

THE ANALYSIS OF SIXTH-YEAR MEDICINE STUDENTS' KNOWLEDGE OF PARAMEDICS COMPETENCIES AND THEIR FIELD OF WORK

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Abstract

The aim: Knowledge about each other roles and responsibilities among healthcare professionals has been indicated as one of the core competencies in collaborative healthcare practice. The primary aim of the study was to recognize and analyze sixth-year medicine students knowledge of paramedic's competencies and field of work.

Material and methods: A questionnaire addressed to sixth-year medicine students from 12 Polish medical universities was used as the evaluation method. The questionnaire consisted of 23 questions. Participants could obtain a maximum number of 48 points. The proportion of 50% was used to establish a minimum level of correct answers in the study group.

Results: 137 questionnaires were taken into consideration (143 questionnaires in total, 6 excluded due to incomplete survey data). The mean age of the study group was 25.2 ± 0.2 years. The mean level of correct answers for the entire study group was $44.31 \pm 20\%$ (Me = 43.75, Q25 = 29.17, Q75 = 60.42). The analysis of results identified eight fields in which the percentage of correct answers was statistically significant below the assumed level of 50%.

Conclusions: The sixth-year medicine students' awareness of paramedics' field of work and competencies is insufficient. Eight specific areas of knowledge were distinguished as insufficient: possible educational activities and work-places, types of intravenous and intraosseous drug delivery routes, unsupervised analgesic drugs and catecholamines available for paramedics, unsupervised intubation in different clinical conditions, pregnancy and childbirth-related procedures and procedures which can be conducted only under physician's supervision.

Key words

emergency medicine,
education,
emergency medical services

INTRODUCTION

The State Emergency Medical Service (SEMS) in Poland was established by the Act of State Emergency Medical Service (ASEMS) on the 8th of September 2006 as a reaction to the incident in Katowice in January 2006 and has a relatively young history [1, 2]. The latest version of the mentioned Act was announced on the 5th of September 2019 [3]. Even though paramedics had been performing their duties and had been educated at Bachelor level before the creation of the SEMS, it was the first law that regulated the profession and clearly stated the purpose of SEMS. The mentioned document provides information about requirements that have to be met in order to become a paramedic. The most important ones are: having full legal rights, being in a good health condition, being fluent in Polish, and receiving proper education [3]. The ASEMS obligates paramedics to update their knowledge and skills, by participating, for example: in additional specialistic courses or conferences [3]. A broad range of powers allows paramedics to work as members of an emergency medical team in an

ambulance, air emergency services team, or a medical dispatcher. They can also perform their duties in various health care facilities, such as emergency departments (ED), other hospital wards, primary health care units, trauma, or resuscitation teams. It is also possible for paramedics to use their skills in the army, police, or fire brigades. Executive acts following the ASEMS were published to describe the paramedic's field of work more precisely. The first version of a detailed description of life support management and health care procedures which can be undertaken by paramedics appeared on the 29th of December 2006, and changed in 2009, 2016, and 2019 [4-7]. When these legal acts are compared, one notices how the number of tasks and responsibilities have extended. As a result of the update, the number of drugs that can be administered by paramedics without supervision increased from 24 to 47. Similar updates concern electrical cardioversion and percutaneous stimulation, procedures that at the beginning had to be supervised by a physician.

Taking into consideration numerous places where paramedics can provide medical services, it is cer-

tain that they have to cooperate with physicians and other employees of the healthcare system. Working as an interdisciplinary team member requires proper communication to transfer knowledge and skills between staff with different competencies and educational backgrounds [8]. However, different academic or training paths amongst medical professionals can also exert a positive impact on the effectiveness of cooperation [8]. Some research shows that interdisciplinary learning and receiving knowledge about the perspective of another healthcare discipline is also valued by students [9]. Since students are usually open-minded, adding interprofessional training to their educational process can change their attitudes towards each other [10]. Moreover, the knowledge about other healthcare professionals' roles and responsibilities is defined as one of the core competencies in collaborative medicine practice [11]. The importance of teamwork in various health care facilities has been previously researched and it has been found that there is a correlation between team performance and the outcome of provided medical services [12]. Some studies indicate that the outcome of good teamwork is the patient's well-being [12-14]. The lack of scientific reports assessing the knowledge of future physicians about the specificity of the paramedics' profession and competencies has prompted us to take an interest in this topic.

THE AIM

The main goal of this research was to recognize and analyze the knowledge of sixth-year medicine students about paramedics' field of work and competencies.

The specific aims were to assess the knowledge of sixth year medicine students about:

- educational background, an obligation of professional development, teaching qualifications and possible healthcare facilities in which paramedics can work,
- selected medical procedures which can be performed by paramedics with and without supervision: number, types of drugs and their ways of administration, electrotherapy procedures, airway management procedures, pregnancy or labour related procedures and elements of the assessment and monitoring of the patient's clinical condition.

MATERIAL AND METHODS

A questionnaire addressed to sixth-year medicine students from 12 Polish medical universities

was used as the evaluation method. The study lasted from the 1st of October to the 30th of November 2019. The questionnaire consisted of 23 questions in total and included: 2 short-answer questions, 8 multiple-choice questions with one correct answer, and 13 multiple-choice questions with more than one correct answer. Regarding the multiple-choice questions, only selecting all correct answers qualified points to be included in the final result. Participants could obtain a maximum number of 48 points. No negative points were considered in the calculation. The proportion of 50% (24 points) was used to establish a minimum level of correct answers in the study group. In order to identify areas of knowledge requiring attention, the percentage of correct answers to individual questions was analyzed and results were compared to a proportion of 50%. An electronic way of collecting the data was applied. The survey was anonymous and voluntary.

Statistical analysis of the data was carried out using PQStat, version 1.8.0.324. Quantitative variables are presented using basic descriptive statistics: the arithmetic mean (\bar{x}), standard deviation (SD) and positional measures - median (Me) and quartiles (Q25 - quartile I, Q75 - quartile III). Participants score was compared to the assumed value of 0.5 (50%) with the t-student test for a single group. Z-test for a single proportion was used to compare results of individual questions to the assumed value of 0.5. Test probability at $p < 0.05$ was considered as significant and test probability at $p < 0.01$ was considered as highly significant.

RESULTS

One hundred and thirty seven questionnaires were taken into consideration (143 questionnaires in total, 6 excluded due to incomplete survey data). The mean age of the study group was 25.2 ± 0.2 years. Figure 1. presents the distribution of participants by the university. The mean level of correct answers for the entire study group was $44.31 \pm 20\%$ (Me = 43.75, Q25 = 29.17, Q75 = 60.42). A highly statistically significant difference was found between the mean result and the assumed level of 50% defined as the minimum level of correct answers (95% CI 0.022 - 0.092; $p = 0.0017$). The study group responses to individual questions are presented in Table 1. The analysis of results identified eight fields in which the percentage of correct answers was statistically significant below the assumed level of 50%. All of them were multiple-choice questions with more than one correct answer. According to the methodology, only selecting all correct answers

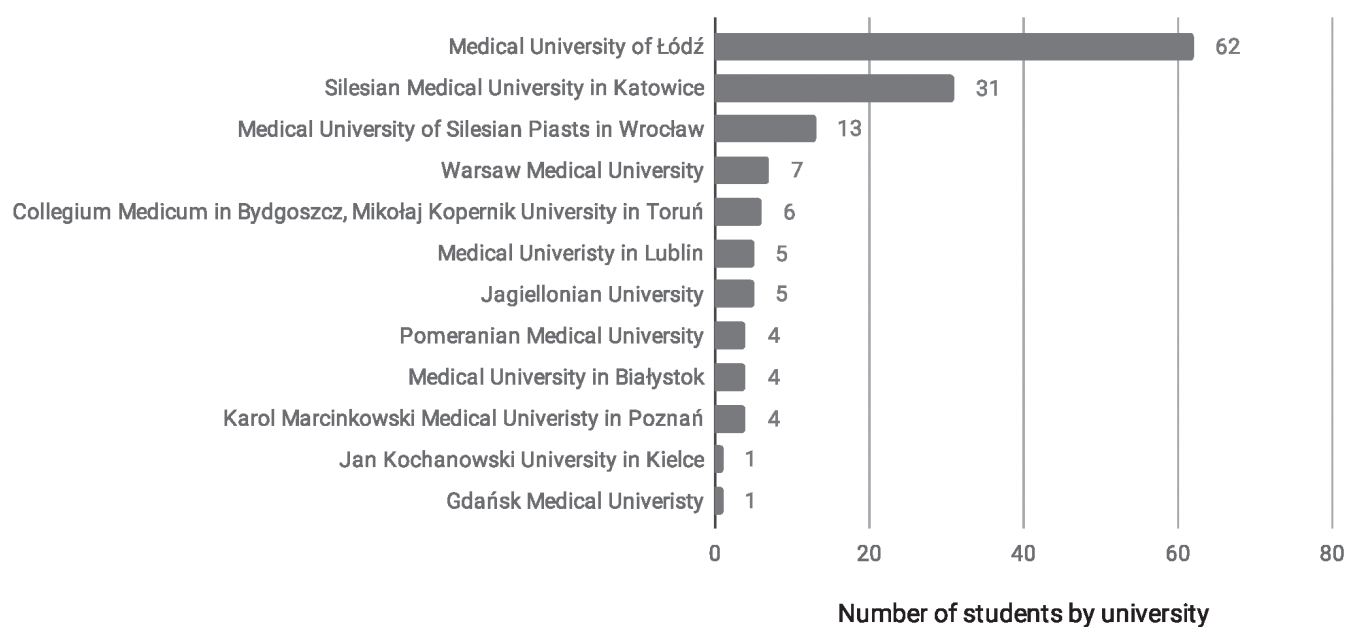


Fig. 1. Distribution of participants by the university.

Table 1. Analysis of the study group answers to individual questions.

Question	Number of correct answers (n = 137)	Percent of correct answers	-95% CI	+95 CI	Z statistic	P value
What are the current requirements to become a paramedic?	122	89.1%	0.825	0.937	9.056	<0.0001
Do paramedics have an obligation to update their knowledge as a part of professional development?	130	94.9%	0.897	0.979	10.423	<0.0001
Which educational activities can be conducted by paramedics without additional teaching qualifications?	41	29.9%	0.224	0.383	4.613	<0.0001
Indicate paramedic's possible workplaces.	40	29.2%	0.217	0.375	4.784	<0.0001
How many drugs can paramedics administer without physician supervision?	61	44.5%	0.360	0.532	1.196	0.2317
What kind of drug administration routes can paramedics use?	81	59.1%	0.504	0.674	2.050	0.0403
What type of intra paramedics provide?	50	36.5%	0.284	0.451	3.075	0.0021
What kind of analgesic drugs can be administered by paramedics without a physician's supervision?	21	15.3%	0.097	0.224	8.031	<0.0001
Which catecholamines can paramedics administer without physician's supervision?	41	29.9%	0.224	0.383	4.613	<0.0001
Can paramedics use muscle relaxants?	88	64.2%	0.556	0.722	3.246	0.0012
Which activities related to electrotherapy can paramedics perform without a physician's supervision?	80	58.4%	0.496	0.667	1.879	0.0602
Which airway management devices can be used by paramedics?	61	44.5%	0.360	0.532	1.196	0.2317
When paramedics can intubate without a physician's supervision?	38	27.7%	0.204	0.360	5.126	<0.0001
Which activities related to pregnancy and childbirth can paramedics perform without a physician's supervision?	44	32.1%	0.244	0.406	4.100	<0.0001
What elements of the assessment/monitoring of the patient's clinical condition can be conducted by paramedics?	122	89.1%	0.825	0.937	9.056	<0.0001
What activities paramedics can perform only under a physician's supervision?	25	18.2%	0.121	0.257	7.347	<0.0001

qualified points to be included in the final result. In each field, the final question results are presented according to the following scheme: the total number of correct answers to individual questions with the percentage results are in brackets. Subsequently, the frequency of each potential answer is given (number of responses and percentage frequency of choice for a given option). In the area of paramedic's educational qualifications, the study group acquired 41 correct answers (29.9%) and indicated that paramedics can conduct first aid training (n=133, 97.1%), qualified first aid training (n=89, 65%) and courses in the field of emergency medical services (n=48, 35%). Paramedics can conduct all of those courses without additional teaching qualifications. Another area refers to paramedic's possible workplaces in which the study group presented complete knowledge in 40 cases (29.2%). Paramedics can perform their duties in ambulances (n=136, 99.3%), emergency departments (n=132, 96.4%), admission units (n=110, 80.3%), hospital wards (n=74, 54%), primary healthcare units (n=55, 40.1%) and in units reporting to the Minister of Defence (n=73, 53.3%). It is also possible for paramedics to work as medical dispatchers (n=120, 87.6%) and take part in medical assistance in mass gatherings (n=134, 97.8%). A statistically important difference was also identified in the field of intravenous and intraosseous drug delivery routes (n=50, 36.5%). The study group knew and answered correctly that paramedics can provide routes in distal limb veins (n=137, 100%), external jugular vein (n=80, 58.4%) and intraosseous route (n=105, 76.6%). Some respondents chose incorrectly that providing intra-arterial (n=20, 14.6%) and central vein routes (n=16, 11.7%) by paramedics is possible. The smallest number of correct answers (n=21, 15.3%) was obtained in the field of unsupervised analgesics use by paramedics. Students were aware that paramedic can administer ibuprofen (n=129, 94.2%), ketoprofen (n=128, 93.4%) paracetamol (n=134, 97.8%) and opioids: morphine (n=69, 50.4%) and fentanyl (n=60, 43.8%). Incorrect answers selected by the examined group stated that paramedics can administer ketamine (n=33, 24.1%) and tramadol (n=67, 48.9%). In the field of unsupervised catecholamines administration participants achieved the result of 41 (29.9%) correct answers. Some participants (n=129, 94.2%) knew that paramedics can administer adrenaline, however administering noradrenaline (n=65, 47.4%), dopamine (n=67, 48.9%), dobutamine (n=43, 31.4%) and isoprenaline (n=20, 14.6%) must be supervised by a physician. A statistical important difference is

also visible in the field of intubation (n=38, 27.7%) where the only correct answer is that paramedics can intubate unsupervised in sudden cardiac arrest (n=82, 59.9%). In case of anaphylactic reactions (n=44, 32.1%) and upper respiratory tract burns (n=34, 24.8%) paramedics are not permitted to intubate unsupervised. The study group responses in the area of pregnancy and labour related procedures resulted in 44 (32.1%) correct answers. Paramedics can deliver a baby (n=129, 94.2%) and manually change the position of the womb (n=75, 54.7%). Nevertheless, conducting a hysterotomy (n=12, 8.8%), prenatal examination (n=14, 10.2%) and oxytocin administration (n=33, 24.1%) are not allowed to perform by paramedics without supervision. In the field of procedures that can be conducted by paramedics only under physician's supervision students indicated: intubation (n=47, 34.3%), opioids administration (n=57, 41.6%) and carrying out a triage (n=17, 12.4%). These procedures and this group of drugs can be carried out by paramedics without the oversight of a physician with limitations described in executive acts. Procedures conducted only under supervision are insertion of an intragastric probe (n=94, 68.6%) and catheterization of the urinary bladder (n=57, 41.6%).

DISCUSSION

According to the methodology and based on the study group's total average score of 22.16 pts (44.1±20%), the examined group's knowledge of the paramedic's field of work has been assessed as insufficient. The analysis of data presented 8 specific fields in which the knowledge of the examined group is below the expected level. Possible workplaces indicate that there will be multiple occasions where physicians of many different specializations will have to cooperate with paramedics on a regular basis, for example in hospital wards or primary healthcare units, as well as in the mode of sporadic meetings, for instance, during handoffs in EDs. What is more, dispatchers direct ambulances not only to typical EDs, but also to the hospitals with wards that are prepared to aid patients in specific clinical cases, such as psychiatry or obstetrics departments, where encounters between a paramedic and a physician not associated with emergency medicine occur. The responses of the examined group may suggest that future physicians are incognizant of the fact that cooperation with paramedics will be needed, even when they choose specialization unrelated directly to emergency medicine. A wide range of medical situations that both physicians and paramedics are

facing, requires proper drugs administration routes that have to be provided. Sufficient knowledge presented by physicians could allow paramedics to ease difficult situations by acting autonomously and by using their full potential in that field. Moreover, it can also prevent situations in which a paramedic is commissioned to perform procedures that they are not trained in. Another significant field concerns analgesic treatment. European Society for Emergency Medicine (EUSEM) pain management guidelines recommend that both in hospital and prehospital phases, pain has to be assessed and treated as soon as possible and with the use of adequate methods [15]. Since Polish paramedics have broad access to analgesic drugs and to the guidelines included in "Good practices of pain management" published by the Ministry of Health, they can and should be expected to use all of their abilities to relieve patient's pain [16]. The insufficient knowledge of the examined group (n=21, 15.3%) in the mentioned field may result in misapprehension concerning the dosage or the type of used analgesic between paramedics and physicians. Another field where misunderstandings can occur is related to catecholamines usage. Paramedics' eligibility is limited to adrenaline, even though some clinical cases in prehospital care may require an administration of other vasopressors instead [17]. Understanding of alleged restrictions could facilitate cooperation, help avoid incomprehension and possibly create a solution to this problem. A similar situation applies to the intubation field where paramedics can intubate only in sudden cardiac arrest, although in case of anaphylaxis or respiratory tract burns, airway management with the use of endotracheal intubation may be recommended [18, 19]. The last of the highlighted fields requiring attention concerned procedures that a paramedic can perform only under physician supervision. In relation to this topic, the role of paramedics and physicians as team members is particularly visible. The study group acquired satisfying results (n=122, 89.1%) in the field of paramedics' education and obligation of professional development (n=130, 94.9%), which can have a positive impact on the attitude towards partnership, as both professions share mutual - academic background. Improved communication processes that are free

of misunderstandings and conflicts, can ameliorate a patient's outcome, minimize medical errors and pursue every medical profession goal - the patient's well-being [20]. The overall results of the study group scored below 50%, which may indicate an existing need for improvement of understanding paramedics' roles, skills and abilities among sixth-year medicine students. The suggested need could be addressed with interdisciplinary learning implemented in curricula.

Findings of Guraya et al. reported positive outcomes of implementing interdisciplinary education [21]. Eisenmann's et al. simulation-based research consisting of student paramedics, final-year medical students and advanced trainees of emergency nursing has shown that students are willing to change their attitudes towards each other, their behaviors, teamwork and communication, as well as update their medical knowledge [22]. In "Framework for Action on Inter-professional Education and Collaborative Practice" published by WHO it is stated that: "Once students understand how to work interprofessionally, they are ready to enter the workplace as a member of the collaborative practice team. This is a key step in moving health systems from fragmentation to a position of strength." [23]. The rising complexity of patients' healthcare problems requires borderless cooperation between representatives of medical professions. Hypothetically, implementing interdisciplinary learning can improve cooperation between physicians and paramedics and improve patient care [22].

CONCLUSIONS

The sixth-year medicine students' awareness of paramedics' field of work and competencies is insufficient. Eight specific areas of knowledge were distinguished as insufficient: possible educational activities and workplaces, types of intravenous and intraosseous drug delivery routes, unsupervised analgesic drugs and catecholamines available for paramedics, unsupervised intubation in different clinical conditions, pregnancy and childbirth-related procedures and procedures which can be conducted only under physician's supervision. The impact of medical students' knowledge of paramedics competencies and field of work on a collaboration with paramedics requires further research.

REFERENCES

1. Ustawa z dnia 8 września 2006 r. o Państwowym Ratownictwie Medycznym. Dz.U. 2006; poz. 1410
2. Sagan A, Kowalska-Bobko I, Mokrzycka A. The 2015 emergency care reform in Poland: Some improvements, some unmet demands and some looming conflicts. *Health Policy*. 2016;11:1220-1225. doi: <https://doi.org/10.1016/j.healthpol.2016.09.009>.

3. Ustawa z dnia 8 września 2006 r. o Państwowym Ratownictwie Medycznym. T. jedn. Dz.U. 2019; poz. 993, 1590.
4. Rozporządzenie Ministra Zdrowia z dnia 29 grudnia 2006 r. w sprawie szczegółowego zakresu medycznych czynności ratunkowych, które mogą być podejmowane przez ratownika medycznego. Dz. U. 2007 nr 4; poz. 33.
5. Rozporządzenie Ministra Zdrowia z dnia 14 stycznia 2009 r. zmieniające rozporządzenie w sprawie szczegółowego zakresu medycznych czynności ratunkowych, które mogą być podejmowane przez ratownika medycznego. Dz. U. 2009 nr 11; poz. 64
6. Rozporządzenie Ministra Zdrowia z dnia 20 kwietnia 2016 r. w sprawie medycznych czynności ratunkowych i świadczeń zdrowotnych innych niż medyczne czynności ratunkowe, które mogą być udzielane przez ratownika medycznego. Dz. U. 2016; poz. 587
7. Rozporządzenie Ministra Zdrowia z dnia 16 grudnia 2019 r. w sprawie medycznych czynności ratunkowych i świadczeń zdrowotnych innych niż medyczne czynności ratunkowe, które mogą być udzielane przez ratownika medycznego. Dz. U. 2019; poz. 2478
8. Schumtz J, Meier L, Manser T. How effective is teamwork really? The relationship between teamwork and performance in healthcare teams: A systematic review and meta-analysis. *BMJ Open*. 2018;9(9):23. doi: 10.1136/bmjopen-2018-028280
9. Burgess A, Kalman E, Haq I et al. Interprofessional team-based learning (TBL): how do students engage?. *BMC Med Educ*. 2020;20:118. doi: 10.1186/s12909-020-02024-5
10. Merati N, Murphy-Busake A, Alfaro P et al. Professional attitudes in health professions' education: the effects of an anatomy near-peer learning activity. *American Association for Anatomy. Anat Sci Educ*. 2020. doi: 10.1002/ase.1964
11. Schmitt M, Blue A, Aschenbrener C et al. Core competencies for interprofessional collaborative practice: reforming health care by transforming health professional's education. *Acad Med*. 2011;86(11):1351. doi: <https://doi.org/10.1097/ACM.0b013e3182308e39>
12. Schmutz J, Manser T. Do team processes really have an effect on clinical performance? A systematic literature review. *Br J Anaesth*. 2013;110(4):529–544. doi: <https://doi.org/10.1093/bja/aes513>
13. Reader T, Flin R, Mearns K et al. Developing a team performance framework for the intensive care unit. *Crit Care Med*. 2009;37(5):1787-1793. doi: 10.1097/CCM.0b013e31819f0451
14. Rosen M, DiazGranados D, Dietz A et al. Teamwork in healthcare: key discoveries enabling safer, high-quality care. *Am Psychol*. 2018;73(4):433-450. doi: 10.1037/amp0000298
15. Hachimi-Idrissi S, Coffey F, Dobias V et al. Guidelines for the management of acute pain in emergency situations. *European Society for Emergency Medicine. EUSEM (online) 2020* [download 01.06.2020]; https://www.eusem.org/images/EUSEM_EPI_GUIDELINES_MARCH_2020.pdf
16. Basiński A, Wordliczek J, Woron J et al. Dobre praktyki leczenie bólu u osób dorosłych w podstawowych zespołach ratownictwa medycznego. *Ministry of Health (online) 2019* [download: 01.06.2020]; <https://www.gov.pl/web/zdrowie/dobre-praktyki-leczenia-bolu>
17. Vahdatpour C, Collins D, Goldberg S. Cardiogenic Shock. *JAHA*. 2019;8(8):e011991. doi: <https://doi.org/10.1161/JAHA.119.011991>
18. Truhlar A, Deakin C, Soar J et al. European Resuscitation Council. Guidelines for Resuscitation 2015. Section 4. Cardiac arrest in special circumstances. *Resuscitation*. 2015;95:148-201.
19. Yoshino Y, Ohtsuka M, Kawaguchi M et al. The wound/burn guidelines - 6: Guidelines for the management of burns. *J Dermatol*. 2016;43(9):989-1010. doi: <https://doi.org/10.1111/1346-8138.13288>
20. Topcu I, Turkmen A, Sahiner N et al. Physicians' and Nurses' medical errors associated with communication failures. *J Pak Med Assoc*. 2017;67(4):600-604.
21. Guraya S, Barr H. The effectiveness of interprofessional education in healthcare: A systematic review and meta-analysis. *Kaohsiung J Med Sci*. 2018;34(3):160-165. doi: <https://doi.org/10.1016/j.kjms.2017.12.009>
22. Eisenmann D, Stroben F, Gerken J et al. Interprofessional emergency training leads to changes in the workplace. *West J Emerg Med*. 2018;19(1):185-192. doi: 10.5811/westjem.2017.11.35275
23. Health Professions Network Nursing and Midwifery Office within the Department of Human Resources for Health. Framework for Action on Interprofessional Education & Collaborative Practice. *WHO (online) 2010* [download 01.06.2020]; https://www.who.int/hrh/resources/framework_action/en/

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POTENTIAL CONFLICT OF INTEREST

Filip Jaśkiewicz is a medical consultant for Octopus VR, Lodz, Poland in the project “Development work in the field of VR ACT application enabling the implementation of medical simulations in ALS / PALS training scenarios” which is co-financed by the European Union under the European Regional Development Fund, Action I.2. investments of enterprises in research and innovation. PF has no potential conflict of interest.

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