Original Article

A study of cardiopulmonary resuscitation literacy among the personnel of universities of medical sciences based in Kermanshah and Khuzestan provinces based on the latest 2015 cardiopulmonary resuscitation guidelines

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Abstract:

INTRODUCTION: Cardiopulmonary resuscitation (CPR) is regarded as the most important skill of the medical staff who is required to be aware of the latest changes to the CPR guidelines so that they can take the most effective actions in the critical conditions of CPR. Therefore, the present study aimed to determine the levels of CPR literacy among the personnel of universities of medical sciences based in Kermanshah and Khuzestan provinces based on the latest 2015 CPR guidelines in 2019.

MATERIALS AND METHODS: In this descriptive, analytical, cross-sectional study, 525 subjects were selected as the sample population using the two-stage cluster sampling. For data collection, a researcher-made questionnaire was used, whose content validity and reliability were confirmed ($r = 0.71$). The study screened the data received and analyzed valid data set through the $t$test and Spearman's correlation coefficient by incorporating SPSS Statistics software version 23.0. In addition, $P < 0.05$ was considered statistically significant.

RESULTS: The 2015 CPR literacy levels of the samples were as follows: excellent (85 subjects or 16.2%), good (404 subjects or 77%), and average (36 subjects or 6.9%). The results of Pearson's correlation coefficient revealed a weak and inverse relationship between the levels of CPR literacy and the age of samples ($r = -0.092$) and work experience (-0.029), which were statistically significant. In addition, the results of Mann–Whitney U-test demonstrated that the level of CPR literacy among the personnel of Ahwaz University of Medical Sciences exceeded that among the personnel of Kermanshah University of Medical Sciences ($P < 0.001$).

CONCLUSION: It is suggested that in retraining the nursing and paramedical personnel, CPR be carried out with more emphasis on the changes introduced in this guideline compared to that in 2010, including esophageal tracheal airway, reasons for the cessation of CPR, intraosseous infusion, and induced hypothermia.

Keywords:

Cardiopulmonary resuscitation, literacy, nurse

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Introduction

Cardiopulmonary resuscitation (CPR) is regarded as the most important skill for the medical staff. Over 1979–2015, CPR programs were taken into account with the aim of increasing the success of measures.[1-3] Research has shown that ventricular fibrillation (V-fib or VF) accounts for more than 80% of cases of cardiac arrest due to acute coronary syndromes outside hospitals.[4] Hence, the most important suggestion in the resuscitation program may be the use of automated external defibrillators (AEDs) by nonprofessionals.[5,6] The importance of massaging the heart in controlled and noncontrolled heart failures outside hospitals has caused nonprofessional rescuers not to waste time in the event of opening victims' airway and controlling their pulses. Therefore, the first measure is to give them a heart massage. In addition, in the 2015 CPR guidelines, firm and quick pressure on the chest at the beginning of the recovery operation is stressed. However, it is suggested that the maximum depth of massage should not exceed 6 cm to prevent lung injury. This type of massage should be carried out 120 times/min at the least for all victims, except for babies aged <1 month. It is necessary that chest returns to its previous position after each massage and it should not be stopped for any reasons.[7,8]

As for all ages, the proportion of heart massage to pulmonary ventilation during CPR is 30 massages to two actions of artificial respiration by professional rescuers, one nonprofessional rescuer, or two nonprofessional rescuers. Moreover, as for children, this proportion is 15–2 by professional rescuers,[9,10] while it is 3–1 for babies under 1 month.[11,12] Each respiration should last for 1 s and cause the chest to raise, and hyperventilation should be avoided. In electrotherapy, one shock is recommended, immediately followed by chest massage and giving artificial respiration for 2 min. This should be continued for at least five cycles or 2 min, and the heart rhythm should be re-controlled. In the case of using AED, the heart rhythm should be controlled after 2 min.[11,13,14] In the new CPR protocol, using asystole is not recommended and emphasis is placed on the continuation of resuscitation and drug therapy.[7] In CPR, the most important drug is epinephrine, and vasopressin should be avoided.[1,15] Moreover, CPR drugs should be administered intravenously, but intraosseous infusion is commonly applied when there is no access to veins and is preferable to intracranial infusion.[5] After confirming the success of CPR, it is recommended that the induced hypothermia be used at a temperature of 32°C–34°C within a 12–24-h interval and reheating after 24 h.[16,17]

In the new recommendations for the CPR of pregnant mothers, the following are suggested: general resuscitation measures in addition to the pressure of the uterus downward if it is higher than the navel, massaging chest in an area higher than the sternum center, electroshock therapy according to the VT and VF treatment guidelines, and emergency hysterectomy if more than 4 min has passed from the resuscitation (1 and 6).

The need for knowledge of these principles and the proper practical application of knowledge are the necessities of training nursing students[11,18] and employed nurses.[3,19-21] The effects of educational programs in learning and understanding the principles of CPR have been stressed inside and outside the country.[22,23] The levels of awareness of CPR measures in different target groups have been reported controversial in medical science universities. For example, in Uromia, the nurses' skills about the application of electroshock therapy were reported very satisfactory.[24] However, in Ardabil, a high percentage of interns did not have acceptable levels of theoretical knowledge and practical skills.[25] Similarly, in Tehran, the medical staff's awareness of the principles of CPR was reported to be significantly inadequate.[26] This shortage of knowledge exists not only in Iran but also abroad. More to the point, in a German study done by Preusch *et al.*, the nurses' awareness of the new CPR guidelines was reported inadequate.[27] Likewise, in a Japanese study, the nurses' awareness of the new CPR guidelines was reported insufficient.[28] In other medical disciplines, such as medical emergencies, there were reports on the lack of awareness of CPR protocols,[29] inappropriate performance in clearing the airway,[30] and lack of awareness in a variety of other fields, such as administering the CPR drugs. In an American meta-analysis conducted by Rittenberger *et al.*, it was reported that drugs were administered to patients very late in resuscitation attempts outside hospitals due to the emergency personnel's lack of CPR knowledge.[31] This lack of awareness necessitates continuing the CPR education. However, the downward trend of awareness after education still remains. It is reported that even after training nurses in CPR, their information about the subject is reduced after 3 months. Hence, it is essential that the continuing education programs be based on the latest changes and emphasis be on psychomotor.[31] In numerous studies, in addition to lack of knowledge, the literacy of nurses and other members of the medical group about the basic and advanced CPR measures has been addressed.[32-35] Work experience[36,37] and employment status[7] are two major factors that can affect CPR literacy.

In Kermanshah University of Medical Sciences, the emergency medical personnel's knowledge of CPR measured 19.5% excellent, 78.6% good, and 1.9% poor.[38] In Kermanshah, the nurses' awareness of CPR was as follows: 20.2% excellent, 65.4% good, 14% moderate,

and 0.3% weak. In addition, there was no statistically significant correlation between awareness of CPR and each of age, work experience, and education, whereas the awareness of CPR was higher in nurses who passed the CPR training course, conducted the principles, or observed them.[38] Despite the difference between nurses and emergency medical personnel in terms of work environment, no significant difference was reported between these two groups in terms of CPR literacy rate in Kermanshah.[39,40]

Observing the important practical points mentioned in the latest version of the CPR guidelines can directly contribute to the success of resuscitation. Accordingly, those who are involved in CPR should use these suggestions, train others, and monitor and manage these principles in clinical environments. Therefore, the present study aimed to determine the levels of CPR literacy among the personnel of universities of medical sciences based in Kermanshah and Khuzestan provinces based on the latest 2015 CPR guidelines in 2019.

Materials and Methods

In the present descriptive, analytical, cross-sectional study, the hospitals affiliated to Kermanshah and Ahvaz Universities of Medical Sciences were visited after obtaining the necessary permits, and after advance notification, the personnel were asked to participate in the study. After data analysis using the SPSS Statistics software (version 23.0, SPSS Inc., Chicago, IL, USA), the data were analyzed descriptively and analytically using the STATA Software Version 11.0 (Statistical Service Center, University of Reading, UK). The statistical population of the present study consisted of all nursing personnel at hospitals affiliated to Kermanshah and Ahvaz Universities of Medical Sciences. Therefore, Kermanshah and Ahvaz Provinces were first chosen through two-stage cluster sampling, and then, cluster sampling was used to select samples at hospitals based in these cities. Participation in this study was voluntary orally, and the important criteria for participating in this study were having a bachelor's degree in nursing, having an employment relationship after graduation, and passing relevant vocational training courses. The final volume of the sample population was estimated to be 480. Hence, 240 samples were selected from each province, i.e., Kermanshah and Khuzestan. The minimum sample size in this study was estimated using a study conducted by Puormirza-Kalhori *et al*.[39] Finally, 292 and 233 patients were studied in Kermanshah and Khuzestan, respectively. Therefore, the final volume of the sample population was 525.

The data gathering tool was a researcher-made questionnaire, which was used in the two previous studies that the tool had appropriate validity and reliability and was up-to-date according to the 2015 CPR guidelines (19 and 20).

This 40-item questionnaire consisted of questions on demographics and the CPR literacy based on the latest changes to the CPR guidelines. The items were as follows: the basic rules for the commencement and termination of CPR (Questions 1–7), the basics of artificial ventilation and airway management (Questions 8–18), the principles of external chest massage (Questions 19–30), and the principles of advanced recovery (Questions 31–40). For true and false answers, 1 and 0 scores were considered, respectively. The new version of the questionnaire with the latest changes to the CPR guidelines was reviewed by ten faculty members at the Faculty of Para Medicine. To determine the reliability of the questionnaire, a preliminary study was conducted at Imam Reza Hospital. Using random sampling, 29 nursing experts were randomly selected and then filled up the questionnaires. The mean score of the questionnaires was 20.62 (±7.45) with a variance of 55.53. Accordingly, a score of 31–40 was excellent, 21–30 was good, 11–20 was average, and <10 was weak. Using the Kuder and Richardson Formula 21, the reliability of the questionnaire measured 0.71. In addition, before sampling, the necessary permits were obtained from Kermanshah and Khuzestan University of Medical Sciences.

Results

The results revealed that the average age and work experience of the samples measured 34.38 (±7.82) and 9.80 years (±6.34), respectively. The Pearson's correlation coefficient showed a weak and inverse relationship between the level of CPR literacy and the age of samples ($r = -0.092$) and work experience (−0.029), which were statistically significant ($P < 0.05$). In addition, the results showed that men and women accounted for 75.8% and 24.2% of the sample population, respectively. The results of independent *t*-test demonstrated that men's CPR literacy was higher than women's ($P = 0.000$). In terms of the basic and advanced CPR courses, 469 (89.7%) and 340 (46.8%) participants passed the courses, respectively. The results of independent *t*-test indicated that there was not a significant difference between the two groups passing either the basic or advanced CPR courses in terms of CPR literacy ($P < 0.05$). Of the samples under study, 443 (44.44%) staff independently and completely participated in CPR operations. The results of independent *t*-test indicated that there was not a significant difference between the samples who participated in CPR operations ($P < 0.05$). Other demographic characteristics of the samples are listed in Table 1.

The 2015 CPR literacy levels of the samples were as follows: very good (85 subjects or 16.2%), good (404 subjects or 77%), and average (36 subjects or 6.9%). The results of comparing the levels of CPR literacy among the samples under study are shown in Table 2.

The results of the Mann–Whitney *U*-test revealed that the level of CPR literacy among the personnel of Ahwaz University of Medical Sciences exceeded that among the personnel of Kermanshah University of Medical Sciences ($P < 0.001$). In the present study, examining the different areas of CPR included 40 questions that measured the CPR literacy based on the latest changes to the CPR guidelines. The items were as follows: the basic rules for the commencement and termination of CPR (Questions 1–7), the basics of artificial ventilation and airway management (Questions 8–18), the principles of external chest massage (Questions 19–30), and the principles of advanced recovery (Questions 31–40). For true and false answers, 1 and 0 scores were considered, respectively. Moreover, the scores were classified as follows: 31–40 (excellent), 21–30 (good), 11–20 (average), and <10 (weak) [Table 3].

The results of *t*-test revealed that there was a significant difference between the medical universities of Kermanshah and Ahvaz in terms of the basics of artificial ventilation and airway management and the principles of advanced recovery. However, there was a significant difference between them in terms of the basic rules for

Table 1: The demographic characteristics of the samples under study in terms of the level of CPR literacy

Demographic characteristics	Interpretation (*P*)	Tukey test

Workplace
  Inpatient ward: 260 (49.5%)
  Nursing management:
127 (24.2%)
  Special care unit: 136 (25.9%)
  Others: 3 (0.4%)
	0.011	The results of Tukey *post hoc* test showed that the CPR literacy rate of nurses working in special care units was higher than that of nurses working in the inpatient wards and management units (*P*=0.012). The results also indicated that the CPR literacy rate of nurses working in the inpatient wards was higher than that of nurses working in the management units and other units (*P*=0.018)

Education
  Health care practitioner diploma:
53 (10.1%)
  AA: 153 (29.1%)
  Continuous BA: 235 (44.8%)
  Discontinuous BA: 31 (5.9%)
  MA: 50 (9.5%)
  PhD: 3 (0.6%)
	0.009	The results of Tukey *post hoc* test showed that the CPR literacy rate of nurses with continuous B.A. degrees was higher than that of nurses with discontinuous B.A., healthcare practitioner diploma, A.A., and M.A. degrees (*P*=0.038). The results also revealed that the CPR literacy rate of nurses with M.A. degrees was higher than that of nurses with health care practitioner diploma, A.A., and discontinuous B.A. degrees (*P*=0.029)

Field of study
  Nursing: 227 (43.2%)
  Medical emergency: 217 (41.3%)
  Anesthetics: 42 (8%)
  Operation room: 39 (7.5%)
	0.000	The results of Tukey *post hoc* test demonstrated that the CPR literacy rate of nurses was higher than that of anesthetics and operation room technicians (*P*=0.003). The results also revealed that the CPR literacy rate of medical emergency technicians was higher than that of anesthetics and operation room technicians (*P*=0.009)

Previous work place
  Special unit: 53 (10.1%)
  Internal medicine: 103 (19.6%)
  Surgery: 80 (15.2%)
  Operation room: 81 (15.4%)
  Emergency department:
184 (35%)
  CCU: 24 (4.6%)
	0.000	The results of Tukey *post hoc* test demonstrated that the CPR literacy rate of special unit nurses was higher than that of nurses in internal medicine units, surgery, emergency department, and operation rooms (*P*=0.049). Not to mention, the results indicated that the CPR literacy rate of CCU nurses was higher than that of nurses in internal medicine units, surgery, emergency department, and operation rooms (*P*=0.034)

CPR=Cardiopulmonary resuscitation, CCU=Cardiac care unit

Table 2: Comparison of cardiopulmonary resuscitation literacy among the samples under study

University of medical sciences	CPR literacy ranking						Statistical test	Interpretation	*P*
	Excellent		Good		Average				
	Absolute	Relative	Absolute	Relative	Absolute	Relative			
Kermanshah	25	8.6	235	80.5	32	11	Mann-Whitney *U*-test	The two groups were significantly different in terms of literacy, and Ahwaz had a higher literacy rate	0.001>
Ahwaz	60	25.8	169	72.5	4	1.7			
Total	85	16.2	404	77	36	6.9			

CPR=Cardiopulmonary resuscitation

Table 3: Comparison of cardiopulmonary resuscitation literacy among the samples under study in terms of the four areas of cardiopulmonary resuscitation literacy

University of medical sciences	CPR literacy rate									
	Commencement and termination of CPR		The basics of artificial ventilation and airway management		The principles of external chest massage		Advanced CPR		Total score	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Kermanshah	2.99	1.06	7.79	1.73	8.63	2.08	6.41	1.68	25.84	4
Ahwaz	5.05	1.09	7.75	1.35	9.42	1.83	6.27	1.20	28.52	3.19
Total	3.91	1.48	7.78	1.57	8.98	2.01	6.35	1.49	27.03	3.90
Statistical test	Independent *t*-test		Independent *t*-test		Independent *t*-test		Independent *t*-test		Independent *t*-test	
Interpretation	0.001>		0.782		0.001>		0.274		0.001>	

CPR=Cardiopulmonary resuscitation, SD=Standard deviation

the commencement and termination of CPR and the principles of external chest massage ($P < 0.001$) [Table 3].

Discussion

In the present study, the 2015 CPR literacy levels of the samples were as follows: very good (85 subjects or 16.2%), good (404 subjects or 77%), and average (36 subjects or 6.9%). This finding was indicative of the fact that the staff's CPR literacy levels were desirable at universities based in Kermanshah and Ahwaz. This finding confirms the main hypothesis of the research. The awareness and performance of 60 emergency medical technicians working in 31 urban medical stations were investigated by Brown *et al.*, and the results indicated that their awareness and performance about the CPR guidelines were average and weak.[29] Similarly, Passali *et al.* reported that the Greek nurses and doctors' knowledge of advanced life support and basic life support (BLS) principles was not sufficient.[32] In another study done by Preusch *et al.* in University of Hildenburg, Germany, the results were indicative of nurses' lack of knowledge, awareness, and training them in basic CPR guidelines.[27] In a Japanese study by Nagashima *et al.*, it was shown that many nurses were unaware of the latest CPR guidelines and suggested that there was a need for more training in CPR principles.[26] Likewise, in an Iranian study conducted by Pour Anaraki *et al.*, it was reported that the medical staff's awareness of CPR principles was significantly insufficient.[26] The lack of knowledge about CPR has been reported not only in Chinese clinical nurses but also in their nursing staff.[41] Likewise, the results of an Indian study on 1054 nurses, physicians, and nursing students revealed that there was a severe shortage of knowledge about BLS.[33] In the same way, a lack of knowledge, attitudes, and performance in the field of CPR was reported in medical students.[34]

In the present study, the CPR literacy rate of male samples was higher than that of women, which was consistent with the results of a study conducted by Pour Anaraki *et al.*[26] There was no statistically significant correlation between age, sex, work experience, field of

study, previous work place, and attending the advanced CPR training courses. The results of a study done by Borimnejad *et al.* were indicative of the positive effects of work experience on nurses' knowledge of CPR.[36] However, in a study performed by Mohsenpour *et al.*, it was concluded that employment status and work experience positively and significantly affected nurses' knowledge of CPR.[7]

In the present study, the level of CPR literacy was not independently evaluated among the emergency medical personnel; however, in a study conducted by Pourmirza Kalhori *et al.*, the acceptable levels of awareness of the knowledge of basic and specialized CPR were investigated among the emergency medical personnel.[38] The results of comparing the knowledge of medical emergency personnel and nurses about CPR literacy demonstrated that the two groups were not significantly different (26 and 27). Therefore, holding CPR retraining workshop can increase the nurses' competency in CPR.[16] Due to the passage of time and forgetting the training materials, retraining the nursing students in CPR is stressed.[42] Hence, it is recommended to use the up-to-date CPR guidelines for student education.[1] In this regard, it is suggested that only virtual programs should not be taken into account and psychomotor capacities should be also boosted through practical workshops.[34]

The results of the present study demonstrated that there was a significant difference between the CPR literacy of healthcare practitioners and other medical majors. In other words, the level of healthcare practitioners' CPR literacy was lower compared to that of others. This finding confirms the results of a study conducted by Guyette *et al.*, in which it was suggested to use nurses and emergency medical personnel in advanced CPR operations.[30] In studies done by Passali *et al.*[32] and Preston *et al.*,[43] the lowest levels of awareness were reported on the principles of advanced CPR. According to Preston *et al.*, the most important reason for the lack of awareness in this area was the lack of adequate skills in examining the needs of patients. In newly graduated physicians, this lack of knowledge and clinical

competence in the basics of advanced CPR can be due to lack of adequate training in emergency medical issues.[44] According to this finding, it is essential that teaching the principles of advanced CPR be included in retraining courses given to nursing and paramedical personnel, and the new strategies of 2015 CPR guidelines should be clearly taught to improve the quality of advanced CPR. This research proposal has also been presented in a study conducted by Ghasemi *et al*. and Perkins *et al*.[45,46] The subjects' level of awareness on the main principles of commencement and termination of CPR and the basics of artificial ventilation and airway management was acceptable, whereas the lack of awareness of BLS had been reported in various studies.[9,26-28,47]

In the topics related to electroshock therapy and using AED (Questions 31–33), the knowledge of the samples was acceptable. In contrast, the results of studies conducted by Borimnejad *et al*.[36] and Baksha and Behnampour[48] were indicative of the lack of awareness on electroshock therapy and using AED. It is suggested that more accurate training be provided in CPR retraining programs, especially in the field of using AED. However, in some other studies, it is suggested that the trained nurses be used in nurses' retraining programs in the area of BLS and AED applications.[49]

The 16th question of the questionnaire was about the laryngeal mask airway (LMA) and Combi tube. The results indicated that the samples' knowledge about this question was satisfactory. This finding was consistent with the results of studies conducted by Guyette *et al*.[30] Given the emphasis on the use of supraglottic airways in 2015 CPR guidelines, it is essential that the required training be provided in retraining courses. This suggestion was confirmed in a study done by Wiese *et al*., in which it was concluded that LMA was more effective than bag valve mask in terms of airway management.[50]

Questions 2–6 of the questionnaire focused on the reasons of termination and failure to start CPR. The results indicated that the samples' knowledge about these questions was not satisfactory. Hence, it is essential that the legal aspects be included in retraining courses. In this respect, there are some reports about incorporating these legal aspects into the retraining courses.[51] The two most important questions of the questionnaire were about the use of intraosseous infusion, instead of injection into the trachea and induced hypothermia, of which the samples under study had a little information, as mentioned in other studies too.[31] Therefore, it is necessary that these two important procedures be stressed in retraining courses. Having examined the questions in the new version of the research tool compared to the CPR changes in 2015, it can be seen that the samples' CPR literacy of these changes was not appropriate, and it is

necessary that more emphasis be placed on these changes in retraining courses. This important point has been mentioned in various studies, as it has been reported that the staff of health organizations do not have the required executive efforts to implement internationally implemented changes in retraining courses based on the AHA guidelines.[52] Hence, it is necessary that the retraining courses of medical staff about CPR topics be taught based on the latest guidelines recommended in scientific communities, and it is suggested that training programs be provided continuously toward boosting knowledge.[53]

Conclusion

It is suggested that in retraining the nursing and paramedical personnel, CPR be carried out with more emphasis on the changes introduced in this guideline compared to that in 2010, including esophageal tracheal airway, reasons for the cessation of CPR, intrabony infusion, and induced hypothermia.

Conflicts of interest
There are no conflicts of interest.

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