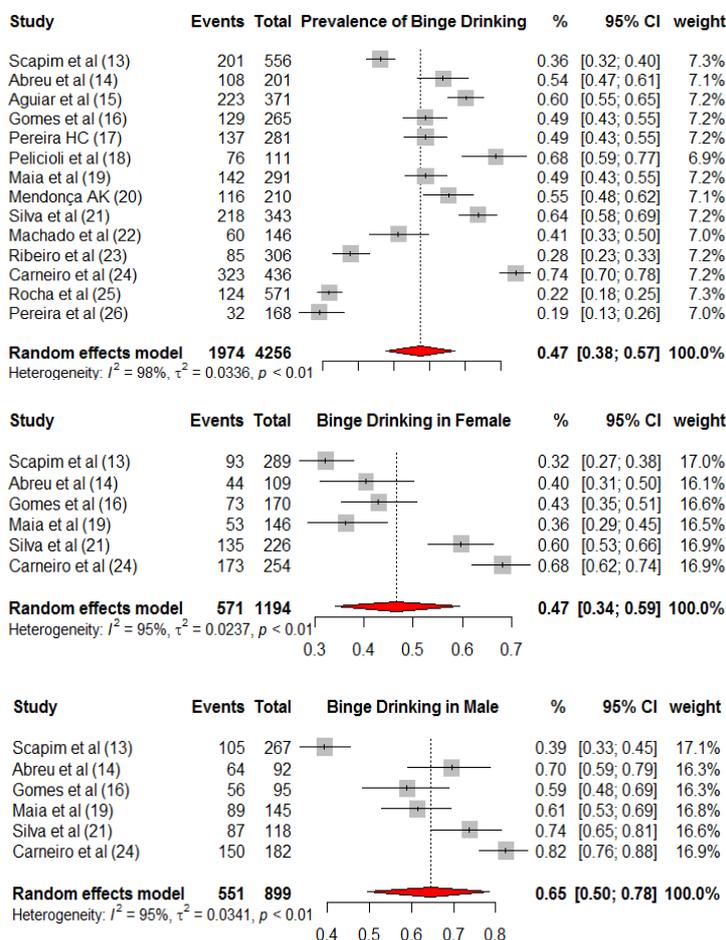


Chart 2. Forest plot of prevalence and confidence intervals estimated in the total population (14 studies), in male (6 studies), and in female (6 studies) students, separately.



Heterogeneity analysis

The meta-analysis with all the 14 studies exhibited high statistical heterogeneity (I^2 : 98.00%; $p < 0.01$), as well as for the 6 studies that included only men (I^2 : 95.00%; $p < 0.001$) and only women (I^2 : 95.00%; $p < 0.001$). Subgroup analyses showed variations according to previously postulated characteristics, such as year of publication (before or after 2015), medical school administration type (public or private), location (capital or interior) and country region (North, Northeast, Southeast, South or Midwest). A high heterogeneity persisted when assessing the different features, suggesting considerable inconsistencies between studies and not a mere chance effect (Table 2).

Publication bias

The inspection of the funnel plot suggests that the findings reported herein are not influenced by the absence of small studies, and Egger’s test was not statistically significant ($p = 0.535$).

DISCUSSION

This systematic review sought to provide a more accurate scenario concerning the prevalence of binge drinking among medical students in Brazil. The pooled measure suggests that almost half (47%) of these students consumes alcoholic beverage amounts above the acceptable limit within a short period of time. This practice is more prevalent in men (65%)

than in women (47%). In addition to the reverse causality that underlies the relationship between alcohol consumption and mental health, binge drinking may lead to a substantial risk of injuries, such as accidents and violence. This, in turn, leads to acute and chronic effects on both individual and collective health, with potential risks for disability and death.

In the United States, a survey conducted by the National Institute on Alcohol Abuse and Alcoholism (NIAAA) estimated that 29.6% of adults aged 18 to 22 practiced binge drinking in the thirty days prior to the data collection²⁷. Another study reported a 58.1% binge drinking prevalence in a sample comprising 485 students from the Georgetown University School of Medicine²⁸. In France, the prevalence measured in the 15 days prior to data collection was 74.8% and involved 302 students²⁹. Data from five medical schools from Korea reported 56% of binge drinking, showing that this behavior was observed throughout all years of the medical course⁴.

Tobacco use, mental disorders, drug use and coping strategies to face day-to-day problems are linked to alcohol abuse among medical students^{28,29}. Regarding binge drinking, some studies associated it to other situations experienced in medical school, such as lower test grades¹³, attending a more advanced medical course phase^{13,14,16} and poor school performance^{19,21}. These studies suggest that factors inherent to the medical school environment may motivate medical students to engage in binge drinking in Brazil.

Table 2. Analysis of subgroups considering 14 studies included in the meta-analysis.

Subgroups	Publication (n)	Prevalence	95% Confidence Intervals	I ² Statistics	P value ^a
<i>Region</i>					
North	n=1	28.00	23.00; 33.00	NA ^b	<0.01
Northeast	n=4	47.00	38.00; 56.00	90.00	<0.01
Southeast	n=7	45.00	28.00; 63.00	98.50	<0.01
South	n=2	65.00	60.00; 69.00	NA	<0.01
<i>Location</i>					
Capital	n=5	37.00	26.00; 49.00	95.20	<0.01
Interior	n=8	52.00	38.00; 67.00	98.10	<0.01
Both	n=1	60.00	55.00; 65.00	NA	<0.01
<i>Type of administration</i>					
Public	n=6	41.00	29.00; 53.00	96.50	<0.01
Private	n=5	61.00	50.00; 71.00	94.40	<0.01
Both	n=3	39.00	18.00; 62.00	97.60	<0.01
<i>Year/publication</i>					
After 2015	n=9	54.00	47.00; 60.00	92.20	<0.01
Up to 2015	n=5	37.00	16.00; 60.00	98.90	<0.01

^aQ Test of Cochran. ^bNot Applicable.

Studies regarding alcohol use and mental health among medical students are not rare in Brazil. For example, a recent systematic review³⁰ aiming to provide a comprehensive picture of mental disorders concluded that problematic alcohol use occurs in 32.9% of medical students, while depression is observed in 30.6%, common mental disorders in 31.5%, burnout in 13.1%, suicidal ideation in 13.4% and poor sleep quality, in 51.5%. The studies included in this review reported a prevalence of 21.17% of common mental disorders¹⁷, 3.59% of addiction patterns detected by the Alcohol Use Disorders Identification Test (AUDIT)²³ and 10.0% of excessive consumption with recommendations to stop drinking²² among binge drinking students. Medication use was also mentioned²¹, as well as experimentation with solvents, cannabis sativa, amphetamines and anxiolytic drugs²⁶.

Binge drinking behavior is still poorly studied, despite the negative potential it may bring to human health. This makes this meta-analysis at the very least, timely, comprising one of the strengths of this study, in addition to the use of a comprehensive search strategy that also includes gray literature. Furthermore, this review, in addition to providing insights into the magnitude of binge drinking, was based on an objective binge drinking definition and included studies that measured alcohol intake by the number of consumed doses. However, Heavy Alcohol Use (more than 3 drinks on any day or more than 7 drinks per week for women, and 4 drinks on any day or more than 14 drinks per week for men) and High-Intensity Drinking (consumption of 2 or more times the gender-specific thresholds for binge drinking) are emerging trends²⁷ that are even less often studied than binge drinking, indicating the need for future assessments.

A high heterogeneity among the studies was noted in the present meta-analysis, involving all studies (n=14), as well as data for men (n=6) and women (n=6), separately. As foreseen in the review protocol, subgroup analyses were performed, but due to the low number of publications stratified by sex, the subgroups were assessed only considering all 14 studies.

The parameters provided for the subgroup analysis, in addition to expressing decreased precision due to the stratification, were not sufficient to explain part of the observed statistical heterogeneity. The prevalence reported in individual studies ranged from 19.0%²⁶ to 74.1%²⁴. Thus, other clinical and/or methodological issues not directly reported in the publications may comprise possible unmeasured heterogeneity sources. Moreover, Brazil is a continental country with great differences experienced by the population groups from its five geographic regions. It may partially explain the variability of prevalence measures, comparing to those found in other countries.

In addition to the unexplained heterogeneity, other limitations for this systematic review are also noted. First, despite the extensive search including gray literature, few studies were obtained, and sample sizes were relatively small. Furthermore, students might not have been sincere when answering the questionnaires, possibly underestimating binge drinking rates.

Publication bias was verified by inspecting the funnel plot and evaluating Egger's test. Although graph symmetry assessments may be inaccurate for extreme proportions, this is a valid approach in the case of measurements around 0.50³¹. Thus, the symmetrical distribution of the studies and the rejection of the null hypothesis that the results might be expressing due to the effect of the absence of small studies, suggest that the estimated parameters are free from publication bias.

CONCLUSIONS

Binge drinking is practiced by almost half of our future physicians. These results provide insights as to the choices and decisions that these students make regarding the consumption of potentially dangerous substances for human health. Despite the high heterogeneity, the magnitude of binge-drinking problem estimated in this meta-analysis demands an effective involvement of medical schools in Brazil, by counseling and other actions to prevent the harmful consequences for medical students and society.

AUTHORS' CONTRIBUTION

Maria Isabel do Nascimento contributed to the study design, supervision, data collection, analysis and writing of the manuscript. Juliana dos Santos Costa contributed to the study design, data collection, writing of the manuscript. Carlos Augusto Ferreira de Andrade contributed to the study design, supervision, data analysis, writing and critical review of the final version of the manuscript. The authors approved the final version of the manuscript and are responsible for its content.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

SOURCES OF FUNDING

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