

Assessment of stress load and its causes among dental students

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Summary

Aim. The aim of this study was to assess the stress level among dental students, characterize the factors that induce it and describe which students are most susceptible.

Method. Two internationally recognized, independent and validated to Polish language and conditions stress questionnaires were used: the Perceived Stress Scale (PSS-10) and the Perceived Medical School Stress Instrument (PMSS). The present study received approval from the Jagiellonian University Bioethical Committee (no. 1072.6120.290.2020).

Results. A total of 272 students from all five years of the dental undergraduate program at Jagiellonian University Medical College were enrolled in the study, including 197 female and 75 male respondents. The overall response rate was 85%. The total PSS-10 score for all dental students was 22.14 ± 6.65 . A total of 182 (66.91%) respondents had high levels of stress. Female students had significantly higher stress levels than male students, accordingly 22.9 ± 6.51 and 20.12 ± 6.69 . Moreover, first and fifth year students had the highest stress level. In the case of PMSS the total score for all dental students was 36.84 ± 8.65 .

Conclusions. Perceived stress among Polish dental students is generally high. These findings suggest that psychological support services should be made widely available to all dental students. Such services should be targeted to the specific needs of male and female students as well as to those in specific years of study.

Key words: PSS-10, PMSS, dental students

Introduction

Hans Selye introduced two definitions of stress: eustress or good stress, and distress or bad stress. Eustress is considered beneficial, as it motivates our bodies to action. Distress appears when the stressor is severe or affects the body for a long period of time. It causes mental suffering and difficulties in making decisions, and can lead to a large number of disorders [1].

The long-term effects of stress depend on its intensity and duration. They may include diabetes [2], cardiovascular disease, memory and cognitive disorders, and pathological changes in the central nervous system, leading to impairment of the immune system [3]. Persistent stress may also trigger mental health problems, such as depression, anxiety, and suicidal thoughts [4].

Compared to the general population, students are a high-risk group for stress [5]. Research on 430 medical students from the Jagiellonian University Medical College in Kraków has shown that medical training in particular is associated with high levels of stress [6]. Apart from the fact that chronic stress may affect students' health, it can also have a negative impact on their academic performance, as it affects their ability to learn [3].

In Poland, dental degree programs last for five years, during which time students face both academic and personal challenges. The stress factors associated with dental education include taking examinations and receiving grades, faculty–student relations, the large amounts of classwork, financial pressure, treatment of patients, and lack of leisure time [7]. These factors and their intensity may vary depending on the year of study. Preclinical students indicate that they are mainly stressed about examinations, while clinical students report clinical training as the main stressor [8]. The level of stress may decrease with the experience gained during dental training. This may also indicate that, over time, students can develop better coping mechanisms and, as a result, become able to minimize the negative impact of chronic stress [4].

Acknowledging levels of stress, the main stressors, and the difficulties of being a dentistry student may be valuable both for dental educators and for the students themselves. It can help implement changes in the dental education system, which may lead to a reduction in stress factors and, as a result, in levels of stress among students. Moreover, the ability to cope with stress that is developed during dental education could be useful in students' future career, as being a dentist is considered one of the most stressful occupations [9].

The aim of this study was thus to assess the stress level among dentistry students from the Jagiellonian University Medical College using standardized psychometric tools, describe the factors that induce stress and determine which students are most susceptible to it.

Materials and methods

Study population

The survey invited all 320 dentistry students from the Polish-language program at the Jagiellonian University Medical College (JUMC) during the 2021 winter exam period. For second-year, fourth-year, and fifth-year students, the questionnaire was paper-based and was carried out directly before exams, similarly to the original study by Vitaliano [10]. For the first-year and third-year dentistry students, the questionnaire was carried out using an online platform, as the COVID-19 pandemic meant they did not have any exams in person. Both part-time and full-time dentistry students could take part in the study. Full-time students do not pay for their program, unlike part-time students. This difference is related to success in the application process. The syllabus, however, did not differ for the mode of study.

The one inclusion criterion applied was that each participant be a Polish-language dentistry student at the Jagiellonian University Medical College. The sole exclusion criterion was filling out the questionnaire incompletely. We determined the correlations that existed between year of study, age, sex, whether a student paid tuition, PSS-10 score, PMSS score, and each answer on the PMSS. The present study received approval from the Jagiellonian University Bioethics Committee (no. 1072.6120.290.2020). All subjects gave their informed consent for inclusion in the study, and their rights were protected. All procedures were performed in accordance with the 1964 Declaration of Helsinki and its later amendments.

Questionnaires

In this study, two internationally recognized, independent and validated to Polish language and conditions stress questionnaires were used: the Perceived Stress Scale (PSS-10) and the Perceived Medical School Stress Instrument (PMSS) [6, 11]. All subjects were informed about the aim of the study and that participation was entirely voluntary and anonymous.

The PSS-10 consists of ten questions answered on a five-point scale (from 0 ‘never’ to 4 ‘very often’), with reverse scoring for four positively stated items, and measures the subjective feelings and thoughts associated with a number of behaviors and personal problems, as well as with means of coping with these. The overall score ranges from 0 to 40, with 20–40 suggesting a high level of stress, 14–19 pointing to a medium level of stress, and 0–13 indicating a low level of stress [11–13]. No permission is required to use the PSS-10 in nonprofit academic research (as stated on the website of the Laboratory for the Study of Stress, Immunity, and Disease at the Department of Psychology, Carnegie Mellon University).

The PMSS questionnaire, created by Vitaliano, assesses stress associated with medical studies [10] and includes information on the stress related to personal and financial problems, interactions with the academic administration, and the gaining of medical knowledge. It describes both perceived dissatisfaction and negative points of

view using 13 questions, to which answers are given on a five-point scale (ranging from 1 'I totally disagree' to 5 'I totally agree'). The lowest obtainable score is 13 while the greatest is 65. Higher scores refer to higher levels of stress and anxiety.

We decided to employ the PSS-10 and PMSS questionnaires as both are commonly used to measure stress levels [10, 14-19], with the PSS-10 now available in 25 languages [20]. Shiralkar et al. indicate that PMSS is one of the standard sets of outcome measures of distress among medical students [21]. Both surveys have been translated into Polish and validated for both the Polish language translation and the environment [6, 11].

Statistical analysis

For the statistical analysis, we used R version 3.6.2 [22], calculating the mean, standard deviation, median, minima, maxima, and quartiles for the quantitative (numerical) variables. In the case of variables that were not expressed numerically (i.e., qualitative variables), we enumerated the count and percent of occurrence of each value. The Mann–Whitney U test was employed to compare quantitative variables in two groups, while for the comparison of these variables in more than two groups the Kruskal–Wallis test was performed. Dunn's test was used as a post-hoc procedure. All correlations between quantitative variables were tested with Spearman's correlation coefficient. These analyses were conducted at the 0.05 level of significance, so p values below 0.05 were taken to imply statistical significance.

Results

A total of 272 students from all five years of the dental degree program at the Jagiellonian University Medical College were enrolled to the study, including 197 female and 75 male respondents. The overall response rate was 85%. Table 1 shows the group characteristics.

Table 1. **Characteristics of the study group**

Parameter		Total (N = 272)
Age	mean ± SD	21.81 ± 1.88
	median	22
	quartiles	20 – 23
Gender	female	197 (72.43%)
	male	75 (27.57%)
Year of study	I	45 (16.54%)
	II	63 (23.16%)
	III	52 (19.12%)
	IV	61 (22.43%)
	V	51 (18.75%)

table continued on the next page

Parameter	Total (N = 272)	
Mode of study	full-time	204 (75.00%)
	part-time	68 (25.00%)

The combined PSS-10 score for all dental students was 22.14 ± 6.65 . A total of 182 (66.91%) respondents had high levels of stress, 60 (22.06%) had moderate levels of stress, and 30 (11.03%) had low levels of stress.

The total PMSS score for all dental students was 36.84 ± 8.65 ; the median was 37, and the range was 13–65 points.

PSS-10 results in relation to sex, age, year of study, and mode of study

Male and female dental students differed significantly in total PSS-10 scores. In both groups the mean level of stress was high. Stress level among female students was at 22.9 ± 6.51 , the median was 23 and the quartiles ranged from 19 to 28. The mean level of stress among male students was at 20.12 ± 6.69 . The median for male students was 20 and the quartiles ranged from 15.5 to 24. The variation between female and male students was 2.78. The stress level was statistically significantly higher in female dental students.

The correlation between PSS-10 and age was statistically insignificant ($r = -0.099$, $p = 0.103$).

First-year and fifth-year students had the highest mean levels of stress. The mean PSS-10 score among first-year students was 24.58, with a standard deviation of 6.4, a median of 25, and quartiles ranging from 20 to 30. Among fifth-year students, the mean PSS-10 score was 23.98, with a standard deviation of 6.37, a median of 24, and quartiles ranging from 20 to 28. The lowest stress level was observed in fourth-year students, where the mean PSS-10 score was 18.93, the standard deviation was 6.18, the median was 20, and the quartiles ranged from 15 to 23. The mean level of stress in each year was high; only among fourth-year students was the mean stress level moderate. The results are presented in Table 2.

Table 2. Comparison of PSS-10 scores and year of study. P – Kruskal-Wallis test + post-hoc analysis (Dunn's test)

PSS10 [points]	Year of study					p
	I (N = 45) – A	II (N = 63) – B	III (N = 52) – C	IV (N = 61) – D	V (N = 51) – E	
Mean \pm SD	24.58 \pm 6.4	22.71 \pm 5.94	21.27 \pm 7.14	18.93 \pm 6.18	23.98 \pm 6.37	$p < 0.001$
Median	25	23	22.5	20	24	
Quartiles	20 – 30	19 – 28	16 – 26.25	15 – 23	20 – 28	A > C, D E, B > D

There are no differences in the syllabus between the modes of study: the only difference between full-time and part-time students is that the latter pay tuition fees. The mean levels of stress for both groups were high, but we did not observe any sta-

tistically significant relationship between those two groups. The mean PSS-10 score for part-time students was 21.91 with a standard deviation of 7.04, a median of 21, and quartiles ranging from 18 to 27.25. The mean PSS-10 for full-time students was 22.21 with a standard deviation of 6.55; the median was 23 and the quartiles ranged from 18 to 27.

PMSS results in relation to sex, age, year of study, and mode of study

The correlations between total PMSS scores and sex, age, academic year and mode of study were statistically insignificant.

*Comparison of each PMSS item with sex, age, and mode of study
(all 13 PMSS items are presented in Table 3).*

Table 3. **PMSS questions**

Question	English version of PMSS
Question 1	Medical school fosters a sense of anonymity and feelings of isolation among the students
Question 2	I am concerned that I will not be able to endure the long hours and responsibilities associated with clinical training and practice
Question 3	I do not know what the faculty/administration expect of me
Question 4	Medical training controls my life and leaves too little time for other activities
Question 5	I am concerned that I will be unable to master the entire pool of medical knowledge
Question 6	This medical school is fostering a physician role at the expense of one's personality and interests
Question 7	Medical school is more competitive than I expected
Question 8	The attitude of too many of the faculty is that students should be subjected to 'baptism of fire'
Question 9	The majority of students feel that success in medical school is in spite of the administration rather than because of it
Question 10	Medical school is cold, impersonal and needlessly bureaucratic
Question 11	Medical school is more of a threat than a challenge
Question 12	Personal finances are a source of concern to me
Question 13	Accommodation is a source of concern to me

Male students significantly more often agreed with PMSS-3 ("I do not know what the faculty/administration expect of me") than the female students. Moreover, PSS-10 correlates positively ($r > 0$) and significantly with male PMSS-3 results. This means that the more stressed the male students were, the more they agreed with the PMSS-3 statement.

Age was found to correlate statistically significantly and positively ($r > 0$) with PMSS-10 ("Medical school is cold, impersonal and needlessly bureaucratic"). This

means that the older the students were, the more they agreed with this statement. Age correlated statistically significantly and negatively ($r < 0$) with PMSS-1 (“Medical school fosters a sense of anonymity and feelings of isolation among the students”), meaning that older students agreed less with this statement.

Full-time students significantly more often agreed with PMSS-5 (“I am concerned that I will be unable to master the entire pool of medical knowledge”) than the part-time students.

Comparison of total PMSS and each PMSS item with PSS-10 score

The correlation between total PMSS and PSS-10 was significant and positive ($r = 0.548, p < 0.001$); moreover, PSS-10 correlated statistically significantly ($p < 0.05$) and positively ($r > 0$) with each PMSS question, so the higher the PSS-10 stress level, the higher were the PMSS results (see Table 4).

Table 4. Correlation between combined PMSS, each PMSS question and PSS-10

PMSS	PSS-10
	Spearman's correlation coefficient
PMSS	$r = 0.548, p < 0.001^*$
PMSS-1	$r = 0.227, p < 0.001^*$
PMSS-2	$r = 0.377, p < 0.001^*$
PMSS-3	$r = 0.297, p < 0.001^*$
PMSS-4	$r = 0.373, p < 0.001^*$
PMSS-5	$r = 0.356, p < 0.001^*$
PMSS-6	$r = 0.339, p < 0.001^*$
PMSS-7	$r = 0.284, p < 0.001^*$
PMSS-8	$r = 0.373, p < 0.001^*$
PMSS-9	$r = 0.217, p < 0.001^*$
PMSS-10	$r = 0.299, p < 0.001^*$
PMSS-11	$r = 0.411, p < 0.001^*$
PMSS-12	$r = 0.254, p < 0.001^*$
PMSS-13	$r = 0.233, p < 0.001^*$

*statistically significant ($p < 0.05$) and positive ($r > 0$) result

Discussion

Our main finding was that dentistry students are exposed to significant stress in the course of their studies, resulting from both the course itself and from more general issues, such as their own personal problems. A total of 272 participants took

part, and the mean perceived stress level, as measured by the PSS-10 questionnaire, was 22.14 ± 6.65 . Cohen et al. in their work “A global measure of perceived stress” [12] demonstrated that the mean PSS-10 score in populations aged 18-29 is 14.2 ± 6.2 , which represents a medium stress level [12, 13]. Our research here demonstrates that Polish dentistry students undergo high levels of stress. Previous studies on dentistry students have likewise demonstrated that they suffer from greater stress than the general population, though dentistry students in other countries tended to be less stressed than their Polish counterparts [23]. The differences in the stress level between dentistry students and the general population of the same age can be explained by the activities that are directly and indirectly associated with dentistry programs, including high expectations, high level of competition, excessive workload, examinations, lack of time off, and the inherent difficulties of learning precise manual skills [24-26].

Female dentistry students proved to be statistically significantly more stressed than their male counterparts. Studies from other countries have likewise shown gender differences in dentistry students, generally finding men to be less stressed than women [23, 27-29]. A number of studies have tried to explain this difference in various ways. For example, one explanation that has been offered is that women are said to react to stress more frequently in an emotionally-focused way and to blame themselves more often than are men [30]. According to Garbee et al., female dentistry students had lower self-confidence levels than male students [24]. Postponement of marriage [24] and difficulties in dealing with aggressive patients were also said to be significant factors [31]. According to Matud et al. [32], women statistically significantly more often react in an emotional or avoidance coping manner, while men react in a rational and detachment coping style. Males also react statistically significantly more often with an emotional inhibition coping style than females [32]. A study of 440 Polish paramedics showed that the emotion-focused coping style is a significant risk factor for PTSD [33]. All of the above may suggest that women are more likely to suffer from long-term stress and its complications.

We also observed that dentistry students in the first and fifth years had the highest mean stress levels. According to a meta-analysis by Puthran et al., first year medical students had higher rates of depression than students in the other years [34], while Galán et al. indicate that second-year followed by fourth-year dentistry students had the highest levels of anxiety and stress [35], which may be associated with differences in curricula. Fifth-year students experience both the stressors associated with dental training and the stressors associated with their future work as doctors, with full responsibility of care over their patients [36-38]. Moreover, the greatest concerns of both first-year and fifth-year students in our study were, firstly, that they will be unable to master the entire pool of medical knowledge, and secondly, medical school—which seemed like more of a threat than a challenge to them.

We did not find any significant differences in PMSS by gender, age, academic year, or mode of study. Our findings here are in agreement with studies conducted at dental schools in other countries, which also noted no significant differences [16, 18, 19]. Furthermore, Polish dentistry students had higher mean PMSS scores than Pol-

ish [6], German [19], Norwegian [17] and US medical students [15]. Norwegian, German, and US doctors are reported to experience greater general satisfaction with working conditions, remuneration, and job satisfaction than are Polish doctors, which seems to agree with these findings [39-41]. According to Kötter et al., students with greater scores on the PMSS suffered from worse mental well-being [18]. In our study, we noted a significant positive correlation between PMSS and PSS-10: the higher the PSS-10 score, the greater the anxiety, as assessed by the PMSS scale. We further observed that, interestingly, there was a significant negative correlation between age and PMSS-1 (“Medical school fosters a sense of anonymity and feelings of isolation among students”) and a significant and positive correlation between age and PMSS-10 (“Medical school is cold, impersonal, and needlessly bureaucratic”). The older the students were, the more they disagreed with the PMSS-1 statement and agreed with the PMSS-10 statement.

Limitations

Our study has a number of strengths, but we should also mention some of its limitations. All of the collected data were from self-report questionnaires, which are of a subjective nature and susceptible to falsification due to social expectations and the exaggeration or negation of feelings. Another point to be borne in mind is that our sample included students from only a single university, although it was very large ($n = 272$) and had a very high response rate of 85%. This is also one of the few studies that took into account dentistry students from all years of their program.

Conclusions

We found that perceived stress among Polish dentistry students is generally high. We also observed that female dentistry students were significantly more stressed than males. Students in the first and fifth years were the most susceptible to stress. Interestingly, we did not observe any statistically significant differences between part-time and full-time students. These findings suggest that support services should be made widely available to all dentistry students. Such services should be targeted to the specific needs of male and female students as well as to those in specific years of study.

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