Comparison of Stress Levels and Factors Inducing It Between Polish Medical and Dental Students in the Pre-Clinical Years of Their Training

Porównanie poziomu stresu i czynników go wywołujących pomiędzy polskimi studentami medycyny i stomatologii w okresie zajęć przedklinicznych

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Keywords
PMSS, PSS-10, medical and dental students, preclinical years, stress

Abstract
Introduction: Stress has become an integral part of modern life. In the short-term, stress can be beneficial, but however, experiencing it long-term is increasingly common and can lead to multiple disorders, such as cardiovascular disease, diabetes and memory disabilities. Medical and dental undergraduates experience both stress related to their medical training and such associated with existence in general.
Aims: The primary aim of this study was to determine stress level among medical and dental students in the pre-clinical years of their training and find out which factors induce stress the most. The second objective was to discover which pre-clinical students are most susceptible to stress: medical or dental.
Materials and methods: A total of 599 pre-clinical students from both dental and medical undergraduate studies at Jagiellonian University Medical College were enrolled in the study, of which 491 were medical and 108 were dental students. To assess stress levels and the factors that induce it, we used 2 validated surveys: the Perceived Stress Scale (PSS-10) and the Perceived Medical School Stress (PMSS) instrument.
Results: We observed that dental pre-clinical students obtained significantly higher scores on the PSS-10 (23.49 ±6.18) and PMSS (37.34 ±8.08) than their medical colleagues: PSS-10 (21.58 ±6.89) and PMSS (35.33 ±8.15). However, both medical and dental students demonstrated high stress levels.
Conclusions: Both pre-clinical Polish medical and dental students experience high levels of stress. The later achieved significantly higher scores regarding level of stress than their medical peers. Both medical and dental students most strongly agree with statements indicating that training takes over their life and leaves too little time for other activities. These findings allow to suggest that support services should be made widely-available to all preclinical medical and dental students. Such services should be targeted to the specific needs of both groups. It also seems necessary to conduct similar research in other groups of medical students whose programme also comprises clinical classes (with patients) – including students of physical therapy, nursing, occupational therapy as well as emergency services. Students of these faculties often spend more time directly beside the patient's bed, dealing with his/her care or rehabilitation.

The individual division of this paper was as follows: A – research work project; B – data collection; C – statistical analysis; D – data interpretation; E – manuscript compilation; F – publication search

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Słowa kluczowe
PMSS, PSS-10, studenci medycyny i stomatologii, lata przedkliniczne, stres

Streszczenie
Wstęp: Stres stał się nieodłącznym elementem współczesnego świata. Stres krótkotrwały może być korzystny, natomiast ten przewlekły, który jest coraz bardziej powszechny może prowadzić do wielu zaburzeń, takich jak choroby układu krążenia, cukrzyca czy zaburzenia pamięci. Studenci medycyny jak i stomatologii doświadczają stresu zarówno związanego z życiem codziennym jak i tego związanego z kształceniem na uczelniach medycznych.
Cel pracy: Podstawowym założeniem badania było określenie poziomu stresu i czynników go wywołujących w latach przedklinicznych kształcenia lekarzy jak i lekarzy dentystów. Drugim celem było zaobserwowanie, którzy przedkliniczni studenci są bardziej podatni na stres, czy ci z medycyny czy ze stomatologii.
Materiały i metody: W badaniu wzięło udział 599 studentów z lat przedklinicznych kierunku lekarskiego jak i kierunku lekarsko-dentystycznego z Collegium Medicum Uniwersytetu Jagiellońskiego, z czego 491 byli to studenci medycyny i 108 studenci stomatologii. W celu oceny poziomu stresu i określenia czynników go wywołujących wykorzystano dwa zwalidowane kwestionariusze: Perceived Stress Scale (PSS-10) oraz Perceived Medical School Stress (PMSS).
Wyniki: Zaobserwowaliśmy, że studenci z lat przedklinicznych na kierunku lekarsko-dentystycznym prezentowali statystycznie istotnie wyższy poziom stresu PSS 10 (23,49 ±6,18) i PMSS (37,34 ±8,08) niż ich odpowiednicy z kierunku lekarskiego PSS-10 (21,58 ±6,89) i PMSS (35,33 ±8,15). Jednak średnio studenci obu badanych grup mieli wysoki poziom stresu.
Wnioski: Polscy studenci medycyny i stomatologii z lat przedklinicznych doświadczają wysokiego poziomu stresu. Studenci w okresie zajęć przedklinicznych na kierunku lekarsko-dentystycznym uzyskali istotnie wyższe wyniki poziomu stresu (bardziej podatni na stres) niż studenci na kierunku lekarskim. Ponadto, obie te grupy zdecydowanie zgadzają się ze stwierdzeniem, że ich całe życie jest podporządkowane studiom medycznym, co pozostawia im za mało wolnego czasu na inne aktywności. Wyniki te sugerują, że w okresie zajęć przedklinicznych usługi wsparcia powinny być szerzej dostępne dla wszystkich studentów medycyny i stomatologii. Takie usługi powinny być ukierunkowane na specyficzne potrzeby obu grup. Konieczne wydaje się także przeprowadzenie podobnych badań w innych grupach studentów kierunków medycznych, w programie których to także znajdują się zajęcia kliniczne (z pacjentem) – w tym studentów fizjoterapii, pielęgniarstwa, terapii zajęciowej, ratowników medycznych. Często studenci tych kierunków więcej czasu spędzają bezpośrednio przy łóżku pacjenta zajmując się jego pielęgnacją czy usprawnianiem.

INTRODUCTION

Stress has become an integral part of modern life. Short-term stress can be beneficial, however, long-term stress is increasingly common and may lead to multiple disorders, such as cardiovascular disease, diabetes and memory disabilities[1].

Research into stress and the factors that induce it has been conducted among medical professionals for decades. Generally speaking, stress levels among medical staff are higher than in the general population[2–5]. The main factors leading to stressful stimuli in physicians are making mistakes, burnout, job strain, social expectations, peer-pressure, continuous training and excessive workload[6–9]. Moreover, medical professionals working in hostile work environments are also more likely to feel compassion, fatigue and make poor clinical decisions[10].

Medical and dental undergraduates experience both stress related to their medical training and associated with existence in general. The main factors leading to stressful stimuli vary according to year of study, and include adaptation to medical school, ethical conflicts, exposure to death and human suffering, abuse, educational debt, personal life events, high levels of competition, high expectations held by others, overworking, working with cadavers and lack of time for relaxation[11–14]. As suggested by Moir et al., medical school students are more susceptible to depression than those studying in other fields, with almost one -third of medical school students suffering from it worldwide[15,16]. In our previous research, 802 out of 1,321 (60.72%) medical students and 182 out of 272 (66.91%) dental students demonstrated high levels of stress[17,18]. The potential personal and professional consequences of medical students' distress, according to Dyrbye, include broken relationships, substance abuse, poor self-care (lack of exercise and poor diet), decline in physical health, suicide, impaired academic performance and competence, cynicism and decline in empathy, academic dishonesty, attrition from medical school and medical blunders[11]. Moreover, Dyrbye described solutions that should be taken into consideration by medical schools: all students should be taught how to deal with stress and to promote their self-awareness as well as personal health (underrating regular physical activity and getting adequate amounts of sleep). Struggling students should also be identified and assisted[11].

STUDY AIM

The aim of this study was to answer the following questions:

1. What is the level of stress among medical and dental students in the pre-clinical years of their training?
2. Which factors induce stress the most in pre-clinical years of medicine and dentistry?
3. Which pre-clinical students are most susceptible to stress: medical or dental students?

MATERIALS AND METHODS

Population

Medical training lasts for 6 years in Poland, of which the 1st and the 2nd years are pre-clinical. Dental training lasts 5 years, and the 1st and 2nd years are also pre-clinical.

We approached all the medical and dental pre-clinical students enrolled in the Polish-language programme at Jagiellonian University Medical College (JUMC) in Kraków, Poland. The majority of medical and dental students were surveyed during the winter exam period. The questionnaire was paper-based and was carried out before exams, similarly as done in an earlier study conducted in the USA[19].

Only for 1st-year dental students was the questionnaire carried out using an online platform before the exam session, since the COVID-19 pandemic meant they did not have exams on-site.

All students were invited to take part in the study, regardless of whether they were undergoing fee-paying or state-paying programmes, and there were no differences in the syllabus between these 2 study modes. However, state-paying programme students do not pay tuition fee for the course, but fee-paying programme students must pay tuition fees as a result of scoring lower in the application process.

The inclusion criteria was being a 1st- or 2nd-year Polish-language medical or dental student at JUMC. The exclusion criterion was an incorrectly filled-out questionnaire.

Questionnaires

We used 2 independent international stress questionnaires, both validated for the Polish translation and environment: the Perceived Stress Scale (PSS-10) and the Perceived Medical School Stress Instrument (PMSS)[20,21]. The researcher explained the study objectives to all participants via mail and social media, emphasizing that participation was voluntary and anonymous.

PSS-10 is used to assess a range of subjective feelings and thoughts associated with personal problems, behaviour and ways of coping with them. It contains 10 questions with a 5-point answer scale ranging from 0 (never) to 4 (very often), with a reverse response for 4 positively stated items. The minimum score is 0 while the maximum score is 40. A score between 20 and 40 indicates a high stress level, a score within the range of 14-19 indicates a medium stress level, and a score from 0 to 13 indicates a low stress level[20,22,23]. According to the website of the Laboratory for the Study of Stress, Immunity, and Disease at the Department of Psychology, Carnegie Mellon University, permission is not needed to use PSS-10 for non-profit academic research.

PMSS is used assesses stress associated with medical studies, such as that arising from personal and financial problems, interaction with academic administration, and gaining medical knowledge. It allows to describe negative points of view and perceived dissatisfaction. It contains 13 questions with a 5-point answer scale ranging from 1 ('I totally disagree') to 5 ('I totally agree'). The minimum score is 13 and the maximum is 65, with higher scores meaning higher stress and anxiety levels.

We decided to use the PSS-10 and PMSS questionnaires because both are widely used in research measuring stress levels[19,24–29]. Cohen's PSS-10 scale has been translated into 25 different languages[30]. PMSS has been described by Shiralkar et al. as belonging to the standard set of outcome measures of distress among medical students[31]. Moreover, both surveys have been translated into Polish and validated for language and environment[20,21]. PSS-10 has also been used to validate PMSS, which showed a statistically significant positive correlation between the questionnaires[21].

Statistical analysis

The results were analysed using R Software, version 3.6.2[32]. Quantitative variables were assessed by calculating the mean, standard deviation, median and quartiles. Qualitative variables were evaluated by enumerating the count and percentage occurrence of each value. Quantitative variables in 2 groups were compared using the Mann-Whitney test. Quantitative variables in more than 2 groups were analysed using the Kruskal-Wallis test. Dunn's test was applied as a post-hoc procedure. Correlations between quantitative variables were assessed using Spearman's correlation coefficient. These analyses were conducted at the 0.05 level of significance, thus, *p*-values below 0.05 were interpreted as statistically significant.

RESULTS

A total of 599 pre-clinical students from both dental and medical undergraduate studies at Jagiellonian University Medical College were enrolled in the research, of which 491 were medical and 108 were dental students. In Table 1, the characteristics of the group are presented.

Table 1

Characteristics of the study group

		Medical students	Dentristy students
Parameter		**Total (N=491)**	**Total (N=108)**
Age	Mean ± *SD*	19.88 ± 1.14	20.34 ± 1.46
Gender	Female	292 (59.47%)	77 (71.3%)
	Male	199 (40.53%)	31 (28.7%)
Year of studies	I	264	45
	II	227	63

Pre-clinical medical and dentistry students: comparison of PSS-10, PMSS, and each PMSS question

We observed that dental pre-clinical students had significantly higher scores on the PSS-10 (23.49 ±6.18) ($p = 0.012$) and PMSS (37.34 ±8.08) ($p = 0.024$) than their medical colleagues PSS-10 (21.58 ±6.89) ($p = 0.012$) and PMSS (35.33 ±8.15) ($p = 0.024$). However, both medical and dental students demonstrated high levels of stress. Furthermore, we found that dental students, significantly more often than medical students, agreed with PMSS-2 ('I am concerned that I will not be able to endure the long hours and responsibilities associated with clinical training and practice'), PMSS-3 ('I do not know what the faculty/administration expects of me'), PMSS-8 ('the attitude of too many at the faculty is that students should be subjected to a "baptism of fire"'), PMSS-9 ('the majority of students feel that suc-

Table 2

All 13 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 expects 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 at the faculty is that students should be subjected to a '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

Table 3

Comparison of PSS-10, PMSS and each PMSS item between pre-clinical years of medical and dental students

		Pre-clinical years		
		Medical students (N=491)	**Dentistry students (N=108)**	***p***
PSS-10	Mean ± *SD*	21.58 ± 6.89	23.49 ± 6.18	
	Median	22	24	$p=0.012$*
	Quartiles	17 - 26	19 - 28	
PMSS	Mean ± *SD*	35.33 ± 8.15	37.34± 8.08	
	Median	35	37	$p=0.024$*
	Quartiles	30 - 40	31 - 42	
PMSS-1	Mean ± *SD*	2.61 ± 1.07	2.68 ± 0.98	
	Median	3	3	$p=0.46$
	Quartiles	2 - 3	2 - 3	
PMSS-2	Mean ± *SD*	2.44 ± 1.18	2.82 ± 1.23	
	Median	2	3	$p=0.003$ *
	Quartiles	2 - 3	2 - 4	
PMSS-3	Mean ± *SD*	2.67 ± 1.18	3.06 ± 1.23	
	Median	3	3	$p=0.003$ *
	Quartiles	2 - 3	2 - 4	
PMSS-4	Mean ± *SD*	3.86 ± 1.2	3.88 ± 1.1	
	Median	4	4	$p=0.897$
	Quartiles	3 – 5	3 – 5	
PMSS-5	Mean ± *SD*	3.9 ± 1.17	3.88 ± 1.07	
	Median	4	4	$p=0.549$
	Quartiles	3 - 5	3 - 5	
PMSS-6	Mean ± *SD*	3.02 ± 1.25	2.93 ± 1.14	
	Median	3	3	$p=0.488$
	Quartiles	2 - 4	2 - 4	
PMSS-7	Mean ± *SD*	2.77 ± 1.22	2.68 ± 1.11	
	Median	3	2	$p=0.39$
	Quartiles	2 - 4	2 - 3	
PMSS-8	Mean ± *SD*	2.95 ± 1.18	3.36 ± 1.1	
	Median	3	3	$p=0.001$ *
	Quartiles	2 - 4	2.75 - 4	

PMSS-9	Mean ± *SD*	3.04 ± 1.21	3.35 ± 1.16	
	Median	3	3	p=0.017 *
	Quartiles	2 - 4	2 - 4	
PMSS-10	Mean ± *SD*	2.49 ± 1.14	2.69 ± 1.06	
	Median	2	3	p=0.059
	Quartiles	2 - 3	2 - 3	
PMSS-11	Mean ± *SD*	2.08 ± 1.11	2.17 ± 1.02	
	Median	2	2	p=0.215
	Quartiles	1 - 3	1 - 3	
PMSS-12	Mean ± *SD*	1.89 ± 1.21	2.15 ± 1.23	
	Median	1	2	p=0.014 *
	Quartiles	1 - 2	1 - 3	
PMSS-13	Mean ± *SD*	1.62 ± 1.06	1.72 ± 1.08	
	Median	1	1	p=0.138
	Quartiles	1 - 2	1 - 2	

p – Mann-Whitney test; * statistical significance (p<0.05).

cess in medical school is in spite of the administration rather than because of it') and PMSS-12 ('personal finances are a source of concern to me'). See Table 3.

Comparison of 1st-year medical and dental students

We observed significant differences in PSS-10 (p = 0.002) and PMSS (p = 0.002) scores between 1st-year medical and dental students. Stress levels were high in both groups, but we found that 1st-year dental students significantly more often agreed with PMSS-2, PMSS-3, PMSS-8, PMSS-11 ('Medical school is more of a threat than a challenge') and PMSS-12 than did their peers from medical studies. See Table 4.

Comparison of 2nd-year medical and dental students

We did not find any significant differences in PSS-10 or PMSS between 2nd-year medical and dental students. However, stress level, as measured by PSS-10, were high in both groups. The 2nd-year medical students significantly more often agreed with PMSS-5 ('I am concerned that I will be unable to master the entire pool of medical knowledge') and PMSS-6 ('This medical school is fostering a physician role at the expense of one's personality and interests') than did 2nd-year dental students. See Table 5.

DISCUSSION

We found that pre-clinical medical and dental students are exposed to significant stress, both associated with their course of study and of a more general nature—relating to personal problems, behaviour and ways of coping. Moreover, we observed that pre-clinical dental students had significantly higher levels of stress than their medical colleagues, as measured by PSS-10 and PMSS. To our knowledge, this is the first study in which stress levels are compared between pre-clinical medical and dental students. A total of 599 participants took part in the research, 491 and 108 from the medical and dental courses, respectively. The mean perceived stress level, according to the PSS-10 questionnaire, was 21.58 ±6.89 for medical students and 23.49 ±6,18 for dental students. Harris Poll and Cohen, in "A Global Measure of Perceived Stress", suggest that the mean PSS-10 level for the population aged 18-29 was 14.2 ± 6.2, which represents medium stress levels[22,23]. In our study, it has been shown that Polish pre-clinical medical and dental undergraduates experience high stress levels. Murphy's comparative study allowed to show that pre-clinical dental students also experienced high stress levels and, in general, he observed that dental students had greater stress levels than medical students,[33] which is in line with our study. Ersan, however, found pre-clinical dental students to have moderate stress levels[34]. Similar results were observed by Fares et al., who found that 62% of pre-clinical medical students suffer from high stress[35]. Kumar et al. reported that the most important source of stress among dental students were 'examinations and grading'[36]. However, we noted that stress among our Polish pre-clinical dental and medical students occurred mostly because they were concerned about their ability to master the entire pool of medical knowledge. This is in line with the study of Peker et al., who also found that 'amount of assigned work' and 'fear of failing the year' were the most stress-provoking factors for pre-clinical students[37]. Some similarities might be noticed in another study conducted among the Polish population[38].

We found that 1st-year dental students were significantly more stressed than 1st-year medical students, which may be caused by minor differences in the curriculum, where dental students need to acquire both dental and general medical knowledge. However, we did not find this difference to be significant in the 2nd year.

Limitations

Our study has a number of strengths, but we should also mention some of its limitations. All the data were self-reported by students, and thus, may involve a risk of bias, due to a tendency for respondents to colour

Table 4

Comparison of PSS-10, PMSS and each PMSS item between 1st-year medical and dental students

		First year		
		Medical students (N=264)	**Dentistry students (N=45)**	***p***
PSS-10	Mean ± *SD*	20.97 ± 7.18	24.58 ± 6.4	*p*=0.002*
	Median	21	25	
	Quartiles	16 - 26	20 - 30	
PMSS	Mean ± *SD*	33.91 ± 7.62	37.87 ± 7.4	*p*=0.002*
	Median	33	37	
	Quartiles	29 - 39	32 - 43	
PMSS-1	Mean ± *SD*	2.6 ± 1.06	2.73 ± 0.91	*p*=0.355
	Median	3	3	
	Quartiles	2 - 3	2 - 3	
PMSS-2	Mean ± *SD*	2.31 ± 1.1	2.82 ± 1.11	*p*=0.004 *
	Median	2	3	
	Quartiles	1 – 3	2 - 4	
PMSS-3	Mean ± *SD*	2.62 ± 1.2	3.31 ± 1.12	*p*<0.001 *
	Median	3	4	
	Quartiles	2 – 3	2 - 4	
PMSS-4	Mean ± *SD*	3.8 ± 1.24	4.11 ± 1.09	*p*=0.098
	Median	4	4	
	Quartiles	3 - 5	4 - 5	
PMSS-5	Mean ± *SD*	3.78 ± 1.23	4.11 ± 0.88	*p*=0.196
	Median	4	4	
	Quartiles	3 - 5	4 - 5	
PMSS-6	Mean ± *SD*	2.76 ± 1.26	2.96 ± 1.15	*p*=0.314
	Median	3	3	
	Quartiles	2 - 4	2 - 4	
PMSS-7	Mean ± *SD*	2.67 ± 1.24	2.47 ± 0.99	*p*=0.32
	Median	3	2	
	Quartiles	2 - 3	2 - 3	
PMSS-8	Mean ± *SD*	2.82 ± 1.18	3.29 ± 1.1	*p*=0.015 *
	Median	3	3	
	Quartiles	2 - 4	2 – 4	
PMSS-9	Mean ± *SD*	2.95 ± 1.21	3.33 ± 1.19	*p*=0.052
	Median	3	3	
	Quartiles	2 - 4	2 - 4	
PMSS-10	Mean ± *SD*	2.32 ± 1.1	2.58 ± 1.1	*p*=0.136
	Median	2	2	
	Quartiles	2 – 3	2 – 3	
PMSS-11	Mean ± *SD*	1.92 ± 1.05	2.24 ± 0.96	*p*=0.008 *
	Median	2	2	
	Quartiles	1 - 2	2 - 3	
PMSS-12	Mean ± *SD*	1.76 ± 1.12	2.13 ± 1.18	*p*=0.013 *
	Median	1	2	
	Quartiles	1 - 2	1 - 3	
PMSS-13	Mean ± *SD*	1.6 ± 1.05	1.78 ± 1.04	*p*=0.072
	Median	1	1	
	Quartiles	1 - 2	1 - 2	

p – Mann-Whitney test; * statistical significance (*p*<0.05).

Table 5

Comparison of PSS-10, PMSS and each PMSS item between 2nd-year medical and dental students

		Second year		
		Medical students (N=227)	**Dentistry students (N=63)**	***p***
PSS-10	Mean ± *SD*	22.3 ± 6.49	22.71 ± 5.94	*p*=0.679
	Median	23	23	
	Quartiles	18 - 26	19 - 28	
PMSS	Mean ± *SD*	36.98 ± 8.44	36.98 ± 8.55	*p*=0.864
	Median	36	37	
	Quartiles	31 - 42	31 - 42	
PMSS-1	Mean ± *SD*	2.61 ± 1.08	2.63 ± 1.04	*p*=0.859
	Median	3	3	
	Quartiles	2 - 3	2 - 3	
PMSS-2	Mean ± *SD*	2.59 ± 1.25	2.83 ± 1.31	*p*=0.214
	Median	2	3	
	Quartiles	2 - 4	2 - 4	
PMSS-3	Mean ± *SD*	2.72 ± 1.16	2.87 ± 1.28	*p*=0.378
	Median	3	3	
	Quartiles	2 - 3	2 - 4	
PMSS-4	Mean ± *SD*	3.92 ± 1.15	3.71 ± 1.08	*p*=0.108
	Median	4	4	
	Quartiles	3 - 5	3 - 5	
PMSS-5	Mean ± *SD*	4.04 ± 1.09	3.71 ± 1.16	*p*=0.034 *
	Median	4	4	
	Quartiles	3 - 5	3 - 5	
PMSS-6	Mean ± *SD*	3.31 ± 1.18	2.9 ± 1.15	*p*=0.017 *
	Median	3	3	
	Quartiles	3 - 4	2 - 4	
PMSS-7	Mean ± *SD*	2.9 ± 1.19	2.83 ± 1.17	*p*=0.594
	Median	3	3	
	Quartiles	2 - 4	2 - 4	
PMSS-8	Mean ±*SD*	3.11 ± 1.16	3.41 ± 1.1	*p*=0.054
	Median	3	4	
	Quartiles	2 - 4	3 – 4	
PMSS-9	Mean ± *SD*	3.14 ± 1.2	3.37 ± 1.15	*p*=0.213
	Median	3	3	
	Quartiles	2 – 4	2.5 - 4	
PMSS-10	Mean ± *SD*	2.68 ± 1.15	2.76 ± 1.03	*p*=0.489
	Median	3	3	
	Quartiles	2 - 3	2 - 3.5	
PMSS-11	Mean ± *SD*	2.27 ± 1.15	2.11 ± 1.06	*p*=0.372
	Median	2	2	
	Quartiles	1 - 3	1 - 3	
PMSS-12	Mean ±*SD*	2.04 ± 1.29	2.16 ± 1.27	*p*=0.381
	Median	1	2	
	Quartiles	1 - 3	1 - 3	
PMSS-13	Mean ± *SD*	1.64 ± 1.06	1.68 ± 1.12	*p*=0.706
	Median	1	1	
	Quartiles	1 - 2	1 - 2	

p – Mann-Whitney test; * statistical significance (p<0.05).

their outcomes. Another point to be borne in mind is that our sample, although very large (n = 599), included students from only one university.

CONCLUSIONS

Our results allow us to formulate the following conclusions:

1. Pre-clinical Polish medical and dental students experience high levels of stress.
2. Both medical and dental students most strongly agree with statements indicating that their training takes over their lives and leaves too little time for other activities; they are also concerned that that they will be unable to master the entire pool of medical knowledge.
3. Pre-clinical dental students are more susceptible to stress than pre-clinical medical students.

These findings suggest that support services should be made widely available to all pre-clinical medical and dental students. Such services should be targeted towards the specific needs of both groups.

It also seems necessary to conduct similar research in other groups of medical students, for whom the programme also comprises clinical classes (with patients) – including students of physical therapy, nursing, occupational therapy as well as emergency services.

Ethical approval and consent to participate

The study among both medical and dental students was approved by the Jagiellonian University Bioethical Committee, approval No. 1072.6120.292.2019. Patients' informed consent was obtained from all subjects. All procedures were performed in accordance with the 1964 Declaration of Helsinki and its later amendments.

Consent for publication

Non-applicable.

Availability of data and materials

The database and all filled out questionnaires analysed during the current study are available from the corresponding author upon reasonable request.

Competing interests

The authors declare that they have no competing interests.

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References

1. Mariotti A. The effects of chronic stress on health: new insights into the molecular mechanisms of brain–body communication. Future Sci OA 2015; 1: FSO23. DOI:10.4155/fso.15.21.
2. Viehmann A., Kersting C., Thielmann A., Weltermann B. Prevalence of chronic stress in general practitioners and practice assistants: Personal, practice and regional characteristics. PLoS ONE 2017; 12: e0176658. DOI: 10.1371/journal.pone.0176658.
3. Grover S., Sahoo S., Bhalla A., Avasthi A. Psychological problems and burnout among medical professionals of a tertiary care hospital of North India: A cross-sectional study. Indian J Psychiatry 2018; 60: 175-188.
4. Sharma P., Davey A., Davey S., et al. Occupational stress among staff nurses: Controlling the risk to health. Indian J Occup Environ Med 2014; 18: 52-56.
5. Green A., Duthie H.L., Young H.L., Peters T.J. Stress in surgeons. Br J Surg 1990; 77: 1154-1158.
6. Firth-Cozens J. Doctors, their wellbeing, and their stress. BMJ 2003; 326: 670-671.
7. Familoni O. An overview of stress in medical practice. Afr Health Sci 2008; 8: 6-7.
8. Durand A.C., Bompard C., Sportiello J. et al. Stress and burnout among professionals working in the emergency department in a French university hospital: Prevalence and associated factors. Work 2019; 63: 57-67.
9. Chuang C.H., Tseng P.C., Lin C.Y. et al. Burnout in the intensive care unit professionals: A systematic review. Medicine Baltimore 2016; 95: e5629. DOI:10.1097/MD.0000000000005629.
10. Kumar S. Burnout and Doctors: Prevalence, Prevention and Intervention. Healthcare Basel, Switzerland. 2016; 4: 37. DOI:10.3390/healthcare4030037.
11. Dyrbye L.N., Thomas M.R., Shanafelt T.D. Medical Student Distress: Causes, Consequences, and Proposed Solutions. Mayo Clinic Proceedings 2005; 80: 1613-1622.
12. Bernhardt V., Rothkötter H.J., Kasten E. Psychological stress in first year medical students in response to the dissection of a human corpse. GMS Z Med Ausbild 2012; 29. DOI:10.3205/zma000782.
13. Wolf T.M., Faucett J.M., Randall H.M., Balson P.M. Graduating medical students' ratings of stresses, pleasures, and coping strategies. J Med Educ 1988; 63: 636-642.
14. Dyrbye L.N., Thomas M.R., Shanafelt T.D. Systematic review of depression, anxiety, and other indicators of psychological distress among U.S. and Canadian medical students. Acad Med 2006; 81: 354-373.
15. Moir F., Yielder J., Sanson J., Chen Y. Depression in medical students: current insights. Adv Med Educ Pract 2018; 9: 323-333.
16. Puthran R., Zhang M.W.B., Tam W.W., Ho R.C. Prevalence of depression amongst medical students: a meta-analysis. Med Educ 2016; 50: 456-468.
17. Marchewka W., Samborska U., Drojewski K. et al. Assessment of stress load and its causes among medical students. Rehabilitacja Medyczna 2022; 26: 11-19.
18. Marchewka W., Kluczewska M., Ciszek K. et al. Assessment of stress load and its causes among dental students. Psychiatr Pol 2022; 56: 979-990.
19. Vitaliano P.P., Maiuro R.D., Mitchell E., Russo J. Perceived stress in medical school: resistors, persistors, adaptors and maladaptors. Soc Sci Med 1989; 28: 1321-1329.
20. Juczyński Z., Ogińska-Bulik N. NPSR: Narzędzia Pomiaru Stresu i Radzenia Sobie Ze Stresem. Warsaw, Pracownia Testów Psychologicznych 2009: 11-22.
21. Marchewka W., Loster Z., Marchewka J. et al. Stress associated with undergraduate medical courses: A translation and validation of the Perceived Medical School Stress Instrument into Polish and its adaptation to the Polish environment. Folia Med Cracov 2020; 60: 55-66.
22. Cohen S., Kamarck T., Mermelstein R. A Global Measure of Perceived Stress. Journal of Health and Social Behavior 1983; 24: 385-396.
23. Cohen S. Perceived stress in a probability sample of the United States. The Social Psychology of Health 1988: 31-67.
24. Tyssen R., Vaglum P., Grønvold N.T., Ekeberg O. Factors in medical school that predict postgraduate mental health problems in need of treatment. A nationwide and longitudinal study. Med Educ 2001; 35: 110-120.
25. Vitaliano P.P., Russo J., Carr J.E., Heerwagen J.H. Medical school pressures and their relationship to anxiety. J Nerv Ment Dis 1984; 172: 730-736.
26. Holm M., Tyssen R., Stordal K.I., Haver B. Self-development groups reduce medical school stress: a controlled intervention study. BMC Medical Education 2010; 10: 23. DOI:10.1186/1472-6920-10-23.
27. Bramness J.G., Fixdal T.C., Vaglum P. Effect of medical school stress on the mental health of medical students in early and late clinical curriculum. Acta Psychiatrica Scandinavica 1991; 84: 340-345.
28. Kötter T., Voltmer E. Measurement of specific medical school stress: translation of the "Perceived Medical School Stress Instrument" to the German language. GMS Z Med Ausbild 2013; 30. DOI:10.3205/zma000865.
29. Kötter T., Wagner J., Brüheim L., Voltmer E. Perceived Medical School stress of undergraduate medical students predicts academic performance: an observational study. BMC Med Educ 2017; 17: 256. DOI:10.1186/s12909-017-1091-0.
30. Nielsen T., Dammeyer J. Measuring higher education students' perceived stress: An IRT-based construct validity study of the PSS-10. Studies in Educational Evaluation 2019; 63: 17-25.
31. Shiralkar M.T., Harris T.B., Eddins-Folensbee F.F., Coverdale J.H. A systematic review of stress-management programs for medical students. Acad Psychiatry 2013; 37: 158-164.
32. R Core Team. R: A Language and Environment for Statistical Computing. Vienna, R Foundation fo Statistical Computing 2019: 3-9.
33. Murphy R.J., Gray S.A., Sterling G. et al. A comparative study of professional student stress. J Dent Educ 2009; 73: 328-337.
34. Ersan N., Dölekoğlu S., Fişekçioğlu E. et al. Perceived sources and levels of stress, general self-efficacy and coping strategies in preclinical dental students. Psychol Health Med 2018; 23: 567-577.
35. Fares J., Saadeddin Z., Al Tabosh H. et al. Extracurricular activities associated with stress and burnout in preclinical medical students. J Epidemiol Glob Health 2016; 6: 177-185.
36. Kumar S., Dagli R.J., Mathur A. et al. Perceived sources of stress amongst Indian dental students. Eur J Dent Educ 2009; 13: 39-45.
37. Peker I., Alkurt M.T., Usta M.G., Turkbay T. The evaluation of perceived sources of stress and stress levels among Turkish dental students. Int Dent J 2009; 59: 103-111.
38. Brożyna, K., Radzka, A., Tkaczyk J. et al. Stress among medical students in Poland. J Educ Health Sport 2018; 8: 171-179.

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