

PARAMEDICS' KNOWLEDGE OF MEDICAL GUIDELINES AND PROCEDURES FOR PROTECTION AGAINST CORONAVIRUS DURING THE COVID-19 PANDEMIC: A PILOT STUDY

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A – study design, B – data collection, C – statistical analysis, D – interpretation of data, E – manuscript preparation, F – literature review, G – sourcing of funding

ABSTRACT

Background: Paramedics are the frontline workers of the healthcare profession. Thus, they need to be equipped with the relevant knowledge, skills, and protective gear against different forms of infection, including coronavirus disease 2019 (COVID-19).

Aim of the study: To determine the level of paramedics' knowledge about implementing medical guidelines and procedures to avoid coronavirus infection during the COVID-19 pandemic.

Material and methods: This study involved 101 paramedics employed in Emergency Medical Services in Legnica between November 2020 and January 2021. A diagnostic survey method and opinion polling technique were applied. A survey developed by the study authors was used.

Results: Overall, 38 (37.62%) paramedics had sufficient knowledge of medical guidelines and procedures preventing coronavirus infection, 28 (27.72%) had good knowledge, 23 (22.77%) had very good knowledge, and 12 (11.88%) had insufficient knowledge of the topic. Variables such as education ($p=0.305$), participation in any course on COVID-19 ($p=0.650$), frequency of emergency services for patients suspected to have COVID-19 infection or with confirmed COVID-19 infection ($p=0.116$), and job seniority ($p=0.984$) did not have a significant influence on interviewees' knowledge of this topic.

Conclusions: There is a need for organizing courses, workshops, or training events for paramedics concerning the code of conduct and good practice while working with patients who suffer from highly infectious diseases in order to improve safety in the work environment. It is particularly important as paramedics themselves opted to organize such courses. It is recommended that before organizing the course, one should obtain information from potential participants about the preferred format of the course.

KEYWORDS: paramedics, knowledge, COVID-19

BACKGROUND

Viruses from the corona family have been known by mankind for many years. In January 2020 an unknown type of coronavirus was isolated – a novel coronavirus (nCoV). Soon after the World Health Organization (WHO) declared a pandemic of “the new coronavirus” (SARS-COV-2) and the ill-

ness caused by it was called COVID-19 [1]. According to WHO reports, at the end of February 2020 the number of confirmed COVID-19 cases worldwide equaled 85,403 in 53 countries, and by the end of May 2020 it had increased to 5,934,936 cases worldwide [2]. The COVID-19 pandemic has become an urgent health crisis in communities worldwide [3].

A distinctive feature of coronaviruses is high contagiousness with a dominant aerogenic, droplet route of infection. The high rate of infections results from a long period of pathogen survival in the environment. [4]. The unique resistance of the new coronavirus to environmental conditions gives it the possibility to survive a few days on uncleaned surfaces. SARS-CoV-2 infection occurs mainly by contact with an infected patient's airway discharges or by touching contaminated surfaces. [5-7]. The most common symptoms in the initial stage of the illness are fever, coughing, shortness of breath, joint and muscle pains, tiredness, diarrhea, and smell and/or taste disorders. During the course of COVID-19, the induction of inflammatory reactions results in inflammatory cytokine release which triggers a 'cytokine storm' as a defense mechanism of damaged organs. The most common complications of SARS-COV-2 infection are acute respiratory failure, anemia, heart muscle disorder, and sub-infection [8, 9].

Due to the SARS-COV-2 pandemic onset and the real threat to medical professionals, medical procedures should be changed in order to minimize the risk of infection. The changes introduced by the European Resuscitation Council (ERC) concerned almost every stage of patient care [10]. The biggest changes in safety procedures and protection against potential infection related to performing medical rescuing actions and in emergency treatment and care. As a result, the system of State Emergency Medical Services faced a large organizational challenge. The significant number of new job responsibilities and new tasks have made medical personnel put a lot of effort into performing their tasks during the pandemic situation. In the event of a pandemic, only previously established medical procedures and guidelines and the latest knowledge coming from scientific research, which is updated all the time, are able to minimize the risk of COVID-19 infection and possible sickness [11].

Paramedics are the frontline workers of the healthcare profession. As a result, they need to be equipped with the relevant knowledge, skills, and protective gear against different forms of infection, including COVID-19 [12]. A lack of knowledge, inadequate availability of personal protective equipment (PPE), inadequate training, intensity of work, and long-term exposure to infected patients are the main reasons for COVID-19 spread among healthcare workers [13]. A prospective cross-sectional study conducted among 529 healthcare workers globally showed that a significant proportion of them had poor knowledge about COVID-19 transmission and symptom onset [14]. Considering the facts mentioned above, this study was performed to verify the level of paramedics' knowledge about medical procedures and guidelines applicable during the pandemic.

AIM OF THE STUDY

The aim of this study was to determine the level of paramedics' knowledge about implementing medical guidelines and procedures aimed at avoiding coronavirus infection during the COVID-19 pandemic.

MATERIAL AND METHODS

Study design and setting

This study was performed between November 2020 and January 2021 among paramedics employed in Emergency Medical Services in Legnica. Permission to perform the research was given by the Chief of the Medical Services and Bioethical Committee of the University of Medical Sciences in Legnica (permission no. KB 2/2021). The STROBE guidelines (Strengthening the Reporting of Observational Studies in Epidemiology) were followed.

The first step of the study was distributing the questionnaire among paramedics working in different branches of Emergency Medical Services. Because paramedics have a specific type of work, the survey was left for them to complete at a suitable time and then collected from each branch after few days.

The inclusion criteria for this study were: having a professional job title of paramedic, employment in the Emergency Services in Legnica, and consent to participate in the study. People who did not meet abovementioned criteria were excluded from the analysis. Participants were informed about the aim of the research, the potential benefits of the obtained results, and the possibility to withdraw from the research at any stage.

Participants

The participants consisted of 101 paramedics (Table 1). The majority were male (76.24%; 77). The median age was 38 years (range: 30.00–45.00). Most participants had a bachelor's degree (48.51%; 49) and lived in cities (69.31%; 70). The median job seniority equaled 15 years (range: 5.00–20.00). Most participants stated that they attended to infected patients or patients suspected of having coronavirus infection every day (56.44%; 57).

Survey questions/knowledge measurement

A diagnostic survey method and opinion polling technique were applied. A survey created by the study authors consisting of 22 questions was used. The first eight questions were metrics. The remain-

Table 1. Characteristics of the paramedics participating in this study

Variable		Total (N=101)
Age (years)	M±SD	37.82±9.5
	Me	38
	Q1-Q3	30-45
Sex	Female	24 (23.76%)
	Male	77 (76.24%)
Place of residence	Town/city	70 (69.31%)
	Village	31 (30.69%)
Education	Secondary school	33 (32.67%)
	Bachelor's degree	49 (48.51%)
	Master's degree	18 (17.82%)
	PhD	1 (0.99%)
Job seniority as a paramedic (years)	M±SD	13.39±8.47
	Me	15
	Q1-Q3	5-20
Participation in a course about COVID-19	Yes	40 (39.60%)
	No	61 (60.40%)
Participation in COVID-19 academic conferences for medical staff	Yes	24 (23.76%)
	No	77 (76.24%)
Participation in one of the listed certified courses by ERC or AHA in the past 3 years*	ALS/ACLS	56 (55.45%)
	ITLS/PHTLS	26 (25.74%)
	EPALS/PALS	12 (11.88%)
	I did not take part	33 (32.67%)
Frequency of ambulance services for patients suspected of infection or COVID-19 infection identified	Every day	57 (56.44%)
	Several times a week	29 (28.71%)
	At least once a week	13 (12.87%)
	A few times in a month	2 (1.98%)

Legend: ERC – European Resuscitation Council, American Heart Association, ALS – Advanced Life Support Provider Course, ACLS – Advanced Cardiovascular Life Support, ITLS – International Trauma Life Support Provider Course, PHTLS – Prehospital Trauma Life Support, EPALS – European Pediatric Advanced Life Support, PALS – Pediatric Advanced Life Support, * – multiple choice questions (percentages do not sum up to 100), M – mean, SD – standard deviation, Me – median, Q1 – first quartile, Q3 – third quartile.

ing questions concerned the following: frequency of ambulance services for patients with confirmed or suspected COVID-19 infection, practical knowledge and behaviors of paramedics during situations of emergency treatment for patients suspected of having COVID-19 infection, self-assessment concerning knowledge of how to avoid coronavirus infection, and assessment of the need for courses and workshops to improve the level of knowledge and skills to avoid getting infected with highly contagious diseases.

The level of interviewees' knowledge was assessed based on their answers to questions 10–20.

One point was given for every correct answer and no points were given for an incorrect answer. The maximum number of points was thus 11. To evaluate knowledge, the following school rating scale was used: 0–5 points (0–50% of possible score) – insufficient – F; 6–8 points (50–75% of possible score) – sufficient – C; 9 points (75–90% of possible score) – good – B; and 10–11 points (90–100% of possible score) – very good – A.

Statistical analyses

For quantitative variables, the average, standard deviation, median, and quartiles were calculated; for qualitative variables, the number and percentage of each variable's occurrence were calculated. Comparison of quantitative variables between two groups was performed using the Mann–Whitney U test. Comparison of quantitative variables between three or more groups was performed using the Kruskal–Wallis test. In case of statistically significant differences, post-hoc analysis was carried out using Dunn's test to identify groups that were significantly different. Correlations between quantitative variables were analyzed using Spearman's correlation coefficient. $P < 0.05$ was considered statistically significant. Analysis was performed using R software, version 4.0.4.

RESULTS

Of the total 101 interviewees, 38 (37.62%) had sufficient knowledge of medical procedures and guidelines aimed at avoiding coronavirus infection during the COVID-19 pandemic, 28 interviewees (27.72%) had good knowledge, 23 interviewees (22.77%) had very good knowledge, and 12 interviewees (11.88%) had insufficient knowledge,

Most participants (83; 82.18%) correctly answered the question that in the event of an ambulance call for a 50-year-old man with hypertension who has the following symptoms – sudden shortness of breath, temperature of 38.5 °C, and olfactory anesthesia – a mask with N99 filter, protective goggles, face shield, protective suit, shoe guards, and two pairs of gloves have to be worn. Over half of interviewees (53.47%; 54) correctly stated that, after departing in PPE when a patient with identified COVID-19 infection stayed at the place of call, the paramedics cannot take off the PPE at the point where the emergency call was made. Proper knowledge of ambulance and medical equipment decontamination after seeing a patient suspected of having coronavirus infection or infected by the virus was possessed by 60.40% (n=61) of paramedics. The correct order of ambulance and medical equipment decontamination procedures after seeing

a patient suspected to have coronavirus infection or infected by the virus was known by 83.17% of interviewees (n=84). Furthermore, 86.14% (n=87) knew the code of conduct that can minimize the risk of infection while transporting a patient in an ambulance to hospital (Table 2).

Almost all interviewees (91.09%; 92) correctly answered that, while transporting a patient suffering from COVID-19 to hospital, nebulization should be avoided. Another question was: Does CPR generate aerosol? This question was answered correctly by 77.23% (n=78) of paramedics. There was also a question about the desirable ventilation technique with the use of a rebreathing bag. Slightly more than half of respondents (53.47%; 54) correctly answered that the two-hand technique has to be used. Correct

knowledge of the fact that intubation is a procedure that generates aerosol and must be done by the person with the most experience in order to limit the number of people in a room was possessed by 55.45% (n=56) of participants. The interviewees were also asked about the most important activity while using PPE. Almost all respondents answered the question correctly – 94.06% (n=95). The last question asked about the correct order of removing PPE items, which was answered correctly by 77.23% (n=78) of respondents (Table 3).

Variables such as education (p=0.305), participation in any course/workshop connected with COVID-19 (p=0.650), frequency of ambulance departures to patients suspected of having coronavirus infection or with identified infection (p=0.116),

Table 2. Participants' answers to survey questions testing their knowledge about implementing medical guidelines and procedures aimed at avoiding coronavirus infection during the COVID-19 pandemic – part I

Questions:		
In the event of an ambulance call for a 50-year-old man with hypertension who has the following symptoms: sudden shortness of breath, temperature of 38,5 C, and olfactory anesthesia, the following personal protective equipment has to be worn:	n	%
Surgical mask, protective suit, face shield, 2 pairs of gloves, and shoe guards	9	8.91
N95 mask, protective goggles, face shield, long sleeve apron, shoe guards, 2 pairs of gloves	8	7.92
N99 mask, protective goggles, face shield, protective suit, shoe guards, 2 pairs of gloves	83	82.18
I won't wear any PPE mentioned above, as the emergency call is the same as other calls.	1	0.99
Can a paramedic take off their PPE at the place of emergency call when a patient with COVID-19 stays at that place?	n	%
Yes	10	9.90
No	54	53.47
Yes, unless it is done in an ambulance	0	0.00
Yes, unless it is done outdoors	35	34.65
No answer	2	1.98
While decontaminating the ambulance and medical equipment after seeing a patient suspected of having coronavirus infection or infected by the virus, paramedics should:	n	%
Spray disinfectant on the equipment and leave it to dry according to the product data sheet	11	10.89
Spray disinfectant on the equipment, wipe touched surfaces, and leave it to dry according to the product data sheet	28	27.72
Pour disinfectant on surfaces and wipe them	61	60.40
If the surface is dirty with blood or other secretions nothing has to be done	1	0.99
While decontaminating the ambulance and medical equipment after seeing a patient suspected of coronavirus infection or infected by the virus, paramedics should:	n	%
Take off PPE and move to the fogging procedures	2	1.98
Spray surface disinfectant and then take off PPE and move to the ozonating procedure	4	3.96
First disinfect the ambulance, then start the fogging procedure, and finally take off PPE	84	83.17
First disinfect the ambulance, then take off PPE, and finally start the fogging procedure	10	9.90
No answer	1	0.99
While transporting a patient to hospital, one should:	n	%
Turn on internal air circulation in the ambulance in order not to generate aerosol outside the car	8	7.92
Turn on air extraction in order to remove patient's aerosol outside the car	87	86.14
Turn on air conditioning, set ventilation to blow the aerosol to the back of the car	2	1.98
Setting ventilation doesn't matter. an ambulance window has to be opened	4	3.96

Table 3. Participants' answers to survey questions testing their knowledge about implementing medical guidelines and procedures aimed at avoiding coronavirus infection during the COVID-19 pandemic – part II

Questions	n	%
While transporting a patient suffering from COVID-19, one has to avoid:		
Passive oxygen therapy	4	3.96
Nebulization	92	91.09
Eye contact	2	1.98
Monitoring vital functions	0	0.00
No answer	3	2.97
CPR is a treatment:		
Generating aerosol	78	77.23
Only generating aerosol while securing airways	13	12.87
Generating aerosol only while defibrillation	1	0.99
Not generating aerosol	6	5.94
No answer	3	2.97
While ventilating a patient with a rebreathing bag, one should:		
Use the two hands technique	54	53.47
Use C+E technique	33	32.67
Oxygen source has to be cut off	0	0.00
Oxygen flow has to be set to the maximum available on reducer	12	11.88
No answer	2	1.98
Intubation procedure generates aerosol. That is why:		
It has to be done as quickly as possible by the person closest to the patient's head	10	9.90
Before intubation the patient has to be oxygenated at the maximum by means of a rebreathing bag	26	25.74
It should be done by a person with the most experience, limiting the number of people in a room	56	55.45
It should be done by the person with the most experience by means of an armed tube	9	8.91
While using PPE, one of the most important activity is:		
The way it is taken off	95	94.06
Putting on a few pairs of gloves (the more the better)	2	1.98
Putting it on in a sterile manner	0	0.00
To take them off right after handling the patient or leaving the place where the emergency medical team is called	4	3.96
While taking off the protective suit, it has to be put to its left side and put into a red garbage bag and then:		
Take off the mask and goggles	11	10.89
Disinfect your hands	8	7.92
Disinfect gloves	78	77.23
Disinfect mask and goggles	2	1.98
No answer	2	1.98

and job seniority ($p=0.984$) did not have a significant influence on the level of interviewees' knowledge (Table 4).

One of the last questions of the survey was about the need for obligatory courses to improve the level of knowledge and skills that protect medical workers against highly infectious diseases in the future. It turned out that most paramedics were eager to take part in a course in the form of workshop ($n=75$; 74.26%), while 20.79% ($n=21$) would prefer theoretical training in the form of a lecture. Only small percentage of paramedics ($n=5$; 4.95%) stated that there is no need to organize such courses.

DISCUSSION

Ahmad et al. claim that the availability of PPE, COVID-19-related training, and compliance with WHO recommended practices against COVID-19 are instrumental in protection against the infection and its spread [12]. In our research, we decided to focus on assessing the level of paramedics' knowledge about medical procedures aimed at avoiding coronavirus infection. We proved that this knowledge is either sufficient or good. The knowledge of only one-fifth of interviewees was at the very good level, whereas one-tenth had insufficient knowledge of the topic.

Table 4. Correlation between chosen variables and paramedics' knowledge of medical guidelines and procedures aimed at avoiding coronavirus infection

Knowledge level [points]	Education			P
	Secondary (N=33)	Bachelor's degree (N=49)	Master's degree, PhD (N=19)	
M±SD	7.79±1.95	8.2±1.91	8.58±1.5	p*=0.305
Me	8	9	9	
Q1-Q3	7-9	8-10	8-9	
Knowledge level [points]	Have you taken part in any course/workshop on COVID-19?		P	
	Yes (N=40)	No (N=61)		
M±SD	8.05±1.97	8.2±1.8	p**=0.650	
Me	8	9		
Q1-Q3	6.75-10	8-9		
Knowledge level [points]	Frequency of ambulance departures to patients suspected of having COVID-19 infection or with identified infection			P
	Every day (N=57)	A few times a week (N=29)	At least once a week, a few time a month (N=15)	
M±SD	7.82±1.97	8.59±1.55	8.47±1.85	p*=0.116
Me	8	9	9	
Q1-Q3	7-9	8-10	8-9.5	
Job seniority		Spearman's correlation coefficient		P
Knowledge level		-0.002		p=0.984

Legend: M – mean, SD – standard deviation, Me – median, Q1 – first quartile, Q3 – third quartile, * – test Kruskal-Wallis test, ** – Mann-Whitney U test.

According to Higginson et al. (2020), all respiratory infections should be considered COVID-19 until proven otherwise, so paramedics should wear PPE [15]. Updated ERC guidelines from April 2020 concerning COVID-19 put great emphasis on safety issues among health care professionals and recommend wearing PPE while treating every patient potentially infected by coronavirus [16]. Basic PPE that protects against droplets includes gloves, apron, fluid-resistant surgical mask, and face and eye protection [17]. In contrast, the basic kit of PPE protecting against airborne aerosol includes gloves, long-sleeved apron, FFP3 (N99) filter mask or FFP2 (N95) if FFP3 is not available, and face and eye protection. Valim et al. (2014) found that health professionals seem to be selective when supposedly following standard precautions and using PPE [19]. In a study conducted in Pakistan, 52% of healthcare professionals had awareness and 72% were practicing adequate measures to combat COVID-19 [20]. In the present study, the vast majority of interviewees knew what kind of PPE should be worn when responding to an emergency call for a patient with sudden acute suffocation, fever, and olfactory anesthesia. Almost all interviewees were aware of the fact that while taking off PPE it is important to follow the correct order of actions. However, about one-fourth of paramedics did not know at what stage gloves should be disinfected while removing the protective suit.

The International Liaison Committee of Resuscitation (ILCOR) suggests that pressing the chest and CPR are activities that potentially generate aerosol [21]. Three-quarters of interviewees were aware of this fact. It was also pointed out in the guidelines that medical professionals, while performing ventilation by means of a rebreathing bag and face mask, should use the two hand technique. This is supposed to improve tightness and limit the risk of aerosol spreading [16]. As far as our research is concerned, 47% of participants did not have that knowledge.

During the COVID-19 pandemic, while performing emergency action, the number of medical professionals and other people in a room should be limited to the minimum. The person who performs CPR should have the most experience from the whole emergency unit [22]. Correct knowledge of the topic was held by only half of the interviewees.

One of the questions in the survey concerned handling medical waste. In our study, nearly half of paramedics were aware of the fact that after performing emergency action in PPE after which a patient with identified COVID-19 stayed at the place of call, the paramedic unit cannot take off PPE at the place of call. According to Ministry of Health regulations, medical waste generated after providing medical treatment at the place of call should be collected in special containers or bags by medical

professionals and immediately taken to a room designed only for storing medical waste. These regulations have been in force since 2017 and are not new [23].

We also assessed knowledge about ambulance and medical equipment decontamination after seeing a patient suspected to have or infected by COVID-19. Only 60% of interviewees had the correct knowledge that one should pour disinfectant on touched surfaces and wipe them. However, paramedics had much better knowledge about the right order when decontaminating the ambulance and medical equipment – 83.17% answered correctly. A similar study was conducted in Turkey during the COVID-19 pandemic among 400 emergency medical service (EMS) workers (doctors, nurses, emergency medical technicians, paramedics, and ambulance drivers). Vatan et al. evaluated knowledge, attitude, and preventive behaviors for COVID-19 and found that 78% of participants had poor knowledge about floor and surface disinfection. In the study from Turkey, responders who were high school graduates had higher percentages of correct answers than those with a bachelor's degree ($p < 0.001$). Moreover, participants with less than 10 years of experience had many more wrong answers than participants with more than 10 years of experience ($p < 0.001$) [24]. However, in our study, education, participation in any course/workshop connected with COVID, the frequency of ambulance departures to patients suspected of having coronavirus infection or with identified infection, and job seniority did not have a significant influence on the level of interviewees' knowledge.

A previous study conducted by Kotowska & Gawlik pointed to a significant relationship between training courses in the management of patients with COVID-19 and the sense of security among nurses and midwives. In this study, the respondents who did not take part in the training felt less secure more frequently than trained ones [24]. It is worth noting that almost all interviewees in our study were inter-

ested in courses to improve their level of knowledge and skills aimed at protecting medical professionals against highly infectious diseases in the future. They only had different opinions on the form of such courses (workshops vs. theoretical training in a form of a lecture). In the aforementioned study from Turkey, more than half of the participants said that an in-hospital training program on COVID-19 was beneficial [25].

Limitations of the study

One limitation of this study is assessing only a small group of paramedics in one medical facility. However, it should be noted that this is a pilot study. Its main asset is the fact that it is current and innovative. Another limitation is that we did not include the variable "type of work performed with emergency medical teams". The results of our future research will answer the question of whether the type of function performed by the surveyed emergency medical teams has a significant impact on the respondents' level of knowledge.

CONCLUSIONS

Paramedics' knowledge about applying medical guidelines and procedures aimed at protecting against coronavirus during the COVID-19 pandemic was generally sufficient or good. This result may suggest the need for organizing courses, workshops, or training events for paramedics concerning the code of conduct and good practice while working with patients who suffer from highly infectious diseases in order to improve safety in the work environment. It is particularly important as paramedics themselves are interested in such courses. It is recommended that before organizing the course, the potential participants express their opinion about the preferred form of such trainings as, according to our research, it can be different.

REFERENCES

1. Krzystniak K. Koronawirus wydanie II COVID-19, MERS, SARS – epidemiologia, leczenie, profilaktyka. Warszawa: Medyk; 2020. (In Polish).
2. World Health Organization. Coronavirus disease (COVID-19) Weekly Epidemiological Update and Weekly Operational Update [serial online] [cited: 20.06.2021]. Available from URL: <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports>.
3. Wake AD. Knowledge, attitude, practice, and associated factors regarding the novel coronavirus disease 2019 (COVID-19) pandemic. *Infect Drug Resist* 2020; 13:3817-3832.
4. Guan WJ, Ni ZY, Hu Y, Liang WH, Ou CQ, He JX, et al. Clinical characteristics of coronavirus disease 2019 in China. *N Engl J Med* 2020;382(18):1708-1720.
5. Dzieciatkowski T, Dobosz P. Wirus SARS-CoV-2 wywołujący COVID-19 - wytyczne ECDC. Warszawa: PZWL Wydawnictwo Lekarskie; 2020. (In Polish).
6. Elizondo V, Harkins GW, Mabvakure B, Smidt S, Zapile P, Marier C, et al. SARS-CoV-2 genomic characterization and clinical manifestation of the COVID-19 outbreak in Uruguay. *Emerg Microbes Infect* 2021;10(1): 51-65.

7. Chen Y, Peng H, Wang L, Zhao Y, Zeng L, Gao H Liu Y. Infants born to mothers with a new Corona virus (COVID 19). *Front Ped* 2020; 8:104.
8. Ye F, Liu J, Chen L, Zhu B, Yu L, Liang B, et al. Time-course analysis reveals that corticosteroids resuscitate diminished CD8+ T cells in COVID-19: a retrospective cohort study. *Ann Med* 2021;53(1):181-188.
9. Yongzhi X. COVID-19-associated cytokine storm syndrome and diagnostic principles: an old and new Issue. *Emerg Microbes Infect* 2021 Dec;10(1): 266-276.
10. European Resuscitation Council. European Resuscitation Council Covid!19 Guidelines. [serial online] 24 Jul 2020 [cited: 16.06.2021]. Available from URL: <https://www.google.com/search?client=firefox-b-d&q=10.+European+Resuscitation+Council+Covid%2119+Guidelines.#>.
11. Buick J, Cheskes S, Feldman M, Verbeek P, Hillier M, Leong Y, et al. COVID-19: what paramedics need to know! *CJEM* 2020; 22(4): 426-430.
12. Ahmad J, Anwar S, Latif A, Haq NU, Sharif M, Nauman AA. Association of PPE availability, training, and practices with COVID-19 sero-prevalence in nurses and paramedics in tertiary care hospitals of Peshawar, Pakistan [published online ahead of print, 2020 Nov 5]. *Disaster Med Public Health Prep* 2020;1-5.
13. Dhahri AA, Iqbal MR, Ali Khan AF. A cross-sectional survey on availability of facilities to healthcare workers in Pakistan during the COVID-19 pandemic. *Ann Med Surg (Lond)* 2020;59: 127-130.
14. Bhagavathula AS, Aldhaleei WA, Rahmani J, Mahabadi MA, Bandari DK. Knowledge and perceptions of COVID-19 among health care workers: cross-sectional study. *JMIR Public Health Surveill* 2020;6(2): e19160.
15. Higginson R, Jones B, Kerr T, Ridley AM. Paramedic use of PPE and testing during the COVID-19 pandemic. *JPP* 2020; 12(6): 221-225.
16. Perkins GD, Morley PT, Nolan JP, et al. International Liaison Committee on Resuscitation: COVID-19 consensus on science, treatment recommendations and task force insights. *Resuscitation* 2020; 151:145-147.
17. Ligen Y. Handbook of COVID-19 prevention and treatment [serial online] March 2020 [cited: 24.10.2021]. Available from URL: https://www.researchgate.net/publication/339998871_Handbook_of_COVID-19_Prevention_and_Treatment.
18. Cook TM. Personal protective equipment during the coronavirus disease (COVID) 2019 pandemic: a narrative review. *Anaesthesia* 2020;75(7): 920-927.
19. Valim MD, Marziale MH, Richart-Martinez M, Sanjuan-Quiles A. Instruments for evaluating compliance with infection control practices and factors that affect it: an integrative review. *J Clin Nurs* 2014; 23(11-12): 1502-1519.
20. Ahmed N, Shakoor M, Vohra F, Abduljabbar T, Mariam Q, Rehman MA. Knowledge, awareness and practice of health care professionals amid SARS-CoV-2, corona virus disease outbreak. *Pak J Med Sci* 2020; 36: 49-56.
21. Gralton J, Tovey E, McLaws ML, Rawlinson WD. The role of particle size in aerosolised pathogen transmission: a review. *J Infect* 2011; 62(1):1-13.
22. Hong H, Wang Y, Chung HT, Chen CJ. Clinical characteristics of novel coronavirus disease 2019 (COVID-19) in newborns, infants and children. *Pediatr Neonatol* 2020;61(2): 131-132.
23. Rozporządzenie Ministra Zdrowia z dnia 5 października 2017 r. w sprawie szczegółowego sposobu postępowania z odpadami medycznymi. *Dz.U.* 2017 poz. 1975. [cited: 23.06.2021]. Available from URL: <https://isap.sejm.gov.pl/isap.nsf/Doc-Details.xsp?id=WDU20170001975>. (In Polish).
24. Kotowska A, Gawlik M. Variables modulating the sense of safety in nurses and midwives facing epidemiological endangerment of COVID-19. *Med Sci Pulse* 2020; 14, 3: 64-72.
25. Vatan A, Güçlü E, Öğütlü A, Kibar FA, Karabay O. Knowledge and attitudes towards COVID-19 among emergency medical service workers. *Rev Assoc Med Bras (1992)* 2020;66(11):1553-1559.

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