

Depression, stress and anxiety in medical students: A cross-sectional comparison between students from different semesters

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SUMMARY

Objective: To compare the prevalence of anxiety, depression, and stress in medical students from all semesters of a Brazilian medical school and assess their respective associated factors.

Method: A cross-sectional study of students from the twelve semesters of a Brazilian medical school was carried out. Students filled out a questionnaire including sociodemographics, religiosity (DUREL – Duke Religion Index), and mental health (DASS-21 – Depression, Anxiety, and Stress Scale). The students were compared for mental health variables (Chi-squared/ANOVA). Linear regression models were employed to assess factors associated with DASS-21 scores.

Results: 761 (75.4%) students answered the questionnaire; 34.6% reported depressive symptomatology, 37.2% showed anxiety symptoms, and 47.1% stress symptoms. Significant differences were found for: anxiety – ANOVA: [$F = 2.536$, $p=0.004$] between first and tenth ($p=0.048$) and first and eleventh ($p=0.025$) semesters; depression – ANOVA: [$F = 2.410$, $p=0.006$] between first and second semesters ($p=0.045$); and stress – ANOVA: [$F = 2.968$, $p=0.001$] between seventh and twelfth ($p=0.044$), tenth and twelfth ($p=0.011$), and eleventh and twelfth ($p=0.001$) semesters. The following factors were associated with (a) stress: female gender, anxiety, and depression; (b) depression: female gender, intrinsic religiosity, anxiety, and stress; and (c) anxiety: course semester, depression, and stress.

Conclusion: Our findings revealed high levels of depression, anxiety, and stress symptoms in medical students, with marked differences among course semesters. Gender and religiosity appeared to influence the mental health of the medical students.

Keywords: medical education, depression, anxiety, stress, medical students.

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INTRODUCTION

University life during medical training entails full-time commitment and responsibility of undergraduates regarding academic tasks and care provided to patients and their companions. Long working and study hours, environments not ideally suited to learning, sleep deprivation, as well as factors interfering in everyday personal life are common during this period.¹ These aspects, associated with a lack of factors promoting quality of life, can lead to stress levels that negatively impact the physical, mental, and emotional health of students, compromising their academic performance.²

Emotional disorders in medical undergraduates are not uncommon, influencing mental health as well as hon-

esty, academic performance, and use of alcohol and other drugs.³ In Europe, around 30% of medical students suffer from depression or anxiety,⁴ a rate similar to that reported by Brazilian studies, in which 20 to 50% of medical students were found to present with mood disorders.^{5,6} Medical students also have higher rates of depression and suicidal ideation than the general population, posing a major challenge to the training of future physicians.²

Further studies elucidating the factors associated with mental disorders that affect performance and quality of life of undergraduate medical students are needed. Within this context, stress plays a major role in this interrelationship, most likely stemming from the frequent

exposure to pain, suffering and death.⁷ The high levels of stress in medical students are important predictors of anxiety and depression.^{8,9}

In fact, health, work and quality of life are intrinsically linked, where higher levels of stress lead to a decline in quality of life due to demotivation, irritation, depression, and unhappy personal life, impacting interaction of the individuals at different points in their life.¹⁰ Thus, stress impairs learning, since this directly interferes in the brain's executive functions and can affect the performance of undergraduate students at specific times or throughout their academic course.¹¹

In this respect, there appears to be a relationship between the course year and severity of mental disorders.¹² In a four-year cohort study, mild-to-moderate depression rose from 4 to 12% during medical school training. Similarly, another study¹³ reported an increase in mild depression from 4.3 to 11.2%, and in moderate depression from 1.7 to 6.9%, by the end of the first year of medical school.

Ascertaining the times during which students are most susceptible to psychiatric disturbances may help in the implementation of strategies to promote physical, mental, emotional, and spiritual well-being. These strategies might include both individuals and the group as a whole,^{14,15} promoting the resumption of healthy habits, and attention to health, leisure, and religiosity.¹⁶⁻¹⁸

The objective of the present study was to compare the prevalence of anxiety, depression, and stress in medical students from all semesters of medical school training and assess their respective associated factors to evaluate potential stressors and identify the major challenges faced by the students during medical training. Ultimately, the results can aid in the planning and development of more effective intervention and prevention programs and in the implementation of more balanced medical curricula.¹⁹

METHOD

Study design and participants

This cross-sectional study included students from the six years of the medical course of the Federal University of Juiz de Fora (Brazil) and was conducted between September and November 2014. The medical course spans six years (comprising twelve separate semesters) typically divided into three stages, each averaging two years: pre-clinical, clinical, and internship.

All students officially enrolled in the medical course were invited to take part. Students away from the city of Juiz de Fora on governmental international exchange

programs Sciences Without Borders or undertaking optional internships, individuals not present at the time of data collection, and those who did not complete the questionnaire or refused to take part in the study were excluded.

The project was approved by the Research Ethics Committee of the University Teaching Hospital/UFJF under report n° 790.822 and all participating students signed the informed consent form.

Instruments

The self-report questionnaire employed took approximately 20 minutes to answer and collected data on:

- Sociodemographics: age, ethnicity/race, marital status, employment status, family income.
- Religiosity: the Duke Religion Index was used, a five-item measure of three different dimensions of religious involvement: one question (with six possible answers) for organizational religiousness (OR)—religious attendance; one question (with six possible answers) for non-organizational religiousness (NOR)—religious activities performed in private, such as prayer, Scripture study, watching religious TV or listening to religious radio, and three questions (with five possible answers each) for intrinsic religiousness (IR)—pursuing religion as an ultimate end in itself. For the intrinsic religiosity score, we summed the three questions (possible score 3 to 15), in which higher scores indicate higher levels of religiosity. This scale has been previously validated for use in Brazil.²⁰
- Depression, anxiety, and stress: assessed by the DASS 21 – Depression, Anxiety and Stress Scale validated for Portuguese.²¹ This 21-item short scale allows simultaneous assessment of the three emotional states of depression, anxiety, and stress, is easy to apply in both clinical and non-clinical settings, and suitable for use in different age groups,²¹ including medical students.

Procedures

Data collection took place during class time (before or after educational activities) and the questionnaire was applied as follows: the researchers explained the objectives of the study, asked students to fill out the questionnaire and sign the consent form, and guaranteed confidentiality of the data. The questionnaires were applied mid-way through the academic semester in order to assess students at a time nearest their basal state, i.e. outside exam time (end of semester) and resumption of classes (beginning of semester).

Statistical analysis

The data collected were keyed into Excel for Windows and statistical analysis was carried out using the software package SPSS version 17.0 (SPSS Inc.). Descriptive analysis with measurements of frequency, mean, and standard deviation was used to express sociodemographic variables and results from the scales and questionnaires.

The students from the 12 semesters of the course were compared for demographic, socioeconomic, and mental health variables using the Chi-squared or ANOVA tests. When significant difference was detected by ANOVA, a post-hoc test (Bonferroni) was performed.

Linear regression models were employed to assess the factors associated with each dependent variable (stress, depression, and anxiety), including goodness-of-fit measures and assessment of R^2 . The following variables were entered in each step:

- Model 1: gender, semester, age, family income, organizational religiosity, non-organizational religiosity, and intrinsic religiosity.
- Model 2: DASS Depression, DASS anxiety or DASS Stress according to the dependent variable.

A value of $p<0.05$ and confidence interval of 95% were adopted for all analyses.

RESULTS

Of the total 1,009 students enrolled at the medical course, 75.4% ($n=761$) answered the questionnaire, comprising 298 (39.1%) at pre-clinical, 244 (32%) at clinical, and 219 (28.7%) at internship stages.

The profile of the sample studied was predominantly women (55.8%) with a mean age of 22.1 ($SD=3.3$) years, white (75.7%), and with a family income of > eight Brazilian minimum wages (> US\$ 2,000.00) (50.7%). With regard to religious aspects, 51.2% of the students reported being Catholics, 17.1% no religion, 11% Evangelical or Protestant, 8.3% Spiritists, and 6.4% stated they did not believe in God. Sociodemographic data for the sample are given in Table 1.

With regard to the prevalence of depression, anxiety, and stress, as assessed by the DASS-21, 34.6% had depressive symptomatology (8.8% severe or extremely severe), 37.2% had anxiety symptoms (12.2% severe or extremely severe), and 47.1% had stress symptoms (17.4% severe or extremely severe). The constructs anxiety, depression, and stress were highly correlated, with values ranging from $r=0.554$ to 0.696 ($p<0.01$).

TABLE 1 Sociodemographic and religious characteristics of medical undergraduate students.

Variable	
Gender (n, %)	
Female	425 (55.8%)
Male	336 (44.2%)
Age (Mean, SD)	
	22.10 (3.34)
Stage of course (n, %)	
Pre-clinical (1 st -4 th)	298 (39.1%)
Clinical (5 th -8 th)	244 (32%)
Internship (9 th -12 th)	219 (28.7%)
Ethnicity/Race (n, %)	
White	576 (75.7%)
Black	32 (4.2%)
Mulatto	61 (8%)
Others	92 (12.1%)
Family income (n, %)	
Up to 3 minimum wages	105 (13.8%)
4-7 minimum wages	261 (34.3%)
8-12 minimum wages	207 (27.2%)
> 12 minimum wages	179 (23.5%)
Not reported	1 (0.1%)
Religious affiliation (n, %)	
None, but believe in God	130 (17.1%)
None, and do not believe in God	49 (6.4%)
Roman Catholic	390 (51.2%)
Evangelical/Protestant	84 (11.1%)
Spiritist	63 (8.3%)
Others	27 (3.5%)
Not reported	18 (2.4%)

Figure 1 (A to C) shows the differences in mean depression, anxiety, and stress for the different semesters. Significant differences in means were detected for:

- a. anxiety - ANOVA: $F(11,743) = 2.536$, $p=0.004$, between first and tenth ($p=0.048$), and first and eleventh ($p=0.025$) semesters;
- b. depression - ANOVA: $F(11,745) = 2.410$, $p=0.006$, between first and second semesters ($p=0.045$);
- c. stress - ANOVA: $F(11,744) = 2.968$, $p=0.001$, between seventh and twelfth ($p=0.044$), tenth and twelfth ($p=0.011$), and eleventh and twelfth ($p=0.001$) semesters.

Linear regression (Table 2) revealed associations between DASS-21 scores for:

- DASS Stress: with female gender ($B=0.87$, $SE: 0.24$, $p<0.001$), DASS Anxiety ($B=0.63$, $SE: 0.03$, $p<0.001$) and DASS Depression ($B=0.40$, $SE: 0.03$, $p<0.001$) – $R^2=0.568$;

TABLE 2 Linear regression analysis of association of DASS scores with sociodemographic, religiousness, and mental health among medical undergraduate students.

	Model 1			Model 2		
Stress^a	B	SE	P	B	SE	P
Gender (female)	1.46	0.37	<0.001	0.87	0.24	<0.001
Semester	-0.04	0.06	0.472	0.05	0.04	0.220
Age	0.005	0.06	0.941	-0.02	0.04	0.543
Family income	-0.05	0.17	0.770	0.08	0.11	0.456
Religious attendance	0.15	0.18	0.394	0.03	0.12	0.775
Non-organizational religiousness	-0.18	0.14	0.186	-0.07	0.09	0.411
Intrinsic religiousness	0.03	0.08	0.677	-0.06	0.05	0.253
DASS Anxiety				0.63	0.03	<0.001
DASS Depression				0.40	0.03	<0.001
Depression^b	B	SE	P	B	SE	P
Gender (female)	0.24	0.32	0.459	0.56	0.24	0.023
Semester	-0.44	0.05	0.412	0.07	0.04	0.870
Age	0.74	0.05	0.190	0.07	0.04	0.094
Family income	-0.16	0.15	0.281	-0.11	0.11	0.328
Religious attendance	0.08	0.16	0.599	-0.01	0.122	0.891
Non-organizational religiousness	-0.16	0.12	0.191	-0.06	0.09	0.476
Intrinsic religiousness	-0.23	0.07	0.001	-0.22	0.05	<0.001
DASS Stress				0.40	0.03	<0.001
DASS Anxiety				0.27	0.04	<0.001
Anxiety^c	B	SE	P	B	SE	P
Gender (female)	0.78	0.28	0.007	0.10	0.20	0.611
Semester	-0.12	0.04	0.011	-0.94	0.03	<0.001
Age	0.001	0.05	0.978	-0.01	0.03	0.684
Family income	-0.11	0.13	0.407	-0.05	0.09	0.535
Religious attendance	0.13	0.14	0.331	0.05	0.10	0.584
Non-organizational religiousness	-0.07	0.11	0.524	0.04	0.07	0.598
Intrinsic religiousness	0.000	0.06	1.000	-0.05	0.04	0.193
DASS Stress				0.18	0.03	<0.001
DASS Depression				0.43	0.02	<0.001

^aModel 1: R square=0.030; Model 2: R square=0.516.^bModel 1: R square=0.036; Model 2: R square=0.446.^cModel 1: R square=0.020; Model 2: R square=0.568.

- DASS Depression: with female gender ($B=0.56$, SE: 0.24, $p=0.023$), intrinsic religiosity ($B=0.22$, SE: 0.05, $p<0.001$), DASS Anxiety ($B=0.27$, SE: 0.04, $p<0.001$), and DASS Stress ($B=0.40$, SE: 0.03, $p<0.001$) – $R^2=0.446$;
- DASS Anxiety: with semester of course ($B=-0.94$, SE: 0.03, $p<0.001$), DASS Depression ($B=0.43$, SE: 0.02, $p<0.001$) and DASS Stress ($B=0.18$, SE: 0.03, $p<0.001$) – $R^2=0.516$.

DISCUSSION

The results of this study revealed a high prevalence of anxiety, depression, and stress among medical students,

with statistically significant differences for course semesters, and the influence of several factors such as gender and religiosity on the students' emotional state. Medical schools are known to be environments associated with stressors and factors that negatively impact academic performance as well as both physical and emotional health of students.^{9,22,23}

With regard to the changes in mental health found for the different semesters, students from the first semester commenced activities with a high level of anxiety, exceeding that of students from the tenth and eleventh semesters, most likely stemming from the experience of

the unknown, from the expectations of embarking on this new path, and from moving away from home (as it happens to most students in our university). Miller et al.,²⁴ investigating first-year students, postulated that stress in this group stemmed from the nature and overload of the work inherent to the medical course, as well as from the academic structure of the course and its teaching methods. In fact, embarking on a medical course is fraught with numerous challenges beginning with the selection process, undeniably competitive and with a high cut-off point, particularly at Brazilian public institutions. On top of this, there is a certain glamour conferred by society to undergraduate medical students grounded in the dream of implicit economic success, which could lead to an over-expectation and frustration.²⁵ This phenomenon has been corroborated by various studies.^{6,26} A study conducted in Brazil found a higher prevalence of anxiety symptoms in first-year (30.8%) medical students compared to sixth-year (9.4%) medical students,⁶ while an investigation in Malaysia showed that anxious symptomatology was much more prevalent than depressive symptoms, and that stress in students newly enrolling in medical school was greater than students at the latter stages of the course.²⁷

Regarding depressive symptoms, it is noteworthy that students in the present study exhibited a sharp rise in the second period of the course compared with the first. At the outset of the first year, we believe two contradictory feelings come to the fore in the students: on the one hand there is the euphoria of approval, reinforcing the dream of the chosen profession, while on the other there is the frustration of commencing a course with an eminently theoretical content and few practical activities, closely resembling the recently experienced middle school education. The introjected and oft replicated discourse that being a physician demands the abdication of social and personal life, and multiple sacrifices can exacerbate this initial discomfort.²⁸ Similar data was found by Wolf et al.²⁹ with reports that first-year students complained of the scant opportunities to pursue their personal relationships. The authors also revealed that, at the end of the first year, students presented more depressive symptoms, which peaked at the end of the second year in the fourth semester. Similarly, Quince et al.³⁰ performed a longitudinal study at a UK medical school and found a prevalence of depression ranging from 5.7 to 10.6% in students on the basic years and 2.7 to 8.2% in students on the clinical stages of the course.

In the present sample, the high levels of stress across all semesters of the course are illustrated in Figure 1, with a notable rise during the eighth semester of the fourth year, marking the end of the pre-clinical stage (entry to

the clinical or internship/clerkship stage), and during the twelfth period prior to graduation. A substantial decline in stress can also be noted in the tenth and eleventh semesters. During the twelfth semester, the final semester before graduation, the students normally prepare for course conclusion and assume the commitment of practicing the profession. This period is marked by the phase of preparing for the medical residency tests in the chosen area of specialization, where the selection processes are highly competitive and the residency positions are in short supply. The increased distress and lack of time, coupled with the conflicts of choosing a specialty, explain the predominance of stress in internship candidates, a situation confirmed by other authors.³¹ A study in three British universities involving fourth-year medical students found a 31.2% prevalence of emotional disturbances, a similar rate to those found in American studies.⁸ Stress was also found to correlate with depression and anxiety, showing the inter-dependence of these symptoms.

With regard to the factors associated with the mental health of these students, there was an association of gender with both depression and stress. Studies show that women have a greater prevalence of depression and anxiety in the general population, although data for medical students are conflicting. Notwithstanding, a systematic review³ revealed that half of the studies published involving medical students reported difference in depression and stress between genders, corroborated by the present findings.

Another associated factor was intrinsic religiosity. Although many studies point to an association of religious/spiritual beliefs with mental health, physical health, and quality of life^{32,33} and other investigations have assessed religiosity and medical students' views on this issue,³⁴ few studies have specifically investigated the association between mental health and beliefs in medical education. Wachholtz et al.³⁵ assessed 259 American medical students and found that individuals with lower levels of spiritual well-being and daily spiritual experiences had greater psychological stress and burnout. Similarly, Vasegh et al.³⁶ found a negative correlation among religiosity, depression, and anxiety in 285 Iranian students, which is in accordance to our findings. By contrast, Lupo et al.³⁷ conducted a study of 119 medical students in Israel and found no association between religiosity, depression, and anxiety showing these results can be reduced or augmented according to culture and religious affiliation.

The present study has several limitations. This was a cross-sectional study, thereby precluding conclusions on causality and weakening the comparison among semesters, since these involved different student groups. However,

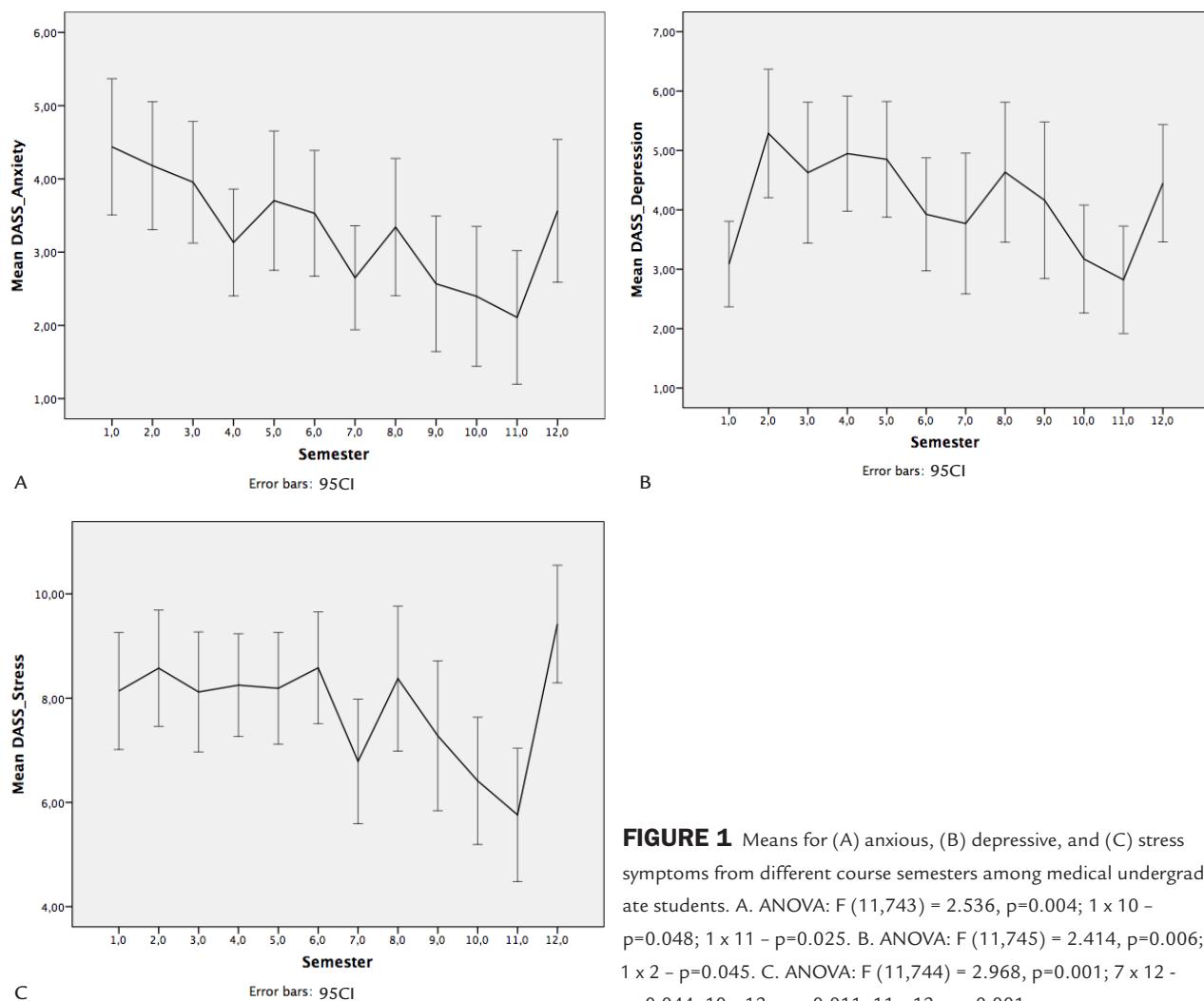


FIGURE 1 Means for (A) anxious, (B) depressive, and (C) stress symptoms from different course semesters among medical undergraduate students. A. ANOVA: $F(11,743) = 2.536$, $p=0.004$; $1 \times 10 - p=0.048$; $1 \times 11 - p=0.025$. B. ANOVA: $F(11,745) = 2.414$, $p=0.006$; $1 \times 2 - p=0.045$. C. ANOVA: $F(11,744) = 2.968$, $p=0.001$; $7 \times 12 - p=0.044$; $10 \times 12 - p=0.011$; $11 \times 12 - p=0.001$.

this type of methodology has been previously used in many other studies on medical education.⁶ Nevertheless, despite the high response rate of over 70%, some students with mental health-related problems may have refused to take part in the study. Since the present study was carried out in one Brazilian medical school, generalization should be made with caution.

On the other hand, the study also has noteworthy strengths. The sample size was suitable for assessments among semesters, while the validated scales employed are used worldwide, easily applicable, and can be reproduced by other schools of medicine. Further follow-up studies are needed to elucidate the course of anxiety, depression, and stress in this population. Future investigations could provide a better understanding of the factors influencing the mental health of these students and aid the planning of interventions to help them cope with the challenges faced.

The present study's findings revealed high levels of depressive, anxiety, and stress symptoms in medical students, with marked differences for course semesters. Factors such as gender and religiosity appeared to influence the mental health of the medical students. These results may help in devising preventive strategies and early identification of students at risk for mental health decline during the course of medical training.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

RESUMO

Objetivo: Comparar a prevalência de ansiedade, depressão e estresse em estudantes de todos os períodos de graduação de medicina e avaliar os fatores associados.

Método: Estudo transversal e comparativo, realizado com alunos dos seis anos (doze semestres) de um curso de medicina brasileiro. Os alunos preencheram um questionário com dados sociodemográficos e relacionados à religiosidade (Duke Religion Index) e à saúde mental (DASS-21 – Depression, Anxiety and Stress Scale). Os estudantes dos 12 períodos do curso foram comparados quanto às variáveis demográficas, socioeconômicas e saúde mental por meio dos testes de Qui-quadrado ou ANOVA. Para avaliar os fatores associados a cada variável dependente (estresse, depressão e ansiedade), foram utilizados modelos de regressão linear.

Resultados: Responderam ao questionário 743 (73,63%) dos 1.009 estudantes matriculados no curso de medicina, com 34,6% apresentando sintomatologia depressiva; 37,2%, sintomas de ansiedade; e 47,1%, estresse. Houve diferenças significantes entre os períodos em relação à ansiedade - ANOVA: ($F = 2,536$; $p=0,004$), sendo as diferenças entre o primeiro e o décimo período ($p=0,048$) e entre o primeiro e o décimo primeiro período ($p=0,025$); à depressão - ANOVA: ($F = 2,410$; $p=0,006$), sendo as diferenças entre o primeiro e o segundo período ($p=0,045$); e ao estresse - ANOVA: ($F = 2,968$; $p=0,001$), sendo as diferenças entre o sétimo e o décimo segundo período ($p=0,044$), entre o décimo e o décimo segundo ($p=0,011$) e entre o décimo primeiro e o décimo segundo ($p=0,001$). Estiveram associados (a) ao estresse: gênero feminino, ansiedade e depressão; (b) à depressão: gênero feminino, religiosidade intrínseca, ansiedade e estresse; (c) à ansiedade: semestre do curso, depressão e estresse.

Conclusão: Os achados do presente estudo mostram altos níveis de sintomas de depressão, ansiedade e estresse em estudantes de medicina, com diferenças marcantes nos diferentes semestres do curso. Fatores como gênero e religiosidade parecem influenciar a saúde mental dos estudantes de medicina.

Palavras-chave: educação médica, depressão, ansiedade, estresse, estudantes de medicina.

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