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Knowledge of and attitudes to occupational and sports medicine among medical students in Zagreb, Croatia

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Occupational and sports medicine (OSM) education is poorly represented in Croatian university undergraduate medical curricula. Zagreb University medical students are required to take OSM classes for a week on their final year of studies. The classes are organised around team-based learning (TBL). Given that students who attend TBL classes have significantly higher exam scores than students who take lectures *ex cathedra*, the aim of this study was to assess students' knowledge and attitudes immediately after TBL OSM classes. This cross-sectional study included 162 final-year Zagreb University School of Medicine students taking TBL classes in OSM in the academic year of 2019/2020. They were recruited from 30 September 2019 to 4 March 2020. Participants filled in a 20-item questionnaire compiled by the authors and adapted to the Croatian legislation. Their answers demonstrated positive attitude toward OSM classes and negative attitude toward occupational medicine practice and OSM specialty. They showed moderate interest only for the job of sports physician. Even though they showed sufficient knowledge of OSM immediately after the course was completed, they were moderately satisfied with their knowledge. Our findings call for rethinking the practical aspects of teaching OSM classes in order to promote OSM practice among medical students or at least raise awareness about the importance of prevention of numerous work or sport-related disorders.

KEY WORDS: legislation; medical education; occupational disease; problem solving; team-based learning

A 2011 study (1) estimated that by 1950 medical knowledge doubled every 50 years. In 1980, this doubling time dropped to 7 years, and in 2010 to 3.5 years. In 2020, the authors projected it to drop to no more than 73 days (1). A multiplication of information this huge demands that medical schools adapt with new and diverse teaching methods and modern technologies that are more aligned to the needs and habits of contemporary students (2). To meet these demands, our Department of Environmental Health and Occupational and Sports Medicine has introduced team-based learning (TBL) to teach a course in Environmental Health and Occupational and Sports Medicine (EH&OSM) course in the academic year 2019/2020. University of Zagreb School of Medicine students are required to take EH&OSM classes for one week in their final year (3) and take exam by the end of that year. In previous academic years, traditional OSM education included lectures (*ex cathedra*), seminars, and practicals (4). Most of the material was only presented and rarely discussed at the course, and student participation was rather passive. Students were expected to study all through the course, but it was left to them to decide whether to prepare for each class or just for the final exam. Those OSM classes mostly followed the textbook from 1999. In contrast, current TBL classes involve small groups of students, who are expected to actively participate in the learning process (5–9). They are required to prepare for each class to be able to deal with given medical problems and discuss possible solutions in workgroups (10). TBL is not only the preferred method over traditional teaching, as reported for Sydney Medical School students in 2017 (6), but also seems to significantly improve exam scores (11–13).

Our OSM classes offer useful information about occupational hazards and their effects on workers or athletes and about the legal framework for handling claims related to occupational diseases or injuries at work (3). For students to be able to address these issues, they first need to get familiar with medical and clinical basics in order to understand the aetiopathogenesis, toxicokinetics, diagnostics, and clinical conditions attributed to OSM (14). The importance of teaching OSM to medical students arises from the significant contribution of occupational and work-related diseases and injuries to the global burden of diseases and from high death rates, which account for about two million a year worldwide (15, 16). Yet, in spite of its

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relevance, OSM education is poorly represented in undergraduate medical curricula (17) through mandatory (18) or elective (19) courses, even though occupational disorders are likely to be encountered by non-occupational physicians first (15).

Since we introduced TBL, we wanted to get student feedback about knowledge gained and attitudes to OSM during or immediately after OSM classes with the aim to check our working hypothesis that they would show sufficient knowledge and express positive attitude toward OSM.

METHODS AND PARTICIPANTS

This cross-sectional study included 162 (112 women and 50 men) of the invited 234 (response rate 69.2 %). final-year medical students who took OSM classes in the academic year 2019/2020. They were recruited from 30 September 2019 to 4 March 2020 at five time points corresponding to the beginning of each of the five EH&OSM course modules. All students were informed about research aims and asked to participate anonymously by filling in our 20-item Google Forms® questionnaire distributed by a link on the School's Learning Management System. The questionnaire had not been validated before its first use in this study. The participants were asked to fill in the questionnaire on their smartphones in the classroom as soon as they completed the course.

The questionnaire consists of two items related to gender (male, female) and a grade point average (GPA, 1-fail, 2-sufficient, 3-good, 4-very good, 5-excellent), six items related to students' self-assessed knowledge of OSM and interest in OSM classes, specialty, and practice (Likert scale 1–5; 1=completely disagree, 2=disagree, 3=not sure, 4=agree, 5=completely agree), and 12 multiple-choice questions related to the learning objectives of the OSM course, in which only one of the four choices (A–D) was correct. We considered overall students' knowledge to be sufficient if more than 50 % of the participants answered each of the 12 questions correctly. Students' attitudes were deemed positive if the median of the degree of agreement with each of the six statements was greater than 3. The multiple-choice questions referred to information presented in the classroom, which was unanimously deemed fundamental knowledge by OSM teachers. Before submitting their answers, the students consented to participation by confirming a statement to that effect in the questionnaire.

At the beginning of the course, all students were divided into 5–6 groups of 3–4 to discuss selected medical cases obtained from the Croatian Institute of Public Health Division of Occupational Health. The learning objectives were to learn how to assess risk at the workplace, differentiate physical, chemical, and biological hazards, and diagnose occupational or work-related diseases and work and sport injuries in line with the Croatian legal framework (20–21). The cases covered the topics shown in Table 1. Teachers moderated group discussions and gave immediate feedback if the answers/solutions were correct. The case selection was consistent with the frequency and type of officially confirmed occupational diseases listed in the Croatian Register of Occupational Diseases 2016–2019 (22).

The study was approved by the Ethics Committee of the University of Zagreb School of Medicine.

Statistical methods

Normality of continuous data distribution was assessed with the Kolmogorov-Smirnov test and, depending on the test results, appropriate non-parametric tests were used in subsequent analyses. Continuous data (GPA, attitudes, and self-assessed knowledge) were represented as medians with corresponding interquartile ranges. Categorical data (correct answers to multiple-choice questions) were represented as absolute and relative frequencies. Correlation was assessed between GPA and each item referring to students' attitudes. P values below 0.05 were considered significant. All analyses were run on the IBM SPSS Statistics version 25.0 (IBM, Armonk, NY, USA).

RESULTS

Detailed information on students' attitudes and self-assessed knowledge is shown in Table 2. The students found

Table 1 Medical cases and aetiology

Type of hazard	Hazard	Case
Physical	Noise	Noise-induced hearing loss
	Vibrations	Hand-arm vibration syndrome
		Carpal tunnel syndrome
Chemical	Asbestos	Asbestos-related pleural diseases
	Aniline	Bladder cancer
Biological	*Leishmania* spp.	Cutaneous leishmaniasis
	Mycobacterium tuberculosis	Lung tuberculosis
	Adenovirus	Viral keratoconjuctivitis
	Hepatitis B virus	Chronic viral hepatitis B

OSM classes interesting, but were not sure about how satisfied they were with their knowledge of OSM. They were moderately interested in pursuing the sports physician career but not inclined to work as occupational physicians. On average, they showed no interest in specialising in OSM.

Table 3 brings detailed assessment of students' knowledge based on their answers to multiple-choice questions. Students showed sufficient knowledge immediately after course completion. We determined insufficient knowledge (24.1 %) to only one question about legal rights based on the loss of work ability. Almost all students (98.1 %) were aware of the Croatian acronym "PUR" (special working conditions, SWC), which is probably the most common abbreviation used in OSM in Croatia and refers to jobs with special working conditions (23).

Median student GPA was 4.2 (interquartile range 4.0–4.6) and was not associated with their attitudes.

DISCUSSION AND OBSERVATIONS ABOUT THE BENEFITS OF TBL

Knowledge

Our findings confirmed the first part of our hypothesis that the students would show sufficient knowledge of OSM after the course, more specifically workplace hazards, health effects, and relevant legislation. They built this knowledge on TBL cases that included occupational diseases with verified hazard exposure duration. At the beginning of the course, students were instructed to read the new textbook (14) and selected research articles to prepare for each case. Discussions on biological hazards were based on the cases of cutaneous leishmaniasis in a military commander or lung tuberculosis and viral keratoconjunctivitis in nurses. Physical hazards were discussed on the cases of noise-induced hearing loss in a carpenter and hand-arm vibration syndrome in a lumberjack. Chronic health effects of exposure to chemicals were addressed by discussing the case of bladder cancer in a car painter and learning about the International Agency for Research on Cancer (IARC) classification. As expected, they showed satisfactory knowledge in this respect.

Their knowledge about causes of occupational injuries was also sufficient. While discussing the case of chronic viral hepatitis B in a nurse, the students learned about needle stick injuries and possible complications such as chronic hepatitis. Discussing the noise-induced hearing loss in a carpenter, they learned about how to assess work ability and disability retirement within the Pension Insurance Act framework (24). Nearly all participants (98.1 %) were familiar with the PUR/SWC acronym (23), which defines workplace conditions and/or professions at risk. Students

Table 2 Self-assessed knowledge and attitudes about OSM (N=162)

Item	Median (interquartile range)*
I am satisfied with my knowledge of occupational medicine.	3.0 (2.0–4.0)
I am satisfied with my knowledge of sports medicine.	3.0 (2.0–4.0)
I am interested in the subject of occupational and sports medicine.	4.0 (3.0–5.0)
I would like to work as a sports physician.	3.0 (2.0–4.0)
I would like to work as an occupational physician.	2.0 (1.0–3.0)
I would like to specialise in occupational and sports medicine.	2.0 (1.0–3.0)

* 1=completely disagree, 2=disagree, 3=not sure, 4=agree, 5=completely agree

Table 3 Percentage of participants answering correctly to multiple-choice questions (N=162)

Correct answer	N (%)
Occupational injury is caused by sudden changes in body position.	93 (57.4)
Occupational disease is the one with a known exposure duration to a hazard.	126 (77.8)
The Croatian Pension Insurance Act regulates rights based on partial loss of work ability.	39 (24.1)
The PUR acronym in occupational medicine refers to special working conditions.	159 (98.1)
The IARC acronym refers to the international agency.	113 (69.8)
Sport coded IA refers to a sport with low static and dynamic load.	120 (74.1)
Prolonged QT interval is not the consequence of exercise.	84 (51.9)
Athletes are assessed for maximum oxygen uptake with the Astrand test.	138 (85.2)
General physician is the first to report occupational disease.	131 (80.9)
Occupational physician's role in occupational safety committee is regulated by the Health and Safety at Work Act.	131 (80.9)
Vocational rehabilitation is a prevention of disability.	92 (56.8)
Static work involves isometric muscle contractions.	132 (81.5)

were asked to analyse specific sections of this policy and use the acronym in oral presentations in the classroom.

Three of the 12 multiple-choice questions relate to the role of occupational and general physicians in reporting occupational diseases, to the legal framework defining the role of occupational safety committees, and to vocational rehabilitation.

The participants also showed sufficient knowledge of sport codes, use of electrocardiogram, and maximum oxygen uptake measurement in athletic ability assessment. Such result was expected since they learned the basics about the types of muscle contractions and load in the second and the fifth year of medical studies.

We have noticed that knowledge was poorer about issues that were not discussed at workgroups in connection to the presented real-life cases, such as rehabilitation, ECG (QT interval), and most prominently legal coverage of partial loss of work ability (Table 3).

Part of the problem is that the current curriculum does not include visits to workplaces or occupational medicine offices, where the students would be able to put their knowledge to practice.

Interestingly, the participants were quite reserved in their own assessment of knowledge gained.

Attitude

Speaking of attitudes toward OSM as a study subject and prospective career, our findings showed an interesting contradiction. The students expressed a relatively high interest in the study subject per se, most likely thanks to the problem-oriented TBL classes, but were far more reserved about pursuing OSM as future career. More precisely, they preferred sports medicine over occupational medicine. This came as no surprise, as our participants did not have a chance to visit occupational medicine services and workplaces, to speak with workers, or observe OM specialists at work and participate in counselling on the use of personal protective equipment and reporting occupational diseases or injuries at work. Even though the same is true of their lack of practice in sports medicine services, the latter seems to have a stronger general appeal. In Croatia, occupational medicine and sports medicine have been integrated in a single specialty since 2004 (14), but specialists may later focus more on either aspect.

Study limitations

As our 20-item questionnaire was used for the first time in this study, we could not compare our findings about knowledge and attitudes toward OSM with earlier courses relying on traditional didactic methods to assess the benefits of TBL, but this does not undermine its importance, as it has been evidenced by reports on experiences from other countries (6, 11–13).

Another limitation may be related to possible bias, as the respondents were recruited by the course teachers (who happen to be the authors of this paper) and who may have been more intrinsically interested in OSM than non-respondents. This, however, does not diminish the value of their feedback, as it points to certain realities about general attitude of medical students toward OSM, the lack of practical training first and foremost.

CONCLUSION

Students' attitudes toward OSM are both positive and negative. They expressed interest in the course but there was no positive attitude toward the profession. Students' knowledge about certain OSM fundamentals was sufficient for further preparation for the exam. Selected medical cases seemed to be well adapted for TBL and appropriately chosen to achieve learning objectives. Theoretical approach to problem solving is necessary, but what develops students' competencies is the acquisition of practical skills. Practical aspects of a teaching strategy on OSM classes should be considered in the future in order to promote OSM practice among medical students or at least raise awareness about the importance of prevention of numerous work or sport-related disorders.

Conflict of interests

None to declare.

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Znanje i stavovi studenata medicine o medicini rada i sporta

Edukacija iz medicine rada i sporta (MRIS) slabo je zastupljena u kurikulima dodiplomskih studija medicine. Studenti medicine na Medicinskom fakultetu Sveučilišta u Zagrebu obvezni su pohađati nastavu iz MRIS-a tjedan dana na posljednjoj godini studija. Nastava je organizirana prema načinu poučavanja u grupi (PUG). Kako studenti koji iskuse PUG imaju bolje rezultate ispita i ocjene u odnosu na studente koji samo pohađaju predavanja, cilj ovog istraživanja bio je procijeniti znanje i stavove studenata odmah nakon nastave iz MRIS-a koja je zasnovana na PUG-u. U ovom presječnom istraživanju sudjelovala su 162 studenta završne godine studija medicine na Medicinskom fakultetu Sveučilišta u Zagrebu koji su iskusili PUG tijekom nastave iz MRIS-a u akademskoj godini 2019./2020. Bili su uključeni u istraživanje od 30. rujna 2019. do 4. ožujka 2020. Sudionici su ispunili upitnik s 20 čestica koji se odnosi na znanje i stavove studenata o MRIS-u. Autori su ga sastavili i prilagodili hrvatskom zakonodavstvu. Rezultati našega istraživanja pokazali su pozitivne stavove studenata prema nastavi iz MRIS-a i negativne stavove prema poslu u medicini rada i specijalizaciji iz MRIS-a. Studenti su pokazali osrednje zanimanje za posao u sportskoj medicini. Iako su pokazali dostatno znanje odmah nakon završetka kolegija, bili su umjereno zadovoljni svojim znanjem iz MRIS-a. Praktični aspekti strategije poučavanja na nastavi iz MRIS-a trebali bi se razmotriti u budućnosti kako bi se promicao rad u MRIS-u među studentima medicine rada i sporta ili barem podigla svijest o važnosti prevencije brojnih poremećaja koji su vezani uz rad ili sport.

KLJUČNE RIJEČI: medicinska edukacija; poučavanje u grupi; profesionalna bolest; rješavanje problema; zakonodavstvo/legislativa