ORIGINAL ARTICLE

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Prevalence and factors associated to depression and suicidal behavior among medical students

Prevalência e fatores associados a depressão e comportamento suicida entre estudantes de medicina

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ABSTRACT

Objective: Depression and suicidal behavior have been described as major problems among medical students. The aim of this study was to assess the prevalence of depression and suicidal behavior among medical students of an institution and to investigate possible associated variables. **Methods:** The authors carried out a cross-sectional study through a self-administered questionnaire, including the Beck Depression Inventory (BDI) and the Beck's Suicide Intent Scale (BSIS) instruments. The diagnosis of depression was based on an instrument adapted according to the DSM-IV and ICD-10 criteria. Logistic regression was performed to search for depression predictor variables. **Results:** In a total of 381 students, the prevalence of depression was 27.6%. Suicidal ideation of moderate to severe intensity was observed in 10.5% of the sample. About 6% of students had previously attempted suicide. Consumption of licit and illicit drugs was frequent among the participants, reaching 78% and 24% of the sample, respectively. The demand for specialized treatment was lower than expected among students with depression. Logistic regression revealed that female gender, reduced interpersonal contact with friends, reduced physical activity, difficulty in facing new situations and high perception of personal pressure were risk factors for depression. **Conclusion:** The prevalence of depression and suicidal behavior among medical students is higher than in the general population. There is a need for further studies to enable a better understanding of the risk factors and variables at play, which is fundamental for the development of early intervention strategies and support for students.

KEYWORDS

Medical students, depression, suicide.

RESUMO

Objetivo: Depressão e comportamento suicida têm sido descritos como problemas importantes entre estudantes de medicina. O objetivo deste estudo foi avaliar a prevalência de depressão e de comportamento suicida entre estudantes de medicina de uma instituição e investigar possíveis variáveis associadas. **Métodos:** Os autores realizaram um estudo transversal por meio de um questionário autoaplicável, incluindo os instrumentos Inventário de Depressão de Beck (BDI) e Escala de Intenção Suicida de Beck (BSIS). O diagnóstico de depressão foi baseado em instrumento adaptado de acordo com os critérios do DSM-IV e da CID-10. Foi realizada análise de regressão logística para avaliar variáveis preditoras de depressão. **Resultados:** Em um total de 381 alunos, a prevalência de depressão foi de 27,6%. A ideação suicida de intensidade moderada a grave foi observada em 10,5% da amostra. Cerca de 6% dos alunos já haviam tentado suicídio. O consumo de drogas lícitas e ilícitas foi frequente entre os participantes, atingindo 78% e 24% da amostra, respectivamente. A demanda por tratamento especializado foi menor do que o esperado entre os alunos com depressão. A regressão logística revelou que o sexo feminino, a redução do contato interpessoal com os amigos, a redução da atividade física, a dificuldade de enfrentar novas situações e a alta percepção de pressão pessoal foram fatores de risco para depressão. **Conclusão:** A prevalência de depressão e comportamento suicida entre estudantes de medicina é maior do que na população em geral. São necessários mais estudos para permitir uma melhor compreensão dos fatores de risco em jogo, o que é fundamental para o desenvolvimento de estratégias de intervenção precoce e apoio a esses estudantes.

PALAVRAS-CHAVE

Estudantes de medicina, depressão, suicídio.

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INTRODUCTION

Medical students represent a high-risk group for mental disorders[1]. The worldwide prevalence of depression and depressive symptoms in this population is around 27%, higher than that found in the general young population (9.3%) and in non-medical undergraduate students (21%)[2,3]. Data indicate that the situation among Brazilian medical students follows a similar trend, with a prevalence of depression of approximately 30%[4].

During the medical course, students are exposed to various stressors that are perceived individually, depending on each one's emotional, cultural, socioeconomic and educational backgrounds[5,6]. However, in a broad way, the literature points out risk factors for the emergence of depression and suicidal ideation during medical training, such as high workload, large volume of theoretical content, insecurity related to entering the labor market, demands from society and educational institutions, in addition to excessive self-demand[1,7,8]. Still, it has been shown that a small fraction of these students actually seek treatment, even with high levels of distress[9,10].

Students with depression present impaired learning, insecurity, low self-esteem, difficulty in handling challenging situations and making assertive decisions, and all these skills are required in medical school[11-13]. Outcomes can range from dropping out of the course to complete suicide. The estimated 12-month prevalence of suicidal ideation among medical students worldwide is 11.1%[3].

Physicians are one of the highest risk groups for suicide and it seems that this problem arises during medical school[14-17]. Research suggests that, in their first year of studies, medical students have rates of mental health disorders similar to the age-matched general population[18,19]. Yet, their mental health deteriorates as they progress through medical school and continues to decline when they enter the workforce.

About 1 million people die from suicide every year and the rate of suicide has increased by 60% globally in the past 45 years[20]. In Brazil, official data show that, only between the years 2000 and 2016, the suicide mortality rate increased by 60%, placing the country among the nine with the highest suicide rate in the world[21]. About 29% of suicide attempts in the country occur in people aged 20 to 29 years. Between 2011 and 2016, the suicide mortality rate in this same age group was 6.8/100,000 inhabitants[21]. Suicide is one of the leading causes of death among young people.

Faced with this scenario, the World Health Organization (WHO) recognized suicide as a public health priority, highlighted in the WHO Mental Health Gap Action Program (mhGAP), launched in 2008[22]. This document concentrated technical guidance and incentives for countries to develop mental health programs. In addition, in the WHO Mental Health Action Plan 2013-2020, the Member States of the organization committed to work to reduce the suicide rate by 10% by 2020, a goal that seems to have been frustrated at the end of this period[23].

Depression is one of the main risk factors for suicide and the information available on the causes or consequences of depression in medical students is still scarce[24]. A better understanding of the epidemiology of suicidal attempts among medical students could assist the development of better early screening and intervention mechanisms for those population groups. This work aims to contribute to the construction of knowledge on this complex phenomenon.

METHODS

This is a cross-sectional study, carried out with students (n = 381) from the medical course of the Pontifical Catholic University of Minas Gerais (PUC Minas), from the first to the sixth years, between March 2018 and February of 2019.

Data were collected through the application of an anonymous, voluntary, self-applicable questionnaire, evaluating sociodemographic, clinical and behavioral aspects (including use of psychoactive substances), the Beck Depression Inventory (BDI)[25,26], the Beck's Suicide Intent Scale (BSIS)[26,27] and a symptom questionnaire adapted from module A of the Mini International Neuropsychiatric Interview (MINI)[28]. This instrument is based on the diagnostic criteria for Major Depression under the 4th edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) and the 10th edition of the International Statistical Classification of Diseases and Related Health Problems (ICD-10).

Data were analyzed statistically using SPSS 19 and PSPP 1.2.0 software. Comparisons between categorical variables were performed using the chi-square test. Comparisons between continuous variables with normal distribution were performed using the Student's *t* test. In order to assess the impact of independent variables on the expression of depressive syndromes, binary logistic regression analysis was performed. Significance was set at 0.05.

Data collection was carried out after approval by the Ethics Committee of PUC Minas. The Participant's Free and Informed Consent Form was signed by all participants.

RESULTS

Sociodemographic characteristics

A total of 381 students were included in the study. The mean age was 22.85 (±3.55) years. There was a predominance of female participants (68.1%) and most of the students were enrolled between the first and fourth years of the course. Other data regarding the sociodemographic characteristics of the sample are shown in Table 1.

Table 1. Sociodemographic characteristics of the sample

	n	%
Sex		
Female	256	68.1
Male	120	31.9
Course cycle		
Basic (1st to 4th semester)	149	39.5
Clinical (5th to 8th semester)	159	42.2
Internships (9th to 12th semester)	69	18.3
Place of birth		
Belo Horizonte	204	54.1
State of Minas Gerais (except Belo Horizonte)	147	38.9
Other states in Brazil	21	5.6
Other countries	5	1.3
Living situation		
Alone	104	27.4
Accompanied	275	72.6
Funding resource		
Does not use	232	61.4
FIES	83	22.0
Prouni	33	8.7
Institutional/union scholarship	28	7.4
FIES + scholarship	2	0.5
Romantic relationships		
Yes	182	47.9
No	198	52.1

FIES: *Fundo de Financiamento ao Estudante do Ensino Superior* (Higher Education Student Financing Fund) – program of the Ministry of Education of Brazil, created in 1999, intended to finance the graduation in higher education of students enrolled in private institutions. Prouni: *Programa Universidade para Todos* (University for All Program) – program of the Federal Government of Brazil, created in 2004, with the objective of granting full and partial scholarships in undergraduate and sequential courses of specific training, in private institutions of higher education.

Use of psychoactive substances

The consumption patterns of licit or illicit drugs by the students were investigated. Table 2 shows the lifetime prevalence of psychoactive substances use and the current frequency of psychoactive substances use by the participating students. About 78% of the participants had already used alcohol or tobacco at some point in their lives. With regard to illicit drugs, this rate reached approximately 24% of the sample, with emphasis on the use of cannabis.

Prevalence of depression, suicidal ideation and history of suicide attempts

The prevalence of major depression was 27.6% in the sample. About 17.3% of students who answered the questionnaire had suicidal ideation in the week before the study and 6% had a lifetime history of attempted suicide, according to the BDI and the BSIS. According to BSIS, 6.2% of the participants presented suicide intention of moderate intensity and 4.3% of high intensity.

Table 2. Psychoactive substances (PS) use by students in the sample

	n	%
Lifetime PS use		
Alcohol	295	78.0
Cigarettes/tobacco	297	78.4
Illicit drugs	90	23.8
Cannabinoids	43	11.4
Stimulants and synthetics	15	4.0
Opioids	2	0.5
Solvents	4	1.1
Current frequency of PS use		
Alcohol		
Never	9	3.0
01 to 03 doses/week	185	62.5
04 to 06 doses/week	53	17.9
07 to 09 doses/week	23	7.8
>10 doses/week	26	8.8
Cigarretes/Tobacco		
Never	297	78.4
Eventually	72	19.0
Every day	10	2.6
Illicit drugs		
Never	228	76.2
Rarely	59	15.6
Eventually	29	7.8
Every day	2	0.5

Psychological and psychiatric treatment

In Table 3, we present the data referring to students undergoing psychological and psychiatric treatments, grouped according to the presence of major depression. We observed that, although students diagnosed with depression receive psychological and psychiatric treatment at a higher frequency than students without this diagnosis, this proportion is still lower than the prevalence of depression observed in the sample.

Table 3. History of psychological and psychiatric treatment according to the diagnosis of depression

	Major depression				p
	Yes		No		
	n	%	n	%	
Psychological treatment					
Current	21	20.0	32	11.8	0.040*
Past	50	47.6	119	43.9	
Not	34	32.4	120	44.3	
Psychiatric treatment					
Current	18	17.1	10	3.7	<0.001***
Past	26	24.8	49	18.1	
Not	61	58.1	211	78.1	

*p<0.05; ***p≤0.001.

Comparison of characteristics between students with and without depression

In Table 4, we present data on the sociodemographic and clinical characteristics of the participants, grouped according to the presence of depression. Depression was more frequent among female participants enrolled in the clinical course of the cycle (i.e., between the 5th and 8th semesters), who lived alone. There was no difference regarding age. Depressed students had higher BDI and BSIS scores. The presence of depression was associated with less involvement in activities such as meeting friends, participating in social and cultural events and practicing sports. On the other hand, depressed students reported lower degree of satisfaction with the course and showed a tendency towards increased perception of stressors, such as academic overload, personal pressure, difficulty in dealing with patients or new situations and lack of time for extra-academic activities. Aspects related to intrinsic religiosity (importance attributed to spiritual beliefs) and extrinsic religiosity (frequency of religious practice) were also evaluated, without differences between the groups (p = 0.112 and p = 0.939, respectively).

Table 4. Comparison of characteristics between students with and without depression

	Major depression				p
	Yes		No		
	n/mean	%/(SD)	n/mean	%/(SD)	
Sex					
Female	83	79.0	170	63.4	0.004**
Male	22	21.0	98	36.6	
BDI	17.8	(8.5)	7,1	(5.4)	<0.001***
BSIS	4.15	(6.3)	1,23	(3.8)	<0.001***
Previous suicide attempts					
Never	84	86.6	192	95.5	0.016*
One attempt	8	8.2	7	3.5	
More than one attempt	5	5.2	2	1.0	
Course cycle					
Basic (1st to 4th semester)	38	36.2	111	40.8	0.021*
Clinical (5th to 8th semester)	55	52.4	104	38.2	
Internships (9th to 12th semester)	12	11.4	57	21.0	
Place of birth					
Belo Horizonte	55	52.4	148	55.0	0.463
State of Minas Gerais (except Belo Horizonte)	40	38.1	106	39.4	
Other states in Brazil	9	8.6	12	4.5	
Other countries	1	0.9	3	1.1	
Romantic relationship					
Yes	44	41.9	137	50.4	0.589
No	61	58.1	135	49.6	
Living situation					
Alone	41	39.0	62	22.9	0.002**
Accompanied	64	61.0	209	77.1	
Alcohol use					
Yes	81	78.6	211	77.6	0.263
No	22	21.4	61	22.4	
Illicit drugs use					
Yes	27	25.7	63	23.2	0.680
No	78	74.3	208	76.8	
Frequency of alcohol use					
1 to 3 doses/week	54	71.1	129	61.7	0.307
4 to 6 doses/week	14	18.4	39	18.7	
7 to 9 doses/week	3	3.9	20	9.6	
>10 doses/week	5	6.6	21	10.0	

	Major depression				p
	Yes		No		
	n/mean	%/(SD)	n/mean	%/(SD)	
Stress relief activities					
Meet friends	81	77.1	246	90.4	0.001***
Date with romantic partner	45	42.9	131	48.2	0.355
Participates in social/cultural events	74	70.5	218	80.1	0.044*
Reads literary books	26	24.8	66	24.3	0.934
Stay with family	67	63.8	200	73.5	0.063
Use of alcoholic beverages	45	42.9	108	39.7	0.576
Use of cigarettes/tobacco	11	10.5	22	8.1	0.462
Use of illicit drugs	6	5.7	11	4.0	0.484
Practice sports	3	2.9	30	11.1	0.012**
Degree of satisfaction with the course					
Bad	3	2.9	0	0	<0.001***
Reasonable	14	13.5	10	3.7	
Good	45	43.3	92	34.4	
Excellent	42	40.3	166	61.9	
Stress factors					
Large volume of contents	76	72.4	155	57.0	0.006**
High workload	73	69.5	138	50.7	0.001***
Academic curriculum	68	64.8	131	48.2	0.004**
Personal pressure	92	87.6	201	73.9	0.004**
Labor market	35	33.3	77	28.3	0.339
Facing new situations	32	30.5	46	16.9	0.012*
Contact with patients	13	12.4	16	5.9	0.035*
Lack of time for him/herself, friends and family	78	74.3	125	46.0	<0.001***
Lack of leisure time	75	71.4	113	41.5	<0.001***

BH: Belo Horizonte; MG: Minas Gerais.

*p<0.05; **p≤0.01; ***p≤0.001.

Characteristics of suicidal behavior in the sample

In the studied sample, the diagnosis of depression was associated with an increase in the expression of suicidal intention – odds ratio: 6.5629 (95% CI: 3.4635 to 12.4358); relative risk: 4.5450 (95% CI: 2.6925 to 7.6720). The same relationship was observed for the recording of suicide attempts – odds ratio: 3.3016 (95% CI: 1.3589 to 8.0217); relative risk: 2.9931 (95% CI 1.3254 to 6.7596). Among students with a history of attempted suicide, there was a significant increase in the demand for psychological ($p < 0.001$) and psychiatric ($p < 0.001$) treatments. The history of attempted suicide negatively correlated with the habit of meeting with friends as a strategy for stress relief ($p = 0.049$). However, it positively correlated with the use of alcohol for the same purpose ($p = 0.025$). Students who had already engaged in suicide attempts reported feeling personal pressure ($p = 0.021$) and lack of leisure time ($p = 0.009$) as stress factors more frequently than those without a history of suicidal behavior.

Logistic regression analysis

Binary logistic regression analysis was performed using the Enter method. The initial model included the variables that were significant in the comparison between the groups, namely: gender, previous suicide attempts, course cycle, housing situation, tension relief activities (meeting friends; participating in social/cultural events; playing sports), degree of satisfaction with the course and stressors (high volume of subjects; high workload; academic curriculum; personal pressure; coping with new situations; contact with patients, lack of time for themselves, friends and family; lack of leisure time). The final model included 293 participants and was composed of the variables described in Table 5. Briefly, the predictive factors for the development of depressive syndromes in the studied population were female gender, decreased contact with friends and reduced sports practice, in addition to a high perception of personal pressure and the fear of facing new situations.

Table 5. Logistic regression's final model

	B	OR	CI 95%	p
Sex (male)	-0.92	0.40	0.19-0.86	0.018*
Meeting friends	-1.17	0.31	0.12-0.83	0.020*
Practicing sports	-1.91	0.15	0.04-0.57	0.005**
Personal pressure	0.89	2.43	1.07-5.52	0.033*
Facing new situations	0.76	2.15	1.06-4.36	0.035*

DISCUSSION

In the present study, the frequencies of depression, suicidal ideation, history of attempted suicide and their associated factors were investigated among medical students at a private Brazilian university. This work contributes to add data to an issue, which, despite being debated since the 1960s, has recently gained the spotlight in the general media and also among researchers and clinicians[7,29].

Despite being a worldwide phenomenon, most of the scientific evidence available on the high prevalence of suicidal behavior among medical students comes from developed countries, and little attention has been paid to low- or middle-income countries[30,31]. However, according to WHO data, 79% of the suicides occurred exactly in low- and middle-income countries in 2016[32]. Brazil occupies the first position in the ranking of countries in Latin America with the highest rate of depression and suicide[33]. Thus, the investigation of depression and suicidal behavior in Brazilian medical students is warranted.

Through a broad survey, we found that the prevalence of depression in the studied group was 27.6%. This data is in line with the international literature and Brazilian studies[1-3,34]. According to WHO data, the prevalence of depression in the Brazilian general population is 5.8%[33]. Surprisingly, from an epidemiological point of view, this data puts medical students on an equal footing with patients affected by clinical conditions traditionally associated with depressive disorders, such as stroke, myocardial infarction or epilepsy, in which the prevalence of depression is around 29%, 28.7% and 23.1%, respectively[35-37]. This data corroborates the idea that medical students constitute a risk group for the development of depression.

We also observed that 17% of students had suicidal thoughts at the time of study. In 10.5% of the students this ideation was of moderate/high intensity. Six percent of students had previously attempted suicide. According to a study carried out in several European countries, the prevalence of suicidal ideation in the week prior to the assessment in the general population can vary significantly according to geography, ranging from 1.1 to 19.8% when cases of mild to severe intensity are included[38]. Other authors, however, claim that suicidal ideation is a worldwide problem, regardless of geographic location, for both Western and non-Western countries[39]. According to these authors, the prevalence of suicidal ideation would not differ significantly between countries on different continents or locations. The magnitude of suicide ideation specifically among medical students in 13 Western and non-Western countries has ranged from 1.8% to 53.6%. Brazilian data are scarcer, but a community-based study found that the 12-month prevalence of suicidal ideation was 5.3%[40]. Thus, we can assume that the frequency of suicidal thoughts in the group of medical students is really above the population average, once more indicating risk.

Recently, Tsegay *et al*. conducted a systematic review and meta-analysis that assessed the occurrence of suicide attempts among medical students[34]. The work included 14 studies carried out between 1981 and 2020, involving 26,393 students from 14 countries. The pooled prevalence estimate of lifetime suicidal attempt among medical students was found to be 2.19%; for studies conducted in high-income countries it was 1.60% and for low and middle-income countries it was 4.02%; among male students it was 3.85% and among female students it was 7.32%. The overall 12-month prevalence of suicidal attempts was 1.64.

In addition to the fact that the majority of students are in a crucial transition period, since most mental disorders start in late adolescence and early adulthood, medical training itself is known to require a lifestyle that can often hamper self-care[5,7]. Sometimes, even before entering college, the students are exposed to great personal pressure, which extends beyond the following years of graduation[15]. During the medical course, they experience multiple stressors, often in conditions of vulnerability and without adequate support, which can lead to negative consequences to their lives[41,42]. Thus, we aimed to evaluate variables that could be associated with the development of depression and suicidal behavior in this group.

In our study, depression was more common among female students, those who lived alone and those who were enrolled in the intermediate, or clinical, cycle of the course. The predominance of depressive disorders among women is recognized in the literature, both in the general population and in university students, as pointed out by a recent meta-regression analysis[43]. The disparity between

gender continues in professional life, as indicated by another meta-analysis carried out with medical students and medical professionals, which showed that psychological distress was greater for female doctors and medical students than for their male counterparts[44]. The literature reports that women attempt suicide or have thoughts of suicide three times more than men, even though the reasons for this difference remain unclear. Some theories have already been proposed, such as greater female vulnerability to psychosocial suffering due to hormonal differences, psychosocial stresses and the behavioral model of learning helplessness[31].

Living alone is another risk factor associated with depression[45]. As pointed out by Gishen, students are subject to many stressors that arise from their particular circumstances[7]. Some report feeling anonymous, isolated, superfluous or that they do not belong or are not valued, especially in big cities and large medical schools.

The intermediate cycle represents a point of transition of the course, in which the students begins their contact with patients from a new perspective, approaching professional practice as a doctor, but still unable to fully exercise it. They can be affected by the powerlessness and uncertainty that clinical practice can provoke. It is a moment when the anguish of dealing with the suffering of sick people is confronted with the student's own choices and resources and this can lead to the emergence of a personal crisis. There is evidence that active coping strategies, such as talking to family and friends, positive framing, exercising, and leisure activities, can reduce the level of perceived stress among college students[46,47].

In this sense, we observed that students with depression reported greater difficulty in dealing with patients and in facing new situations. They expressed a greater perception of academic overload, lack of time for extra-academic activities and personal pressure. The presence of depression was also associated with less involvement with cultural and social activities, contact with friends and physical activities. All of these factors may corroborate the observation that depressed students expressed less overall satisfaction with the medical course. The literature has shown that mental health problems can appear due to situations such as setting high goals that are not finally met, such as satisfaction with the academic results[48]. Some students can be affected by an intensely competitive environment, in which they must adjust to the "average" among their high-performance peers, having previously stood out as exceptional. There may be additional pressure for publications and other curriculum-building achievements since the beginning of medical school. In addition, literature lists information overload, academic burden, unfavorable opinion with the teaching received, lack of leisure time, financial debt, being away from home, sleep deprivation, exposure to death of patients and contact with suffering as reasons to explain the high rates of depression, burnout and vulnerability to suicidal ideation among medical students[49-51].

In our sample, depression was correlated with increased expression of suicidal ideation and with a history of previous suicide attempts. Students with a history of suicide attempts were less likely to meet friends and had a greater perception of personal pressure and lack of leisure time. Although there was no difference in the use frequency of legal and illegal psychoactive substances among all students, whether depressed or not, it was observed that those with a history of suicide attempts tended to perceive the use of alcohol as a source of relief, as opposed to those without suicidal behavior. Other studies also found an association between alcohol consumption and suicidal behavior among medical students[1]. This may suggest deficiencies in coping strategies that deserve further investigation.

The presence of depression and suicidal ideation was associated with a greater search for psychological and psychiatric treatment. However, these rates were lower than those that would be expected considering the prevalence of depression in the sample. In the case of psychiatric treatment, this rate was even lower, which may be associated with the stigma related to psychiatric care. Lauber *et al*., in a study conducted in Switzerland, identified that the use of antidepressants for the treatment of depression was considered beneficial by only 23% of a sample of the general population, while 38% considered this approach harmful[52]. In that study, it was also suggested that the stigma related to mental illness generates prejudice, impaired self-care, reduced self-esteem, social discrimination and a worse prognosis. It could be argued that, because they have greater technical knowledge, this effect would not be reproduced in a population of medical students. However, the evidence points to just the opposite: despite relative easy access to medical care, medical students are often reluctant to seek psychiatric help[53]. They report concerns about time, confidentiality, stigma, and the potential negative effects on their careers as potential impediments[54]. All of these variables are associated with undertreatment of medical students for mental health problems.

The final model of logistic regression encompassed five variables: female gender, greater personal pressure, less contact with friends, fear of facing new situations and reduced practice of physical activities. With respect to the latter, several studies have shown that physical exercise can induce physiological changes in the body, which in turn can reduce stress levels or mitigate the stress response[55-59]. Accordingly, the negative effects of stress can be reduced, as well as mood and positive affect can be stimulated. Considering the prevention and treatment of mental health problems, physical exercise and, especially, outdoor activities have been suggested as particularly beneficial. In this sense, a recent systematic review has shown that exposure to

the outdoors and nature has a positive effect on various emotional aspects related to stress relief[59]. Indeed, in a study involving Norwegian university students, Grasdalsmoen *et al*. reported that physical exercise was negatively associated with all measures of mental health problems and suicide in a dose-response manner, especially in relation to the frequency of physical exercise[60].

The relationship between depressive disorders and the variables described above is possibly bidirectional and the cross-sectional design of the work does not allow inferring causality. This constitutes a limitation of this study, as well as the fact that the studied population is restricted to a single private educational institution, which may reduce its external validity. Another limitation is the use of self-administered questionnaires, which do not require the personal assessment of a clinician in defining the diagnosis. However, the observation of data in line with national and international epidemiological findings, the use of validated and standardized instruments and the broad evaluation of students allowed to draw a reliable and detailed profile of students.

Research has reported that medical schools admission processes are prone to a selection bias for individuals at risk for depressive disorders and suicidal ideation. This vulnerability would be represented by personality traits such as perfectionism, obsession, neuroticism, and introversion, as well as low self-esteem[61,62]. The data found in our study encourage a more in-depth assessment of this population, such as for the identification of personality styles, psychiatric comorbidities, perception of stress or patterns of coping strategies related to the development of maladaptive behaviors.

There is evidence in the literature that the adoption of programs that promote mental health education and aim to reduce stigma, associated with a counseling system with trained professionals and well-designed screening tools that actively recruit individuals at risk of suicide can have significant beneficial effects[63,64]. In the same way, the WHO has recently recommended the creation of mental health services for university students[65]. Understanding all these issues can allow educational institutions to improve the methods of timely identifying students at risk and institute prevention and early intervention strategies for the phenomenon of depression and suicidal behavior in medical school, in order to hinder negative consequences, including the risk of suicide once students become practicing physicians.

CONCLUSIONS

The prevalence of depression and suicidal behavior among medical students is higher than in the general population. There is a need for further studies to enable a better understanding of the risk factors and variables at play, which is fundamental for the development of early intervention strategies and support for students.

INDIVIDUAL CONTRIBUTIONS

All listed authors made substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data; drafted the article or revised it critically for important intellectual content; and approved the final version to be published.

CONFLICTS OF INTEREST

The author declare no conflict of interest.

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