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Comparison of stress levels and the factors that induce it between medical and dental students in the clinical years of their training

Urszula Marchewka[1], Wojciech Marchewka[1], Lech Popiołek[2], Krzysztof Bryniarski[3]

[1] 5th Military Clinical Hospital in Cracow, Cracow, Poland
[2] Institute of Psychology, Chair of Psychopathology and Preventive Psychology, Ignatianum University in Cracow, Cracow, Poland
[3] Department of Interventional Cardiology, Institute of Cardiology, Jagiellonian University Medical College, Cracow, Poland

Summary

Aim. The aim of our study was to acknowledge the levels of stress, the main stressors and the difficulties of being a dentistry and medicine student.

Material and methods. A total of 994 clinical students from both dental and medical undergraduate degrees at Jagiellonian University Medical College in Kraków, Poland were enrolled in the study, of whom 830 were medical and 164 were dental students. We used two independent international stress questionnaires, both validated for the Polish translation and environment: the Perceived Stress Scale and the Perceived Medical School Stress Instrument.

Results. Both medical and dental students had high levels of stress: 20.9 ± 7.37 and 21.24 ± 6.84, respectively. The level of stress was slightly higher among dental students, however, the results were not significant ($p = 0.767$). Dental students significantly more often were concerned that they will not be able to endure the long hours and responsibilities associated with clinical training ($p = 0.001$), however, medical student significantly more often agreed that medical school fosters a sense of anonymity and feelings of isolation among the students ($p = 0.01$).

Conclusions. Polish clinical medical and dental students experience high levels of stress, which is slightly higher among dental ones.

Key words: stress, medical students, dental students

Introduction

Our daily life is accompanied with stress. It may be short-term which may have a positive impact on our motivation and concentration and is a fundamental survival

mechanism that enhances protection and performance under threat conditions [1]. In opposition there is chronic stress which is related to our conditions in work, school, universities or even homes. It is proved that chronic stress has a negative impact on health, including cardiovascular system, immune system, brain functions, and it may lead to psychiatric disorders such as anxiety and depression [2, 3].

Medical and dental undergraduates experience both short-term and chronic stress which are related to their medical training as well as their existence in general. According to Wolf et al. [4] both medical and dentistry studies are considered to be one of the most academically and emotionally demanding training programs out of any profession. Consequently, the amount of stress experienced during their training is extensive [4]. The main factors leading to stressful stimuli vary by the year of study and include adaptation to medical school, taking examinations and receiving grades, ethical conflicts, exposure to death and human suffering, working with cadavers, as well as educational debt, personal life events, high levels of competition, high expectations held by others, overwork and lack of time for relaxation [5–8].

Acknowledging levels of stress, the main stressors and the difficulties of being a dentistry and medicine student may be valuable both for educators and for the students themselves. It can help implement changes in the dental and medical education system, which may lead to a reduction in stress factors and as a result in levels of stress. For example, university authorities could create special classes, in many aspects similar to the Balint Groups functioning among physicians. Such courses would be dedicated to all medical and dental students, in which they would learn how to cope with stress by way of meditation, mindfulness or yoga. Moreover, they would learn how to properly communicate between each other and with patients or even have group psychotherapy and openly verbalize their concerns and experienced problems. The knowledge and personal skills acquired during this type of classes could increase effectiveness and reduce the number of medical errors.

It has been proven that doctors who do not know how to cope with stress or are exposed to higher levels of stress in the workplace due to a shortage of staff, as well as those who do not understand the impact of stress on the development of depression and do not recognize its symptoms in themselves, make more medical errors and show less confidence in their actions [9, 10]. Unfortunately there are no such classes in study curriculum in Polish medical academies, however, in case of mental crisis, in many universities in Poland all students can contact special centers providing help, where they will receive professional psychological and psychiatric consultation for free.

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 clinical years of their training? (2) Which factors induce stress the most among medical and dental students in the clini-

cal years of their training?; (3) Which clinical students are most susceptible to stress: medical or dental?

Material and methods

Population

Medical training in Poland lasts six years, of which the third, fourth, fifth, and sixth years are clinical. On the contrary, dental training last for five years and the third, fourth, and fifth years are clinical.

We approached all medical and dental clinical students enrolled in the Polish-language program at Jagiellonian University Medical College (JUMC) in Cracow, Poland. Medical students between third and sixth year of training were surveyed during the 2020 winter exam period. The questionnaire was paper-based and was carried out before the exams, similarly to an earlier study conducted in the USA [11]. The dental students were surveyed during the 2021 winter exam period. Again, the questionnaire was paper-based and was distributed to fourth and fifth-year students before the exams, as in the American study [11]. For third-year dental students the questionnaire was carried out using online platform, because 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 part-time or full-time, and there are no differences in the syllabus between these two study modes. However, full-time students do not pay tuition fee for the course, but part-time students must pay tuition fees as a result of scoring lower in the application process.

Regarding the inclusion criteria, all Polish-speaking students of medicine and dentistry from the third to the last year of studies at the Jagiellonian University Medical College were included in the study. The exclusion criterion was an incorrectly filled-out questionnaire.

Questionnaires

We used two 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) [12, 13]. The researcher explained the aims of the study to all participants through mail and social media, emphasizing that participation is voluntary and anonymous.

PSS-10 assesses a range of subjective feelings and thoughts associated with personal problems, behavior, and ways of coping with these. It contains ten questions with a five-point answer scale ranging from 0 (“never”) to 4 (“very often”), with a reverse response for four positively stated items. The minimum score is 0 and the maximum score is 40. A score between 20 and 40 indicates a high stress level, a score in the range 14–19 indicates a medium stress level, and a score from 0 to 13 indicates a low stress

level [12, 14, 15] 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 nonprofit academic research.

PMSS assesses stress associated with medical studies, such as that arising from personal and financial problems, interaction with academic administration, and gaining medical knowledge. It can describe negative points of view and perceived dissatisfaction. It contains thirteen questions with a five-point answer scale ranging from 1 ("I totally disagree") to 5 ("I totally agree"). The minimum score is 13 and the maximum score 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 [11, 16–21]. Cohen's PSS-10 scale has been translated into 25 different languages [22]. PMSS has been described by Shiralkar et al. [23] as belonging to the standard set of outcome measures of distress among medical students. Moreover, both surveys have been translated into Polish and validated for language and environment [12, 13]. PSS-10 has also been used to validate PMSS, which showed a statistically significant positive correlation between the questionnaires [13].

Statistical analysis

The results were analyzed using R Software version 3.6.2 [24]. Quantitative variables were analyzed by calculating the mean, standard deviation, median, and quartiles. Qualitative variables were analyzed by enumerating the count and percentage occurrence of each value. Quantitative variables in two groups were compared using the Mann–Whitney test. Quantitative variables in more than two groups were analyzed using the Kruskal–Wallis test. Dunn's test was used as 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, so p-values below 0.05 were interpreted as statistically significant.

Results

A total of 994 clinical students from both dental and medical undergraduate degrees at JUMC were enrolled in the study, of which 830 were medical and 164 were dental students. The overall response rate was 91% among medical students and 85% among dental students. Table 1 shows the characteristics of the group.

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

		Medicine students	Dentistry students
Parameter		Total (N = 830)	Total (N = 164)
Age	Mean ± SD	23.18 ± 1.62	22.77 ± 1.46
Gender	Female	476 (57.3%)	120 (73.2%)
	Male	354 (42.7%)	44 (26.8%)
Year of studies	III	203	52
	IV	203	61
	V	202	51
	VI	222	-

Table 2. **All thirteen 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.

Both medical and dental students had high levels of stress, however, we did not find any statistically significant differences on PSS-10 ($p = 0.767$) and PMSS ($p = 0.263$)

between study groups (Table 3). Analyzing individual questions 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") and PMSS-9 ("the majority of students feel that success in medical school is in spite of the administration rather than because of it"). On the other hand, medical students significantly more often in the contrary to dental students agreed with PMSS-1 ("medical school fosters a sense of anonymity and feelings of isolation among the students"), 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").

Table 3. **Comparison of PSS-10, PMSS and each PMSS item between clinical years of medical and dental students**

Clinical years				
		Medicine students (*N* = 830)	**Dentistry students (*N* = 164)**	***p***
PSS-10	mean ± SD	20.9 ± 7.37	21.24 ± 6.84	*p* = 0.767
	median	21	21.5	
	quartiles	16-26.75	16-26	
PMSS	mean ± SD	37.42 ± 8.95	36.5 ± 9.02	*p* = 0.263
	median	37	36	
	quartiles	31-43	30-42	
PMSS-1	mean ± SD	2.63 ± 1.11	2.38 ± 1.03	*p* = 0.01 *
	median	3	2	
	quartiles	2-3	2-3	
PMSS-2	mean ± SD	2.34 ± 1.24	2.69 ± 1.19	*p* <0.001 *
	median	2	2	
	quartiles	1-3	2-4	
PMSS-3	mean ± SD	3.03 ± 1.27	2.9 ± 1.25	*p* = 0.307
	median	3	3	
	quartiles	2-4	2-4	
PMSS-4	mean ± SD	3.43 ± 1.28	3.57 ± 1.31	*p* = 0.143
	median	4	4	
	quartiles	2-5	3-5	

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PMSS-5	mean ± SD	4.02 ± 1.17	3.74 ± 1.21	$p = 0.002$ *
	median	3	3	
	quartiles	2-4	2-4	
PMSS-6	mean ± SD	3.33 ± 1.24	3.09 ± 1.3	$p = 0.036$ *
	median	3	3	
	quartiles	2-4	2-4	
PMSS-7	mean ± SD	2.84 ± 1.28	2.7 ± 1.35	$p = 0.172$
	median	3	2	
	quartiles	2-4	2-4	
PMSS-8	mean ± SD	3.04 ± 1.26	2.96 ± 1.29	$p = 0.429$
	median	3	3	
	quartiles	2-4	2-4	
PMSS-9	mean ± SD	3.21 ± 1.27	3.59 ± 1.21	$p < 0.001$ *
	median	3	4	
	quartiles	2-4	3-5	
PMSS-10	mean ± SD	2.91 ± 1.18	2.82 ± 1.21	$p = 0.323$
	median	3	3	
	quartiles	2-4	2-4	
PMSS-11	mean ± SD	2.32±1.23	2.15±1.04	$p = 0.247$
	median	2	2	
	quartiles	1-3	1-3	
PMSS-12	mean ± SD	2.47 ± 1.43	2.22 ± 1.29	$p = 0.066$
	median	2	2	
	quartiles	1-4	1-3	
PMSS-13	mean ± SD	1.85 ± 1.22	1.68 ± 1.07	$p = 0.192$
	median	1	1	
	quartiles	1-2	1-2	

p – Mann-Whitney test; * statistically significant ($p < 0.05$)

Comparison of third year of medical and dental students

We did not find any significant differences in PSS-10 and PMSS between third year of medicine and dentistry students (Table 4). Howbeit, stress level measured by PSS-10 in both groups were high. We observed that third-year dental students significantly more often agreed with PMSS-13 ("Accommodation is a source of concern to me").

Table 4. **Comparison of PSS-10, PMSS and each PMSS item between third year (first clinical) of medical and dental students**

Third year (first clinical year)				
		Medicine students (*N* = 203)	**Dentistry students (*N* = 52)**	***p***
PSS-10	mean ± SD	20.29 ± 7.38	21.27 ± 7.14	*p* = 0.413
	median	21	22.5	
	quartiles	15.5-25	16-26.25	
PMSS	mean ± SD	35.82 ± 8.41	37.44 ± 9.22	*p* = 0.21
	median	35	36	
	quartiles	30-41	32-46.25	
PMSS-1	mean ± SD	2.59 ± 1.03	2.6 ± 1	*p* = 0.909
	median	3	2.5	
	quartiles	2-3	2-3	
PMSS-2	mean ± SD	2.39 ± 1.19	2.58 ± 1.35	*p* = 0.453
	median	2	2	
	quartiles	1-3	1.75-3.25	
PMSS-3	mean ± SD	2.9 ± 1.21	2.9 ± 1.14	*p* = 0.932
	median	3	3	
	quartiles	2-4	2-4	
PMSS-4	mean ± SD	3.49 ± 1.31	3.48 ± 1.32	*p* = 0.958
	median	4	4	
	quartiles	2-5	2-5	
PMSS-5	mean ± SD	3.95 ± 1.21	3.96 ± 1.12	*p* = 0.767
	median	4	4	
	quartiles	3-5	4-5	

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PMSS-6	mean ± SD	3.15 ± 1.24	3.15 ± 1.21	*p* = 0.997
	median	3	3	
	quartiles	2-4	2-4	
PMSS-7	mean ± SD	2.79 ± 1.31	2.75 ± 1.37	*p* = 0.807
	median	3	3	
	quartiles	2-4	2-4	
PMSS-8	mean ± SD	2.79 ± 1.21	3.04 ± 1.3	*p* = 0.22
	median	3	3	
	quartiles	2-4	2-4	
PMSS-9	mean ± SD	3.19 ± 1.21	3.48 ± 1.23	*p* = 0.094
	median	3	4	
	quartiles	2 – 4	3 – 4	
PMSS-10	mean ± SD	2.66 ± 1.11	2.87 ± 1.16	*p* = 0.27
	median	3	3	
	quartiles	2-3	2-4	
PMSS-11	mean ± SD	2.13 ± 1.23	2.15 ± 0.96	*p* = 0.413
	median	2	2	
	quartiles	1-3	1-3	
PMSS-12	mean ± SD	2.24 ± 1.4	2.5 ± 1.42	*p* = 0.157
	median	2	2	
	quartiles	1-3	1-4	
PMSS-13	mean ± SD	1.54 ± 1.01	1.98 ± 1.26	*p* = 0.005 *
	median	1	1.5	
	quartiles	1-2	1-2.25	

p – Mann-Whitney test; * statistically significant ($p < 0.05$)

Comparison of last year of medical (sixth) and dental (fifth) students

We did not find any significant differences in PSS-10 and PMSS between students of last year of medicine and dentistry (Table 5). Similarly to third year, stress level measured by PSS-10 in both groups was high. In case of each PMSS items, dental

students significantly more often agreed with PMSS-2, PMSS-4 ("Medical training controls my life and leaves too little time for other activities") and PMSS-9 but medical students significantly more often agreed with PMSS-12 ("Personal finances are a source of concern to me").

Table 5. **Comparison of PSS-10, PMSS and each PMSS item between last year of medical and dental students**

Last clinical year				
		Medicine students (*N* = 222)	**Dentistry students (*N* = 51)**	**p**
PSS-10	mean ± SD	22.21 ± 7.55	23.98 ± 6.37	*p* = 0.157
	median	23	24	
	quartiles	18-27	20-28	
PMSS	mean ± SD	37.29 ± 9.1	38.63 ± 9.25	*p* = 0.431
	median	37	39	
	quartiles	31-43	32-44	
PMSS-1	mean ± SD	2.57 ± 1.17	2.51 ± 1.19	*p* = 0.725
	median	2	2	
	quartiles	2-3	2-3	
PMSS-2	mean ± SD	2.25 ± 1.29	3 ± 1.26	*p* <0.001*
	median	2	3	
	quartiles	1-3	2-4	
PMSS-3	mean ± SD	2.86 ± 1.39	3.06 ± 1.35	*p* = 0.33
	median	3	3	
	quartiles	2-4	2-4	
PMSS-4	mean ± SD	3.37 ± 1.34	4 ± 1.15	*p* = 0.002 *
	median	4	4	
	quartiles	2-5	3-5	
PMSS-5	mean ± SD	4 ± 1.24	4.02 ± 1.17	*p* = 0.948
	median	4	4	
	quartiles	3-5	3-5	
PMSS-6	mean ± SD	3.34 ± 1.24	3.33 ± 1.37	*p* = 0.865
	median	3	4	
	quartiles	2-4	2-4	

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PMSS-7	mean ± SD	2.85 ± 1.29	2.69 ± 1.35	$p = 0.37$
	median	3	2	
	quartiles	2-4	2-4	
PMSS-8	mean ± SD	3.11 ± 1.31	3.12 ± 1.31	$p = 0.942$
	median	3	3	
	quartiles	2-4	2-4	
PMSS-9	mean ± SD	3.07 ± 1.34	3.73 ± 1.25	$p = 0.002$ *
	median	3	4	
	quartiles	2-4	3-5	
PMSS-10	mean ± SD	2.83 ± 1.16	2.94 ± 1.33	$p = 0.636$
	median	3	3	
	quartiles	2-4	2-4	
PMSS-11	mean ± SD	2.35 ± 1.26	2.51 ± 1.19	$p = 0.296$
	median	2	2	
	quartiles	1-3	2-3	
PMSS-12	mean ± SD	2.75 ± 1.46	2.16 ± 1.21	$p = 0.01$ *
	median	3	2	
	quartiles	1-4	1-3	
PMSS-13	mean ± SD	1.93 ± 1.26	1.57 ± 0.83	$p = 0.169$
	median	1	1	
	quartiles	1-3	1-2	

p – Mann-Whitney test; * statistically significant ($p < 0.05$)

Discussion

Studies from the last thirty years strongly suggest that medical and dental students experience high amounts of stress during training [25, 26]. The present study did not compare medical and dental students to the general population, but instead compared clinical medical students with clinical dental students. Although these groups may seem to be similar, they differ in significant ways.

The study showed that both medical and dental students suffer significant stresses of both an academic and a more general nature, associated with personal problems. The mean perceived stress level, as measured by the PSS-10 questionnaire, was 20.9 ± 7.37 for medical students and 21.24 ± 6.84 for dental students. Both these results

indicate high stress levels. The Harris Poll, as well as the study of Cohen et al. [14, 15] (*A Global Measure of Perceived Stress*), showed that the mean PSS-10 level for the population aged 18–29 was 14.2 ± 6.2, corresponding to a medium stress level. Our study has shown that Polish clinical medical and dental undergraduates experience much higher stress levels. It may be the case that these high stress levels are linked to the lack of opportunity to relax and to engage in activities unrelated to clinical training – which students do not have time to engage in. This possibility was tested for by the item PMSS-4 "Medical training controls my life and leaves too little time for other activities," which proved to be one of the three most highly scored items in the questionnaire in our population (coming third among dental students and second among medical students).

We observed that dental clinical students had somewhat higher stress levels, as measured by PSS-10, than their medical colleagues, but these results were not statistically significant. Our results are in accordance with the comparative study of Murphy et al. [26], where clinical dental students also experienced high stress levels, and where dental students had greater stress levels than medical students. Moore et al. [27] determined that dental students experience greater negative stress and show more signs of mental disorders as a result of chronic stress than a similar sample of medical students [27], which again resembled our results. We additionally observed that dental students were significantly more worried about their ability to endure the hours and responsibilities associated with clinical training and practice. Similar concerns were expressed by medical and dental students surveyed in the study by Schmitter et al. [28]. In attempting to explain this discrepancy, it is worth comparing the medical and dental curricula. Dental students are required to learn and execute a number of specific treatment procedures, and they also take full responsibility for providing comprehensive care to patients, with supervision only when strictly necessary. Polish medical students, on the other hand, do not have responsibilities of this sort. They are more often accompanied by teachers during clinical rotation, where they only provide support and generally do not directly treat patients.

Furthermore, the medical students we surveyed were more concerned than their dental counterparts that medical school fostered the physician's role at the expense of their own personality and interests (PMSS-6). They were also concerned that medical school produces a sense of anonymity and feelings of isolation among students (PMSS-1); this is also in line with the "social isolation" observed in medical students by Schmitter et al. [28]. The medical students were also exposed to other powerful stressors that are directly related to social isolation, such as a lack of confidence in their own abilities, a lack of understanding on the part of nonmedical acquaintances, and others' high expectations of them [8].

Limitations

All the data was self-reported by students, therefore it may involve a risk of bias. We did not take into account possible additional stress factors, such as: paying tuitions fees by students. Another point to be borne in mind is that our sample, although very large (n = 994), included students from only a single university.

Conclusions

We found that both clinical dental and medical students have high level of stress, however, these results when analyzing whole questionnaires were not significant. Regardless, we found significant differences regarding specific questions in the questionnaires. Moreover, we observed that both groups were the most concerned that they will be unable to master the entire pool of medical knowledge, however, medical students presented statistically significantly higher level of concern.

In summary, our results allow us to formulate the following conclusions: (1) Polish Clinical 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 life and leaves too little time for other activities; they are also concerned that they will be unable to master the entire pool of medical knowledge; (3) both groups – clinical dental and clinical medical students – are susceptible to stress.

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

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Ethical approval and consent to participate

The study on both medical and dental students was approved by the Jagiellonian University Bioethical Committee, approval no. 1072.6120.292.2019 and no. 1072.6120.290.2020. Informed consent was obtained from all subjects. All procedures were performed in accordance with the Declaration of Helsinki and its later amendments.

Availability of data and materials

The database and all filled out questionnaires analyzed 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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Corresponding author: Urszula Maria Marchewka
e-mail: urszula.samb@gmail.com