



# The prevalence of depression among dental students in Sarajevo University

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## ABSTRACT

**Introduction:** Medical students, including dental students, are more likely to be burdened with depression, anxiety, burnout, and anorexic tendencies than their peers studying other subjects. In spite of major public health relevance, there is a large knowledge gap regarding mental health issues among Bosnian dental students. The aim of this research is to estimate the depression prevalence among dental students in Sarajevo according to age, gender, and academic year.

**Methods:** A cross-sectional study was conducted among 1<sup>st</sup>, 3<sup>rd</sup>, 4<sup>th</sup>, and 6<sup>th</sup> year students at the Dental School, University of Sarajevo, during 2023-2024. Depression was evaluated using the self-reported patient health questionnaire-9 (PHQ-9). Statistical analysis included the Shapiro–Wilk test, with data presented as means with standard deviations (SDs), medians (Mdn) with interquartile ranges (IQRs), and frequencies. Comparisons between males and females were analyzed using the Student's t-test or Mann–Whitney U-test and one-way analysis of variance or Kruskal–Wallis test across academic years.

**Results:** In the total sample (n = 324), females outnumbered males, 244 versus 80. Clinically significant depression (PHQ-9 ≥10) was reported in 52.79% of students. The average PHQ-9 value was Mdn = 10.00, IQR (6.00, 16.00), M = 11.1, SD = 6.66. The highest average PHQ-9 values were observed in the 4<sup>th</sup> year and the lowest in the 6<sup>th</sup> year. Female students had significantly higher average PHQ-9 scores (p < 0.05).

**Conclusion:** Dental students in Sarajevo exhibited high depression prevalence, but female students were more affected. These findings emphasize an urgent need for targeted mental health interventions in dental education.

**Keywords:** Prevalence; dental students; depression; mental health; patient health questionnaire-9

## INTRODUCTION

Medical literature offers a variety of definitions of mental health. According to the World Health Organization's World Mental Health Report in 2022, mental health is “a state of mental well-being that enables people to cope with the stresses of life, to realize their abilities, to learn well and work well, and to contribute to their communities.” The definition of mental health has been a subject of intensive academic debate (1-3).

Mental health is a multidimensional, dynamic, internal continuum that enables people to use their capacities in accordance with societal norms. Major dimensions include core cognitive and social competencies and the capacity to recognize, express, and regulate emotions, and especially to empathize with others. The ability to maintain

psychological flexibility and to effectively manage adverse life events and social roles also represents one of the core dimensions of the mental health continuum. To varying degrees, all these dimensions help to maintain internal psychological equilibrium (4).

The mental health risk is not static across the lifespan, with different factors playing roles at various stages of life. Worldwide, depression and anxiety are considered the most common mental disorders. Genetic background has a significant role in the pathophysiology of depression (5,6). Moreover, there are great differences among genders regarding the risk for depression. According to meta-analyse women have a 1.5-2-fold higher risk of developing major depressive disorder compared to men, with the divergence emerging during puberty and persisting across the lifespan (7). Although cross-cultural studies in industrialized nations suggest a consistent pattern, there are variations in symptom expression (8).

Young people represent the age group with a significant risk of mental health issues. The burden among this population

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is continuously increasing. Their major causes of illness and disability are depression, anxiety, and behavioral disorders. Clinically, depression is characterized by sadness, diminished interest or pleasure in once-enjoyed activities, and these symptoms can interfere with a person's emotions, thought processes, and ability to manage everyday functions, such as sleep, appetite, and work. In addition, it is often associated with fatigue, sleep disturbances, and difficulty concentrating. If depression is left untreated, it can lead to a poor academic performance and challenges in day-to-day functions (9).

Medical students, including dental students, are more likely to be burdened with depression, anxiety, burnout, and anorexic tendencies than their peers studying other subjects. Depression among medical students is higher compared to the general population (10,11). Worldwide, every third medical student suffers from mental health issues, and the prevalence rates of depression and anxiety are estimated to be 27% and 34%, respectively (12,13). Stressors, such as academic pressure, clinical rotation, social changes, financial independence, and other life transitions contribute to vulnerability of dental students. The consequences of untreated mental health conditions can range later in life, impacting their overall well-being and career path.

In spite of major public health relevance, there is a large knowledge gap regarding mental health issues among Bosnian dental students. This is the first study that analyzed the depression prevalence among dental students in Sarajevo according to age, gender, and academic year.

## METHODS

This cross-sectional study was conducted among undergraduate dental students at the Dental School, University of Sarajevo, during 2023-2024. The aims of the study were explained to students, and they were invited to participate in this research via face-to-face recruitment during regular classes. We used a convenient sampling method. All participants signed an informed consent form before inclusion in the study. There were no exclusion criteria, and only those participants who volunteered to participate in the study were recruited. This research was approved by the corresponding ethical committee at the Dental School, University of Sarajevo, based on the ethical guidelines within the institutional regulations. All participants signed an informed consent form before inclusion in the study.

Students filled out an anonymous paper questionnaire constructed for the purpose of conducting this research, which also included sociodemographic items and the patient health questionnaire-9 (PHQ-9). Initially, this depressive symptom scale and diagnostic tool was introduced in 2001 to screen adult patients in primary care and other medical settings (14). It is well-validated and documented in different settings. PHQ-9 has robust psychometric properties in culturally, linguistically, and geographically diverse samples of adults, contributing to its widespread usage in different contexts (15). PHQ-9 has been translated into more than 70 languages (16), and previously applied in various populations in Bosnia and Herzegovina (17,18).

The nine-item PHQ-9 is part of Pfizer's larger group of trademarked products, called the Primary Care Evaluation

of Mental Disorders (19). This instrument measures the presence and severity of depressive symptoms and a possible depressive disorder (20). The items are based on the Diagnostic and Statistical Manual of Mental Disorders, 4<sup>th</sup> ed (DSM-IV's) diagnostic criteria for major depressive disorder. On each of the nine items, participants are asked to self-rate how often they have experienced the indicated symptoms of depression over the previous two weeks on a 4-point Likert scale: 0 = "not at all," 1 = "several days," 2 = "more than half the days," and 3 = "nearly every day." The scores on each measure are summed, resulting in a total score that can range from 0 to 27, with higher scores reflecting a greater symptom severity (0-4 = minimal depression, 5-9 = mild depression, 10-14 = moderate depression, 15-19 = moderately severe depression, and more than 20 = severe depression). A score  $\geq 10$  is often used as a clinical cutoff for probable major depressive disorder, and it has good sensitivity and specificity.

In statistical analysis, we used descriptive and analytical statistical methods. The Shapiro-Wilk test was used to test the normality of the distribution. For selected variables, data were presented as mean (M), standard deviation (SD), medians (Mdn), interquartile ranges (IQR), and frequencies. The Student's t-test or Mann-Whitney U-test was performed to determine the significance of differences in scores between two groups. The one-way analysis of variance or Kruskal-Wallis test was performed to determine the significance of differences in PHQ-9 score across academic years. All statistical analyses were performed using JASP v.14.4 (Amsterdam, the Netherlands). A value of  $p < 0.05$  was considered statistically significant.

## RESULTS

At the Sarajevo Dental School, a total of 324 dental students participated in the study, of whom 75.31% ( $n = 244$ ) were female and 24.69% ( $n = 80$ ) were male. The female-to-male prevalence ratio was 3.05, indicating a markedly higher proportion of female students.

Female students predominated across all years of study. The highest proportion of female students was observed in the fourth year (80.82%,  $n = 59$ ), while the lowest proportion was recorded in the sixth year (68.00%,  $n = 51$ ) (Table 1).

The median age of dental students in Sarajevo ( $n = 324$ ) was 22.00 years, with an interquartile range (IQR) of 20.00-24.00.

No statistically significant difference was observed in the median age between female students ( $n = 244$ ; Mdn = 22.00, IQR 20.00-23.00) and male students ( $n = 80$ ; Mdn = 22.00, IQR 21.00-25.00), as determined by the Mann-Whitney U test ( $U = 8399.500$ ,  $p = 0.059$ ).

In Table 2, we presented depression categories according to gender. Distribution of depression differs, and females were more affected by depressive disorder. The largest proportions of females were in the mild (26.64%) and moderate (25.82%) categories, as opposed to males, where as many as 36.25% of students were in the mild and 33.75% in the minimal categories. In the total sample, clinically significant depression in the moderate, moderately severe, and severe categories (PHQ-9  $\geq 10$ ) was reported in 52.79% of students.

In Table 3, we presented average values of PHQ-9 items. The highest average value was observed for item 4. “Feeling tired or having little energy” and the lowest for item 9. “Thoughts that you would be better off dead or of hurting yourself in some way.”

The distribution of average PHQ-9 values in the total sample was not normal ( $p < 0.001$ ). Distributions of PHQ-9 total scores among males and females in Sarajevo also did not follow a normal distribution ( $p < 0.001$ ). In the total sample, the average PHQ-9 value was Mdn = 10, IQR (6.00, 16.00), M = 11.1, SD = 6.66.

Among females (n = 244), the PHQ-9 total score ranged from 0 to 27.00, Mdn = 12.00, IQR (7.00-17.00), and among males (n = 80), Mdn = 8.00, IQR (4.00, 10.00). According to the Mann–Whitney test, females had significantly higher PHQ-9 scores compared to males (U = 5984.00) ( $p < 0.001$ ).

**TABLE 1.** Distribution of students according to the year of the study and gender

Females n (%)	Males n (%)	Total n (%)
1 <sup>st</sup> year		
70 (78.65) (28.69)	19 (21.35) (23.75)	89 (100.00) (27.47)
3 <sup>rd</sup> year		
64 (73.56) (26.23)	23 (26.44) (28.75)	87 (100.00) (26.85)
4 <sup>th</sup> year		
59 (80.82) (24.18)	14 (19.18) (17.50)	73 (100.00) (22.53)
6 <sup>th</sup> year		
51 (68.00) (20.90)	24 (32.00) (30.00)	75 (100.00) (23.15)
Total		
244 (100.00)	80 (100.00)	324 (100.00)

**TABLE 2.** Distribution of depression categories according to gender

Gender	Minimal n (%)	Mild n (%)	Moderate n (%)	Moderately severe n (%)	Severe n (%)	Total n (%)
Females	32 (13.11)	65 (26.64)	63 (25.82)	44 (18.03)	40 (16.39)	244 (100.00)
Males	27 (33.75)	29 (36.25)	12 (15.00)	9 (11.25)	3 (3.75)	80 (100.00)
Total	59 (18.21)	94 (29.01)	75 (23.15)	53 (16.36)	43 (13.27)	324 (100.00)

**TABLE 3.** Average values of PHQ-9 items in total sample

PHQ-9 items	Mdn	M	SD	SW	Range
1. Little interest or pleasure in doing things	1.00	1.43	0.99	$p < 0.001$	0-3
2. Feeling down, depressed, or hopeless	1.00	1.23	1.01	$p < 0.001$	0-3
3. Trouble falling or staying asleep, or sleeping too much	1.00	1.59	1.03	$p < 0.001$	0-3
4. Feeling tired or having little energy	2.00	1.94	0.92	$p < 0.001$	0-3
5. Poor appetite or overeating	1.00	1.39	1.13	$p < 0.001$	0-4
6. Feeling bad about yourself? Or that you are a failure or have let yourself or your family down	1.00	1.11	1.11	$p < 0.001$	0-3
7. Trouble concentrating on things, such as reading the newspaper or watching television	1.00	1.38	1.08	$p < 0.001$	0-3
8. Moving or speaking so slowly that other people could have noticed. Or the opposite? Being so fidgety or restless that you have been moving around a lot more than usual	0.00	0.75	0.99	$p < 0.001$	0-4
9. Thoughts that you would be better off dead, or of hurting yourself in some way	0.00	0.34	0.80	$p < 0.001$	0-3

Mdn: Median, M: Mean, SD: Standard deviation, SW: Shapiro-Wilk test, PHQ-9: Patient health questionnaire-9

The highest average PHQ-9 values were observed in the 4<sup>th</sup> year, Mdn = 13.00, IQR (9.00, 18.00), and the lowest in the 6<sup>th</sup> year, Mdn = 8.00, IQR (4.5, 15.00). Average PHQ-9 values in the 1<sup>st</sup> year and 3<sup>rd</sup> year were Mdn = 10.00, IQR (5.00, 16.00) and Mdn = 9.00, IQR (5.00, 13.00), respectively.

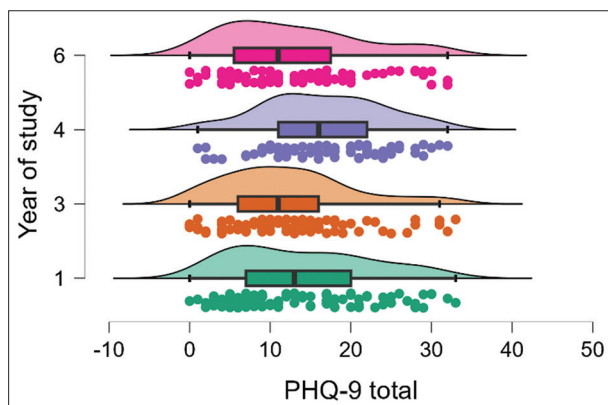
According to the Kruskal–Wallis test, there were significant differences among average PHQ-9 scores across academic years, H (3) = 4.446,  $p = 0.004$ . We used Dunn’s multiple comparison test with Holmes corrections, and significant results were obtained between the 3<sup>rd</sup> and 4<sup>th</sup> year ( $p = 0.003$ ) and 4<sup>th</sup> and 6<sup>th</sup> ( $p = 0.035$ ), while other comparisons did not reach the level of significance (Figure 1).

## DISCUSSION

This is the first study that aimed to estimate the prevalence of depression, categorize depression severity, and compare these epidemiological estimates of depression according to gender and academic year among dental students in Bosnia and Herzegovina. Depression burden was assessed using the PHQ-9, a validated and frequently used tool that has been previously implemented in dental student populations (21,22). Results suggest that females were more burdened with depression and the 4<sup>th</sup> academic year has the highest average PHQ-9 scores.

There is a marked gender imbalance among dental students in Sarajevo. Females represent the vast majority among the student population. In the Sarajevo Dental School, there were a total of 324 dental students, 75.31% (n = 244) females and 24.69% (n = 80) males. Females (3.05) outnumbered males. The proportion of females was the highest at the 4<sup>th</sup> year, 80.82% (n = 59), and the lowest at the 6<sup>th</sup> year, 68.00%. (n = 51).

Increasing female representation among dental students is a complex trend with substantial implications for the medical profession, healthcare, and society. This higher proportion of women was not surprising and has been



**FIGURE 1.** Distribution of patient health questionnaire-9 according to year of study.

previously reported in other studies (23-25). During past four decades, we noticed steady increase in the proportion of women in dentistry, raising questions about the effects of this feminization on the profession. Dentistry has been historically perceived as a male profession, but in the past couple of decades, the number of women in this field has increased. There are numerous speculations about underlying causes, but the results remain inconclusive (26). In a Dutch study, female dentists practice their profession differently from their male colleagues. More than men, they prefer to work in a group practice or in some kind of partnership. Women dentists also appear to have relatively smaller practices than their male colleagues, and on average, they work fewer hours per week. However, it is important to notice that for women dentists' motherhood is an important restricting factor regarding practicing their profession, often resulting in career breaks and diminishing professional productivity (27). The average age of dental students in Sarajevo ( $n = 324$ ) was  $Mdn = 22.00$ ,  $IQR (20.00-24.00)$ . The average age between genders was similar, suggesting that there is no difference when females and males enter dental education.

Depressive disorder affects more females. In Table 2 we presented depression categories according to gender. Distribution of depression differs, and females were more affected by depressive disorder. Female students were more likely to fall into the mild (26.64%) and moderate (25.82%) categories than male students, who fell into the mild (36.25%) and minimal (33.75%) categories. The potential cause of this distribution is still unclear, and according to some studies, it is associated with the different symptomatology. Women more often internalize symptoms, such as sadness, guilt, or worthlessness. Furthermore, they have higher somatic complaints, such as fatigue, pain, and more rumination (e.g., prolonged overthinking behavior) (28). In contrast, men tend to employ avoidant coping mechanisms, including behavioral distraction and substance use, which may mask underlying depressive symptomatology and contribute to underdiagnosis (29). These divergent coping patterns can be explained by early socialization processes that promote emotional expression in girls and emotional restraint in boys, creating distinct pathways to psychopathology. Fluctuations in ovarian hormones, especially estrogen and progesterone, appear to modulate serotonin receptor sensitivity and hypothalamic-pituitary-adrenal axis

functioning, creating periods of heightened vulnerability during reproductive transitions (30). In the total sample, there were 16.36% in the moderately severe category and 13.27% in the severe category. Overall, every second student has clinically relevant depression, which is not a surprise since the highest average value was observed for item 4. "Feeling tired or having little energy" is commonly associated with depression disorder. Females were more burdened with depression not only in terms of the prevalence of clinically relevant depression categories. When average PHQ-9 values are compared between genders, females have significantly higher values. As previously addressed, the higher prevalence of depression in Bosnian female dental students represents the complex combination of biological, psychological, and social factors, and their attributable fractions need to be quantified in a more demanding methodological approach. The gender gap is unquestionably a consequence of the multifaceted interaction between biology, society, and psychology. Nevertheless, the importance of tailored approaches to prevention and treatment for women should not be overshadowed by efforts focused on understanding these complex gender differences.

It should be noted that dental education is not a static process in terms of risk for mental health deterioration. The highest average PHQ-9 values were observed in the 4<sup>th</sup> year and the lowest in the 6<sup>th</sup> year, and differences between the 3<sup>rd</sup> and 4<sup>th</sup> years are significant. Each academic year has specific stressors, but clinical rotations in the 4<sup>th</sup> year seem to challenge dental students more than others. Numerous studies have reported that stress tends to intensify as students progress through each academic year, particularly due to increasing academic and clinical demands (31).

In this study, we faced some limitations and biases that should be acknowledged. First, a cross-sectional self-report survey cannot establish causal relationships between predictor and outcome, as well as assess how depression fluctuates across academic years. Future studies should include data taken at multiple points in time to strengthen and clarify this relationship. Second, unmeasured confounders, such as baseline mental health, institutional policies, or treatment histories, were not checked nor assessed beforehand, which may have also influenced the results. Third, self-reported measures are inherently susceptible to response biases, including potential underreporting due to social stigma or overreporting influenced by survey relevance. However, the anonymous nature of data collection in this study likely mitigated stigma-related reporting bias.

Still, observed clinical implications of these gender differences are substantial and multifaceted. It should be addressed that diagnostic criteria based predominantly on "female-typical" symptoms of sadness and worthlessness may fail to capture male presentations characterized by irritability, aggression, or somatic complaints (32). This diagnostic bias contributes to the underreporting of depression in men while simultaneously pathologizing normative emotional expression in women. Treatment approaches likewise require gender-sensitive adaptation, with evidence suggesting women respond more favorably to serotonergic medications and interpersonal therapies, whereas men may benefit more from behavioral activation and male-oriented support formats (28,33).

In addition, most studies have been conducted in Western populations, limiting understanding of cultural variations in gender roles and emotional expression. Future research should prioritize longitudinal designs that track gender differences across developmental stages while incorporating intersectional analyses of how gender interacts with race, class, and sexual orientation to shape depression risk. Despite these constraints, the study's large sample and cross-institutional comparison provide valuable insights into depression among dental students, highlighting the need for targeted mental health interventions tailored to institutional and gender-specific vulnerabilities.

PHQ-9 has been previously applied in various populations in Bosnia and Herzegovina (17,18). A summary score cut point of  $\geq 10$  was found to be optimal for maximizing sensitivity without loss of specificity. Using this cut point, the PHQ-9 was found to have a sensitivity for major depression of 88% (screened positive for probable major depression) and a specificity of 88% (12% will have a false positive finding) (20). However, it should be noted that PHQ-9 serves as a screening tool and trained clinicians must make the final diagnosis through structured interviews. The structured clinical interview for DSM-IV contains a question for every symptom for each disorder in the DSM and is often considered the "gold standard" in psychiatric assessment. In spite of the limitation, results are in line with other studies which reported prevalence rates of depression and anxiety among medical students to be 27% and 34%, respectively (12,13).

## CONCLUSION

This study was the first to investigate the depression prevalence among dental students in Bosnia and Herzegovina. The majority of dental students are female, and according to the findings, every second student exhibits clinically relevant depression, with women appearing to be more affected. Dental students represent a particularly vulnerable group for mental health issues. This research advances our understanding of mental health challenges faced by medical students, emphasizing the influence of gender and academic factors. Early identification and tailored interventions are essential to reduce these risks and build resilience within this student population.

## DECLARATION OF INTEREST

Authors declare no conflict of interests.

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