



REVIEW ARTICLE

Mental health problems among medical students in Brazil: a systematic review and meta-analysis

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Objective: To provide a comprehensive picture of mental health problems (MHPs) in Brazilian medical students by documenting their prevalence and association with co-factors.

Methods: We systematically searched the MEDLINE/PubMed, SciELO, LILACS, and PsycINFO databases for cross-sectional studies on the prevalence of MHPs among medical students in Brazil published before September 29, 2016. We pooled prevalences using a random-effects meta-analysis, and summarized factors associated with MHP.

Results: We included 59 studies in the analysis. For meta-analyses, we identified the summary prevalence of different MHPs, including depression (25 studies, prevalence 30.6%), common mental disorders (13 studies, prevalence 31.5%), burnout (three studies, prevalence 13.1%), problematic alcohol use (three studies, prevalence 32.9%), stress (six studies, prevalence 49.9%), low sleep quality (four studies, prevalence 51.5%), excessive daytime sleepiness (four studies, prevalence 46.1%), and anxiety (six studies, prevalence 32.9%). Signs of lack of motivation, emotional support, and academic overload correlated with MHPs.

Conclusion: Several MHPs are highly prevalent among future physicians in Brazil. Evidence-based interventions and psychosocial support are needed to promote mental health among Brazilian medical students.

Keywords: Mental health; depression; medical students; mental disorders

Introduction

Mental health problems (MHPs) and mental distress can significantly impair quality of life¹ and empathy.² Furthermore, higher mental well-being is positively associated with empathy³ and negatively associated with suicidal ideation, unprofessional behaviors, and burnout.⁴ From this perspective, MHPs may have a serious impact on a student's life, affecting capacity to organize highly demanding study hours, socialize, and perform academically. Among students of the health professions, this could affect patient care, since empathy and professionalism might be impaired.

The literature reports that medical students display poorer psychosocial wellbeing when compared to peers of the same age⁵ and exhibit higher prevalence of depression and burnout than the general population,⁶ presumably due to the intense workload expected. In particular, a number of potentially stressful factors have been reported among Brazilian medical undergraduates. These include a highly stressful environment, competitiveness, excessive workload, sleep deprivation, peer pressure, and many

other personal, curricular, institutional, and affective factors.^{1,7,8} Additionally, undergraduate medical education in Brazil is facing new challenges, such as conciliating a Unified Health System (SUS)-centered national curriculum guideline with the psychosocial needs of students⁸ within the framework of a 6-year curriculum divided into three cycles: a basic (preclinical) cycle, a clinical-theoretical cycle, and the more practical "internship" cycle.

Research into factors associated with MHPs is important for the development of interventions, especially at this paradigm-changing stage of curriculum planning. Factors known to be associated with MHPs in medical students include female gender,^{9,10} maladaptive personalities,⁹ financial difficulties,¹⁰ pre-existing mental health problems,¹¹ and exposure to an older, fragmented, and more theoretical curricular structure.¹²

In a study of 62,728 medical students, the overall prevalence of depression was reported to be 28.0%.¹³ Existing systematic reviews and meta-analyses on this issue have been generated for medical students from Asia,^{14,15} North America,⁹ English-speaking countries outside North America,¹⁶ and more globally.^{13,17} To our knowledge, only one review¹⁸ relates to Brazilian medical students, but was limited to a range of depressive and anxiety disorders and did not include statistical analysis or provide a detailed description of methodology to enable future replication.

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This study aims to provide a comprehensive insight into Brazilian medical student mental health, by addressing the following questions relating to medical students in Brazil: 1) what is the prevalence of MHPs and 2) which co-factors are associated with MHPs. We hypothesized that the most investigated MHPs would be depression, anxiety, and burnout; that clinically significant depression would affect a significant proportion of medical students; and that female students would be generally more affected by mental health issues, given this trend in the general public.

Methods

We registered the protocol of this review in the International Prospective Register of Systematic Reviews (PROSPERO; record no. CRD42016048236).¹⁹

Searches

On September 29, 2016, one reviewer (JPP) searched MEDLINE (via PubMed) from 1966 to 2016, SciELO from 1909 to 2016, LILACS from 1980 to 2016, and PsycINFO from 1927 to 2016. The review team developed a common search strategy, including terms related to Brazil, medical students, mental health, mental disorder, and other related terms. The complete search strategy is available from the registered protocol.¹⁹ We did not apply limitations to the search. In addition, we manually screened the references of the included papers for potential inclusion in the review.

Inclusion criteria

We only included cross-sectional studies that evaluated the prevalence of MHPs amongst medical students in Brazil. We included studies if: 1) they were cross-sectional; 2) they assessed medical students enrolled in Brazilian medical schools; 3) they reported prevalence of one or more MHPs. For this review, we defined an MHP as any diagnosable mental disorder or symptom of mental disorder (e.g., depression, burnout, suicidal ideation).

Exclusion criteria

We excluded studies if: 1) they included medical student participants with non-medical students in the same group, but provided no subgroup analysis; 2) MHPs were not the main focus of the questionnaire/diagnostic instrument (e.g., the focus was quality of life); 3) they used instruments not validated for the Portuguese language and for Brazilian populations (linguistic and cultural validation was required); or 4) the full study was not available.

Outcomes

The primary outcomes for this review were the prevalence of depression and common mental disorders (CMD). The secondary outcomes were the prevalence of other MHPs and factors associated with MHPs.

Study selection and data extraction

Two review team members (JPP and HTG) independently screened titles and abstracts, assessed studies for eligibility, and performed data extraction. Any discrepancies in study selection were resolved through discussion with a third reviewer (GCP). We used the Preferred Reporting Items for Systematic Reviews and Meta-Analyses²⁰ (PRISMA) flow chart to illustrate the study selection process (Figure 1).

The data extracted from each study included: study characteristics (e.g., location, sample size), participant characteristics (e.g., mean age, gender), and results for the prevalence of MHPs and factors associated with MHPs. Detailed information on data extraction is provided in the protocol.¹⁹ We requested missing data (such as exact number of participants, mean age, and gender) from study authors as necessary.

Risk of bias assessment

Two authors (JPP and HTG) assessed reporting of ethical approval and appraised the studies using the risk-of-bias tool developed by Hoy et al.²¹ We used this tool because it addresses external and internal validity and has high inter-rater agreement.²¹ We omitted the last item of the tool ("Summary item on the overall risk of study bias") because of its subjectivity. We resolved disagreements by discussion. We used ratings to generate a quality index for the quality-effects²² (QE) meta-analysis.

Data synthesis and statistical analysis

We used the Meta-analysis of Observational Studies in Epidemiology (MOOSE) statement²³ to guide the reporting of this review.

When studies provided appropriate data, we pooled the results using a random-effects (RE) model, thus reporting the aggregate prevalence, corresponding p-value, and 95% confidence interval (95%CI). We used double arcsine transformation and normalized prevalence data after pooling and back-transformation.²⁴ We presented the results in forest plots. We also performed a sensitivity analysis to examine whether use of a QE model²² produced a substantial difference in the results. We investigated the QE model because it accounts for study quality and leads to a distinctly conservative confidence interval when heterogeneity exists.²² When two or more studies reporting the same mental health problem were based on the same database, we selected only one for the quantitative synthesis, favoring the study that was first published. We selected this criterion because additional studies have focused on particular subgroups, which could augment their contribution to the meta-analysis results.

We assessed heterogeneity using the I^2 statistic. We considered an I^2 value of 75 to 100% to represent high heterogeneity.^{25,26} When at least 10 studies²⁵ were available for a meta-analysis, we investigated heterogeneous results through subgroup analysis and meta-regression. For subgroup analyses, we considered the following characteristics: 1) gender; 2) study cycle (the Brazilian medical school years are divided into three

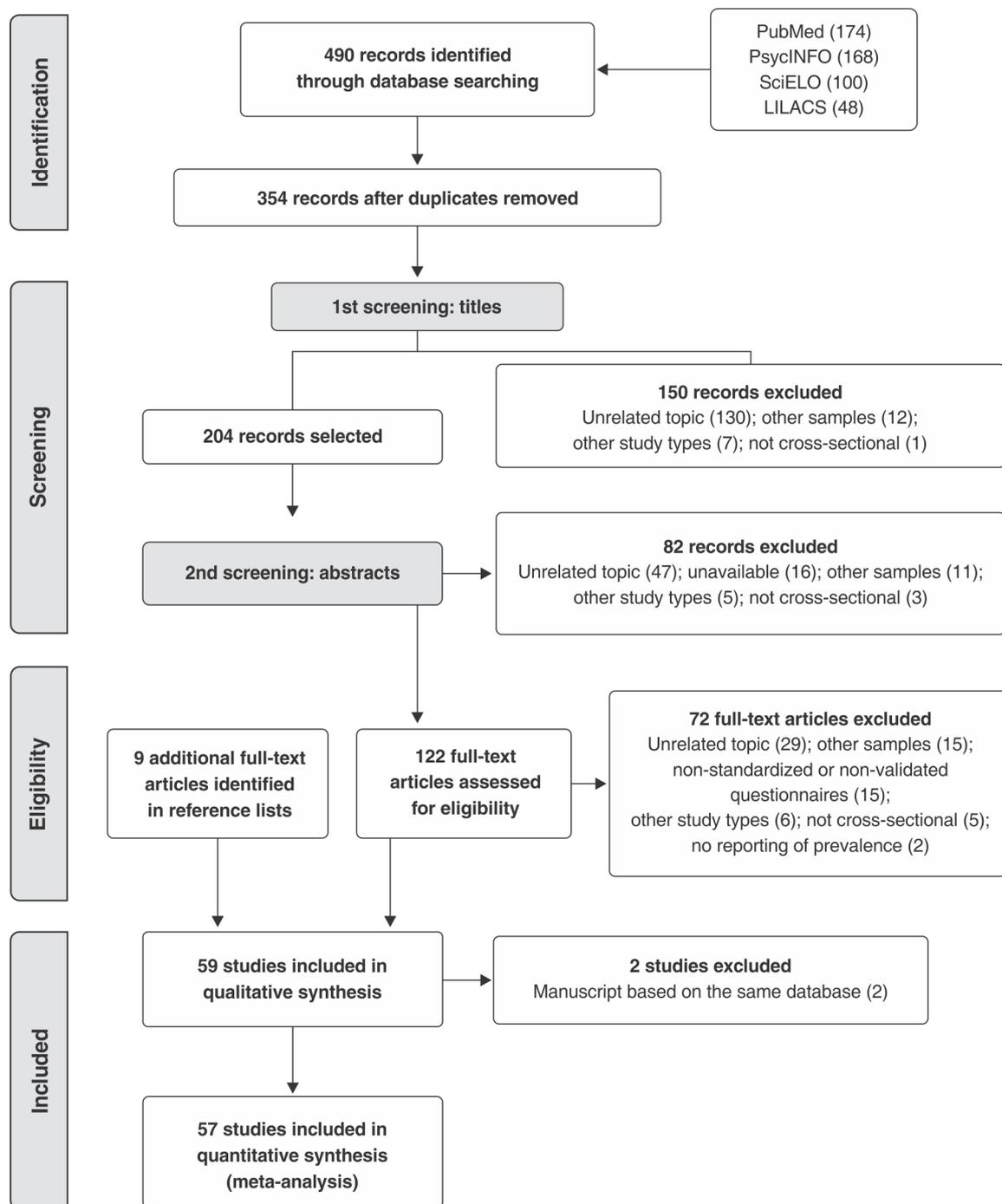


Figure 1 Flow diagram of study inclusion.

cycles of 2 years each); 3) country region where the school is located; 4) cutoff scores (when we noted variation between studies); 5) symptom severity; and 6) risk-of-bias score. For the meta-regression, we considered: 1) proportion of male students; 2) age; and 3) risk-of-bias score. We divided studies into low (≥ 0.9) and high (< 0.9) risk of bias. We assessed evidence of publication bias by Egger's regression method,²⁷ when at least 10 studies were available.²⁵ We performed meta-analyses using MetaXL version 5.3 (EpiGear International, Sunrise

Beach, Queensland, Australia), and carried out meta-regression and Egger's regression method using the "metafor" function in R software version 3.2.0 (R Foundation for Statistical Computing, Vienna, Austria).

Results

We included 59 studies²⁸⁻⁸⁶ in the qualitative analysis, and 57^{28-37,39-52,54-86} studies involving a total of 18,015 medical students in the quantitative analysis (Table 1). All

Table 1 Selected characteristics of the 59 studies of mental health problems amongst medical students in Brazil included in qualitative analysis of a 2016 systematic review and meta-analysis

Study (date)	Region of Brazil	Students (n)	Mean age (years)	Male (%)	Mental health problem assessed/Instrument
Abrão (2008) ²⁸	SE	400	NR	44	Depression/BDI
Aguiar (2009) ²⁹	NE	199	22	54.5	Stress/LSSI
Alberton (2013) ³⁰	S	391	NR	48.8	Disordered eating patterns/EAT
Alexandrino-Silva (2009) ³¹	SE	338	22.4	31	Depression/BDI; suicidal ideation/BSI; hopelessness/BHS
Almeida (2007) ³²	NE	223	22	50.2	Common mental disorders/SRQ-20
Almeida (2016) ³³	NE	376	22.1	41.1	Burnout syndrome/MBI-HSS
Amaral (2008) ³⁴	CW	287	21.3	45.7	Depression/BDI
Amorim (2008) ⁷⁸	SE	285	21.1	47	Potentially hazardous alcohol intake/AUDIT
Amorim (2012) ³⁵	NE	203	NR	NR	Potentially hazardous alcohol intake/AUDIT
Baldassin (2006) ³⁶	SE	472	21.9	40.5	Trait anxiety/STAI-T
Baldassin (2008) ³⁷	SE	481	21.9	40.5	Depression/BDI
Baldassin (2013) ^{38*}	SE	481	NR	40.5	Depression/BDI
Baldisserotto (2005) ⁷⁹	S	378	22.6	59	Common mental disorders/SRQ-20
Baltieri (2015) ³⁹	SE	100	21.4	100	Depression/BDI
Bassols (2008) ⁸⁰	S	78	22	56.4	Stress/LSSI
Bassols (2014) ⁴⁰	S	232	23.1	50.4	Depression/BDI; anxiety/BAI
Bassols (2015) ⁴¹	S	232	23.1	50.4	Stress/LSSI
Brunch (2009) ⁸¹	S	233	NR	NR	Depression/BDI; trait anxiety/STAI-T
Cardoso (2009) ⁴²	CW	234	23.7	65.8	Low sleep quality/PSQI
Castaldelli-Maia (2012) ⁴³	SE	732	NR	36.6	Depression/BDI
Costa (2010) ⁴⁴	NE	473	22.6	49.7	Common mental disorders/SRQ-20
Costa (2012) ⁴⁵	NE	84	24.2	51.2	Depression/BDI
Costa (2012) ⁴⁶	NE	369	22.4	50.4	Burnout syndrome/MBI-HSS
Costa (2014) ⁴⁷	NE	93	NR	NR	Common mental disorders/SRQ-20
Cunha (2009) ⁴⁸	SE	295	21.2	41.9	Common mental disorders/SRQ-20
Danda (2005) ⁴⁹	NE	410	21.7	53.1	Excessive daytime sleepiness/ESS
Di Pietro (2009) ⁵⁰	SE	164	NR	NR	Concern with body shape/BSQ
Facundes (2005) ⁵¹	NE	141	NR	NR	Common mental disorders/SRQ-20
Fiorotti (2010) ⁵²	SE	229	NR	50.2	Common mental disorders/SRQ-20
Furtado (2003) ⁸²	SE	178	22.2	41	Stress/LSSI
Gavioli (2009) ^{53*}	SE	455	NR	38.8	Common mental disorders/SRQ-20
Guimarães (2005) ⁸³	SE	413	22.5	43.6	Stress/LSSI
Hidalgo (2002) ⁵⁴	S	342	NR	58.2	Common mental disorders/SRQ-20; excessive daytime sleepiness/ESS
Hirata (2007) ⁵⁵	NE	161	22.1	47.8	Depression/BDI
Leao (2011) ⁵⁶	SE	156	24.6	56	Depression/BDI; anxiety/BAI
Lima (2006) ⁵⁷	SE	455	NR	38.8	Common mental disorders/SRQ-20
Loayza (2001) ⁵⁸	S	302	20.5	60.9	Common mental disorders/SRQ-20
Macedo (2009) ⁵⁹	SE	290	21.6	41	Depression/BDI
Moro (2005) ⁶⁰	S	140	NR	NR	Depression/BDI
Nicoli (2011) ⁶¹	SE	110	NR	40.2	Compulsive eating/BES
Pagnin (2014) ⁶²	SE	127	21.4	45	Depression/BDI; Anxiety/BAI; excessive daytime sleepiness/ESS; low sleep quality/PSQI
Pagnin (2015) ⁶³	SE	193	21.4	46.1	Low sleep quality/MSQ; depression/BDI
Paro (2010) ⁶⁴	SE	385	22.3	38.7	Depression/BDI
Paula (2014) ⁶⁵	NE	652	22.7	41.1	Depression/BDI-II
Porcu (2001) ⁸⁴	S	126	NR	55.6	Depression/BDI
Rique (2014) ⁶⁶	NE	221	22.3	55.7	Low sleep quality/PSQI; excessive daytime sleepiness/ESS
Rocha (2013) ⁶⁷	NE	354	NR	50.5	Common mental disorders/SRQ-20
Santos (2011) ⁶⁸	NE	234	NR	NR	Burnout syndrome/MBI-HSS
Serra (2015) ⁶⁹	SE	657	22.7	38.8	Depression/BDI; anxiety/BAI
Silva (2014) ⁷⁰	SE	434	22	41.9	Common mental disorders/SRQ-20
Silveira (2014) ⁷¹	S	152	25.2	36.2	Potentially hazardous alcohol intake/AUDIT
Souza (2010) ⁸⁵	S	359	21.3	43.4	Depression/BDI; anxiety/STAI
Souza (2005) ⁷²	NE	562	21.5	57	Stress/GHQ
Tabalipa (2015) ⁷³	S	262	23	43.9	Depression/BDI; anxiety/BAI
Tempeski (2015) ⁷⁴	All	1,350	22.8	47.1	Depression/BDI; anxiety/STAI
Torres (2016) ⁷⁵	SE	471	22.5	41.6	Obsessive-compulsive disorder/OCI-R; Depression/BDI
Vallilo (2011) ⁸⁶	SE	400	22.6	44	Depression/BDI
Vasconcelos (2015) ⁷⁶	NE	234	22	34.2	Anxiety and depression/HADS
Volcan (2003) ⁷⁷	S	165	NR	58.8	Common mental disorders/SRQ-20

AUDIT = Alcohol Use Disorders Identification Test; BAI = Beck Anxiety Inventory; BDI = Beck Depression Inventory; BDI-II = Beck Depression Inventory, version II; BES = Binge Eating Scale; BHS = Beck Hopelessness Scale; BSI = Beck Scale for Suicidal Ideation; BSQ = Body Shape Questionnaire; CW = Center-West; EAT = Eating Attitudes Test-26; ESS = Epworth Sleepiness Scale; GHQ = General Health Questionnaire; HADS = Hospital Anxiety and Depression Scale; LSSI = Lipp's Stress Symptoms Inventory; MBI-HSS = Maslach Burnout Inventory-Human Service Survey; MSQ = Mini-Sleep Questionnaire; NE = Northeast; NR = not reported; OCI-R = Obsessive-Compulsive Inventory-Revised; PSQI = Pittsburgh Sleep Quality Assessment; S = South; SE = Southeast; SRQ-20 = 20-item Self-Report Questionnaire; STAI = State-Trait Anxiety Inventory; STAI-T = Trait Anxiety Inventory.

* Not included in the quantitative synthesis.

forest plots are available on request from the authors. We conducted subgroup analyses for depression and CMD (Tables 2 and 3).

Prevalence of mental health problems

Depression

In an analysis of 25 studies, the summary prevalence of depression among medical students in Brazil was 30.6% (95%CI 24.0-37.7, $p \leq 0.01$, $I^2 = 97.96\%$). Table 2 reports stratified prevalences of depression.

The prevalences of depression were significantly different when using medium (32.9%, 95%CI 28.9-37.2) vs. higher (9.9%, 95%CI 6.5-14.1) cutoff scores. When stratified by symptom severity, aggregate prevalence was 23.3% (95%CI 19.3-27.6) for students with mild symptoms, 8.4% (95%CI 5.4-12.0) for moderate symptoms, and 2.1% (95%CI 0.8-4.0) for severe symptoms. For meta-regression, only the risk-of-bias score was significant ($\beta = 0.7937$, $p = 0.0092$).

Common mental disorders

CMDs can be translated as an indicator of a non-psychotic mental disorder,⁸⁷ evaluated by the 20-item Self-Report Questionnaire (SRQ-20). The questionnaire assesses 20 somatic, mood and anxious symptoms. It is not a diagnostic instrument, but a community screening tool, and cutoff scores may vary according to the cultural context in which it is administered.

The prevalence of CMDs among medical students in Brazil was 31.5% (95%CI 26.1-37.1, $p \leq 0.01$, $I^2 = 92.67\%$), based on 13 studies. Simple meta-regression showed that both risk-of-bias score ($\beta = 0.4986$, $p = 0.0029$) and percentage of male students ($\beta = -0.0100$, $p < 0.01$) were significant, but only the percentage of male students was significant when both variables were included in the regression.

We detected minimal variation in cutoff scores for CMD, and severity of symptoms is not reported for CMD. Thus, subgroup analyses were not conducted by these characteristics. When prevalences were stratified by region, students from the South region of the country

Table 3 Subgroups analyses of prevalence of common mental disorders among medical students in Brazil

Subgroups	Studies (n*)	RE model pooled prevalence% (95%CI)
Gender		
Female	7	37.1 (30.0-44.4)
Male	7	31.9 (23.8-40.4)
Cycle studied		
Basic	6	37.4 (31.1-43.8)
Clinical	6	42.8 (35.3-50.3)
Internship	6	34.6 (24.5-45.2)
Region of Brazil		
Southeast	4	38.1 (29.5-47.1)
South	4	21.1 (18.9-23.6)
Northeast	5	31.5 (26.1-37.1)

95%CI = 95% confidence interval; RE, random-effects.

* n indicates number of studies.

Table 2 Subgroup analyses of prevalence of depression among medical students in Brazil

Subgroups	Studies (n*)	RE model pooled prevalence% (95%CI)
1 Severity (score) [†]		
Mild	17	23.3 (19.3-27.6)
Moderate	15	8.4 (5.4-12.0)
Severe	16	2.1 (0.8-4.0)
2 Cutoff (score) [‡]		
Low (≥ 4)	2	51.5 (12.8-89.5)
Medium (≥ 10 to ≥ 12)	18	32.9 (28.9-37.2)
High (≥ 15 to ≥ 20)	4	9.9 (6.5-14.1)
3 Gender		
Female	8	26.8 (19.0-35.2)
Male	8	17.0 (12.0-22.5)
4 Cycle studied		
Basic	9	30.9 (16.5-46.8)
Clinical	5	33.8 (6.6-65.1)
Internship	6	29.4 (12.3-48.7)
5 Region of Brazil		
Southeast	14	29.1 (18.6-40.3)
South	6	34.3 (26.3-42.6)
Northeast	4	30.4 (25.6-35.6)
Center-West	1	26.7 (24.0-37.7)

95%CI = 95% confidence interval; RE = random-effects.

* n indicates number of studies.

[†] The scores juxtapose between studies using the Beck Depression Inventory (BDI-I or II), e.g., mild severity has been considered by authors as ≥ 4 to ≤ 9 or ≥ 15 to ≤ 20 points in different studies; the total possible score is 63.

[‡] Cutoff scores were divided by the review team into low (≥ 4), medium (≥ 10 to ≥ 12), and high (≥ 15 to ≥ 20) out of a possible 63 points for the 24 studies that used the BDI-I or II.

showed a significantly lower prevalence (21.1%, 95%CI 18.9-23.6) compared to those from the Southeast (38.1%, 95%CI 29.5-47.15) and Northeast (31.5%, 95% CI 26.1-37.1) regions (Table 3).

Other mental health problems

Analysis of three studies yielded a summary prevalence of burnout of 13.1% (95%CI 10.2-16.4) among medical students in Brazil. One study reported the prevalence of current suicidal ideation and hopelessness through standardized and validated tools. The prevalences were, respectively, 13.4% and 95.5%.

Four studies reported prevalences of trait anxiety (89.6%, 95%CI 43.3-100.00), two of state anxiety (62.1%, 95%CI 0.00-100.00), six of anxiety in a general sense (32.9%, 95%CI 22.0-44.9), six of stress (49.9%, 95%CI 57.8-53.0), and one of obsessive-compulsive disorder (3.8%). Pooled data from three studies yielded an aggregate prevalence of problematic alcohol use of 32.9% (95%CI 29.3-36.6). The aggregate prevalence of low sleep quality was 51.5% (95%CI 21.2-81.2, pooled data from four studies), while that of excessive daytime sleepiness was 46.1% (95%CI 37.7-54.5, pooled data from four studies).

The prevalence of compulsive eating and disordered eating patterns was 10.9% and 10.0% respectively (data from one study). Disordered eating patterns were more prevalent among females (17.0%) than males (2.6%). One study investigated concern over body shape, but only reported prevalences for females (21.1%) and males (9.5%) independently.

Factors associated with mental health problems

To balance the effect of multiple comparisons (see paragraph on limitations, Discussion section) and for ease of interpretation, we assessed factors that showed significant correlations in more than one study or those significant after multivariate analyses (Table 4). Female gender was significantly associated with depression, anxiety, and stress, while male gender was more associated with burnout. Thoughts of dropping out, later stages of the course, little involvement in leisure activities, lack of emotional support, and academic overload were correlated with MHP.

Assessment of publication bias, quality of studies, and sensitivity analysis

We found no significant evidence of publication bias in the 25 studies that investigated depression ($p = 0.0658$) or in the 13 studies that investigated CMD ($p = 0.6542$). We did not conduct such analyses for the other conditions because too few studies were available.

Risk-of-bias tool scores ranged from 5 to 10 out of a possible 10 points (table available on request from the authors). As noted above, risk-of-bias score was the only significant factor in the meta-regression analysis for depression, while for CMD it was significant on simple meta-regression. Studies with low risk of bias tended to report higher prevalences of depression (37.4%, 95%CI 27.4-47.7) and CMD (37.7%, 95%CI 31.0-44.6), than those with high risk of bias (30.6% [95%CI 24.0-37.7] and

Table 4 Factors associated with mental health problems among medical students in Brazil, according to studies included in a 2016 systematic review and meta-analysis

Mental health problem	Positive association ⁽ⁿ⁾ , $p \leq 0.05$
Depression	Female gender ^{(6)*} ; desire to switch courses ^{(2)*} ; later stages of the course ^{(2)*} ; internship cycle ^{(2)*} ; clinical cycle ⁽³⁾ ; dissatisfaction with the course ⁽²⁾ ; tobacco smoking ⁽²⁾ ; average (compared to good) academic performance*; difficulties in relationships*; emotional tension*; evening-type preference*; feeling pressured by parents*; having concerns over the future*; not having a parent who was a physician*; not participating in social activities*, parents were physicians*; poor or reasonable physical health*, thoughts of dropping out*; religion other than Catholic*, sedentary life style*; sporadic or rare involvement in leisure activities*; uncertainty about professional future.*
Common mental disorders	Not receiving sufficient emotional support ^{(5)*} ; difficulty making friends ^{(4)*} ; thoughts of dropping out ^{(2)*} ; feelings of rejection ^{(2)*} ; academic overload ^{(2)*} ; few leisure activities ⁽³⁾ ; financial problems ⁽³⁾ ; not satisfied with professional choice ⁽²⁾ ; clinical cycle ⁽²⁾ ; feeling rejected by peers/friends ⁽²⁾ ; history of psychological treatment ⁽²⁾ ; sleep pattern disorder*; sedentary life style*; not working*; not having a car*; lack of confidence in acquisition of skills*; feelings of discomfort in relation to the activities of medical school*; unmatched expectations about the course*; prior diagnosis of mental disorder*; emotional tension and feelings of unhappiness*; long-lasting difficulty asking questions during classes due to shyness*; arousal during the night*; insomnia*; daytime sleepiness*; less than 7 hours of sleep per night*; poor self-evaluation of academic performance*; difficulty initiating sleep*; difficulty maintaining sleep*; falling asleep later*; waking up earlier*; low social interaction.*
Burnout	Lack of confidence in acquisition of skills ^{(2)*} ; thoughts of dropping out ^{(2)*} ; male gender ⁽²⁾ ; having failed examinations*; feeling uncomfortable in academic activities*; not seeing coursework as a source of pleasure.*
Anxiety	Female gender ^{(3)*} ; parents were not physicians*; feeling pressured by parents.*
Stress	Female gender ⁽⁵⁾ ; first year of the course*; lower family income*; dissatisfaction with the course*; using escape/avoidance as coping strategy.*
Low quality sleep	Cynicism*; emotional exhaustion.*
Excessive daytime sleepiness	Emotional exhaustion*; decreased academic efficacy*; cynicism.*
Obsessive-compulsive disorder	Depressive symptoms*; first year of the course*; adaptation difficulties.*

n = number of studies in which the association was found (minimum = 1).

*Significant after multivariate analysis (logistic regression).

31.5% [95%CI 26.1-37.1] respectively). However, the difference was not significant. Sensitivity analysis showed no significant difference between results for the QE model, when compared to the RE model.

Discussion

Our findings support those from other parts of the world,^{9,13-17} emphasizing how prevalent depression and other mental disorders are among medical students. Among the included studies, more had been published from 2010-2016 than during the entire preceding decade. This draws attention to the fact that, although these issues have long been reported, they continue to be common in the lives of medical students, possibly contributing to the high prevalence of MHPs among physicians.^{88,89}

We report that a high proportion of Brazilian medical students are suffering from various MHPs. These include psychological stress, anxiety, depression, sleep pattern disorders, burnout, eating disorders, and potentially hazardous alcohol use.

The most prevalent mental health problem that fitted the meta-analysis was trait anxiety (89.6%), indicating that most medical students have a considerably permanent tendency to experience anxiety, stress, and worries.⁹⁰ Yates et al.¹¹ observed, in a retrospective survey, that medical students with a mental health problem were more inclined to have a pertinent pre-admission mental health history. Moreover, Puthran et al.¹³ have found a tendency of depression prevalence to decline in later years of the medical course. These findings suggest that the high levels of mental disorders among medical students may not be predominantly due to a toxic learning environment, as some authors have argued,^{7,91} but rather to the contribution of the characteristics of individuals selected through a highly competitive entrance exam. Other hypotheses are that final-year students might be receiving more treatment or feeling more fulfillment from their professional choice as they become more in charge of patient care. In the worst-case scenario, those more severely depressed students have already dropped out. This does not mean that students with MHPs should not receive appropriate support within their higher-education institutions. It is precisely because these high prevalences are observed that we believe an open, non-stigmatized communication should exist between students and the institution, especially during the early years of training.

Our analysis showed that depressive symptoms, when stratified by severity, are predominantly mild – an evaluation that was not done in previous reviews.^{13,17} Assessment of symptom severity in depression is based on the number of symptoms, functional impairment, and suffering imposed by symptoms.⁹² Following this construct, which is also used by depression scales,^{92,93} mild depression imposes just the number of symptoms required for diagnosis or a few more, and produces only mild social/occupational impairment.⁹⁴ It is different from minor or minimal or subthreshold depression,⁹⁵ and benefits from evidence-based treatment (e.g., cognitive-behavioral therapy or interpersonal therapy, alone or in combination with antidepressants⁹⁶). The extent to which

mild depression symptoms affect the lives of medical students should be investigated in future longitudinal studies. However, our finding is not completely unexpected. Because depression can be a debilitating disorder, only students that were performing academic activities at the times of data collection were appraised, making students that dropped out or were absent due to a mental disorder not visible to the study (see paragraph on limitations below).

Many MHPs and their correlations intersect, suggesting that they might be coexistent in high-risk groups of students. Female students tended to have higher prevalences of depression and CMD. Additionally, female gender was associated with mood and anxiety disorders, while male gender was associated with burnout. Similar gender differences are also observed in the general population and in medical students from other parts of the world.^{9,97,98} Modifiable stressors also need to be addressed to improve well-being. As a recent systematic review⁹⁹ revealed, there is no satisfactory evidence that learning environment interventions could contribute to improved mental well-being in medical students; additional high-quality research is needed in this area. We observed that signs of lack of motivation (e.g., thoughts of dropping out, dissatisfaction with the course, decreased academic efficacy) and lack of emotional support were associated with MHP, as in medical students from other countries.⁹ The use of portfolios,¹⁰⁰ self-assessments,¹⁰¹ and continued mentorship¹⁰² in undergraduate medical education could improve students' engagement and reflection about the course, alleviating sources of distress and helping students perceive their coursework as a gratifying activity. A drop in academic performance can be an indicative of a mental disorder. This is a key marker, because academic records are usually easily available to tutors. Future studies could consider the efficacy of using this kind of information to identify students that are potentially in decline.

This review has important limitations. We extracted data from cross-sectional studies to summarize associated factors; therefore, we must note that this type of study design is not suitable for making causal inferences. Also, many studies made simultaneous multiple comparisons between subgroups, possibly generating false-positive results. Obvious heterogeneity existed among studies. We consider that risk of bias is a relevant reason that can contribute to inter-study differences, as indicated by the meta-regression. Still, most of the heterogeneity remains unexplained. Neyman bias (where most severe cases would be inadvertently excluded from the study, e.g. due to hospitalization; also called survival bias) is an example of bias that is unlikely to be described, inadvertently leading to more optimistic findings. Prevalence values can also differ when researchers use different time frames, environments, or data collection methods. There is no consensus as to the ideal cutoff score for depression, and we observed significant differences in prevalence values for studies that used different cutoff scores. For most of the outcomes, few studies were available, possibly leading to skewed results. No study reported the prevalence of psychotic or personality disorders,

suggesting that this is a gap in the literature. Finally, the tools used do not aim at diagnosis. This could result in larger prevalences, since sensitivity is commonly preferred when using screening tools.

On the basis of this review, the pooled prevalences of depression, anxiety, CMD, and problematic alcohol use among medical students in Brazil ranged from 30.6 to 32.9%. Approximately half of the students were experiencing low sleep quality, and 46.1% experienced excessive daytime sleepiness. Burnout affected approximately 13% of students. These findings suggest that future physicians are at great risk of depression, anxiety, alcohol-related, sleep, and eating disorders. Our findings are in line with studies reporting MHPs among medical students in other countries, which suggests the existence of a global problem. Signs of lack of motivation, insecurity, poor academic performance, financial problems, and lack of emotional support were all associated with MHPs, and constitute modifiable stressors that could be targets for novel interventions. As Brazilian medical students are at high risk of MHPs, it is imperative that psychosocial support be provided within higher-education institutions and that students be monitored for frequency and severity of these problems. Evidence-based interventions are needed to promote well-being and mental health.

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Disclosure

The authors report no conflicts of interest.

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