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ORIGINAL ARTICLE

Our Level of Success in Cardiopulmonary Resuscitation Training: Where is it?, Where does it Need to be?

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Abstract

Introduction: All healthcare professionals should always have a high level of basic knowledge and skills related to cardiopulmonary resuscitation (CPR) practices. Our objective in this study is to assess the knowledge of specialty students regarding CPR practices to designate training priorities, content and frequency aimed at preserving CPR knowledge and skills.

Methods: Data were collected in line with the 2015 ERC guideline. A test form with 20 questions covering CPR knowledge and training status, with four options to each question, was distributed to research assistants in different clinics in a training and research hospital.

Result: Knowledge and skill levels in Anesthesiology and Reanimation Departments and emergency department clinics were higher. A significant relationship was found between monthly CPR instances and these levels. Those who practiced CPR two or more times had better knowledge and skills. The relationship of CPR knowledge and skill level with the frequency of education; the level of success in 6 months, within 1 year and in those who did not receive training was determined as 67.89%, 58.49%, and 55.25%, respectively.

Discussion and Conclusion: Where we are, the level of knowledge and skills for CPR practices is only at 59.52% and this means that we are considerably behind our goal. Where we should be, targeted success level for CPR should be 90% or higher, which necessitates regular CPR training in all clinics. Effective rotation programs or simulation-based CPR training in clinics with monthly 0–1 CPR instances will greatly contribute to attaining our objective. Retraining at <6 months will preserve updating the information and therefore significantly contribute to effective CPR practices.

Keywords: Cardiopulmonary resuscitation; research assistant; training.

Sudden cardiac death (SCD) usually means unexpected death from a cardiovascular cause in a person with or without a pre-existing heart disease[1]. Success rates in cardiopulmonary resuscitation (CPR) applications are higher in hospital cases, and higher in patients with ventricular fibrillation (VF) as starting rhythm, when compared to patients with asystole and pulseless electrical activity (PEA)[2]. When cardiac arrest occurs, <20% of pa-

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tients in the hospital survive and can be discharged[3]. In the study conducted by Ebell et al.,[4] it was reported that only 13% of in-hospital cardiac arrest cases could be discharged. Early and effective CPR is the most important practice that determines the line between death and life in cases of sudden cardiac arrest both in hospital and non-hospital settings.

CPR practices should be at the top of the basic knowledge and skills of all personnel working in the field of health. How dynamic are we in terms of CPR knowledge and skills, which is an indispensable fundamental point that all healthcare professionals, especially physicians, should know and how effectively can we apply it? CPR practices require a multidisciplinary approach. To talk about an effective CPR, it is necessary to call the blue code or 112, start chest compressions at the appropriate count and depth immediately and perform early defibrillation if the rhythm is appropriate. As healthcare practitioners, we have to be ready and dynamic in the light of up-to-date information in a period where CPR training is given in non-governmental organizations as well as healthcare professionals and efforts are being made to increase the knowledge and skills of the society on CPR. Retraining is essential for up-to-date knowledge and the skills to be at a high level. Training intervals differ according to the characteristics of the participants (i.e., healthcare professionals or citizens). It is known that CPR skills deteriorate during the months following training, therefore the frequency of retraining within a year may be insufficient. While optimal frequency for CPR retraining is not known, frequent "low-dose" retraining sessions may be beneficial[3].

Materials and Methods

After the institutional and local ethics committee permissions (HNEAH-KAEK 2020/35) were obtained for our study, data were collected by the researchers in line with the 2015 ERC guideline. A test form, which contains 20 questions covering current CPR knowledge and training status, with four options to each question, was prepared and distributed to research assistants working in different clinics in a training and research hospital for participation.

Statistical Reviews

When evaluating the findings obtained in the study, IBM SPSS Statistics 22 (SPSS IBM, Turkey) programs were used for statistical analyses. While evaluating the study data, the appropriateness of the parameters to normal distribution was evaluated using the Shapiro Wilks test. While evaluating the study data, in addition to using descriptive statistics (mean, standard deviation, frequency), for the comparison of quantitative data of parameters without normal distribution, Kruskal Wallis test was used in intergroup comparisons as well as Dunn test in determining the group that causes the difference. Mann Whitey U test was used to compare the parameters, which did not exhibit normal distribution, between two groups. Significance was evaluated at $p<0.05$ level.

Findings

177 research assistants from different clinics agreed to participate in our study (Table 1).

Participants' ages range from 24 to 42, with a mean age of 28.59±2.71.

While 71.8% of the participants are under the age of 30, 28.2% are 30 or over. 50.8% are male and 49.2% are female. 10.2% are in the internal diseases clinic, 5.6% in general surgery, 26% in family medicine, 11.9% in emergency service, 3.4% in neurology, 6.2% in gynecology, 4.5% in urology, 5.1% in otorhinolaryngology, 13% in anesthesiology, 6.8% in orthopedics, 2.8% in ophthalmology, and 4.5% are in psychiatry clinic (Table 1).

Table 1. Distribution of general characteristics (n=177)

	Min-Max	Mean±SD
Age	24-42	28.62±2.78
	n	**%**
Clinic		
Internal diseases	18	10.2
General surgery	10	5.6
Family medicine	46	26.0
Emergency	21	11.9
Neurology	6	3.4
Gynecology	11	6.2
Urology	8	4.5
Otorhinolaryngology	9	5.1
Anesthesiology	23	13.0
Orthopedics	12	6.8
Eye diseases	5	2.8
Psychiatry	8	4.5
Age group		
<30 years	127	71.8
≥30 years	50	28.2
Gender		
Male	90	50.8
Female	87	49.2

Table 2. Distribution of information related to working parameters

	Min-Max	Mean±SS (median)
Duration of office as an assistant (Years) (n=154)	0.08–5	2.01±1.37 (2)
Number of CPRs administered per month (n=173)	0–7	1.51±1.49 (1)
Number of correct answers to questions related to CPR knowledge and skills	2–17	10.12±2.83 (10)
CPR knowledge and skill level	11.76–100	59.52±16.65 (59)
	n	**%**
Previous CPR training status analyzed (n=177)		
Not trained	51	28.8
Past 6 months	37	20.9
1 year and longer	89	50.3
Number of CPRs administered per month group (n=173)		
Between 0 and 1	122	70.5
Between 2 and 3	28	16.2
4	23	13.3

CPR: Cardiopulmonary resuscitation.

The duration of the participants' employment as assistants varies between 0.08 and 5 years, with an average of 2.01±1.37 and a median of 2 years. The number of CPRs administered per month ranges from 0 to 7, with a mean of 1.51±1.49 and a median of 1. While 28.8% of the participants did not receive any previous training in CPR, 20.9% received CPR training in the last 6 months and 50.3% 1 year ago or longer. 70.5% of the participants perform CPR 0–1 times a month, 16.2% between 2 and 3 and 13.3%, 4 or more times (Table 2).

The distribution rates of correct answers from participants to skill and knowledge questions are presented in Table 3. There are 17 questions in total. The number of correct answers given to CPR knowledge and skills questions ranged

Table 3. Distribution of information on correct answers to questions

	Incorrect n (%)	Correct n (%)
How many minutes are those who use chest compressions changed during CPR? (Q1)	52 (29.4)	125 (70.6)
How long the chest compressions should be paused in CPR due to any reason? (Q2)	55 (31.1)	122 (68.9)
What is the publication cycle of resuscitation guidelines in years? (Q3)	78 (44.1)	99 (55.9)
In which of the rhythms given together, defibrillation is applied? (Q4)	43 (24.3)	134 (75.7)
Which of the following is false regarding CPR? (Q5)	70 (39.5)	107 (60.5)
What should be done first for the patient whose arrest rhythm is VF ? (Q6)	17 (9.6)	160 (90.4)
What should minimum percentage of chest compression fraction be in CPR? (Q7)	136 (76.8)	41 (23.2)
What should be the chest compression rate per minute? (Q8)	33 (18.6)	144 (81.4)
Which of the following is wrong about the depth of chest compression? (Q9)	117 (66.1)	60 (33.9)
What is the minimum diastolic pressure value be in mmHg to be able to say that CPR is performed effectively? (Q10)	80 (45.2)	97 (54.8)
Which of the following is wrong when applying defibrillation? (Q11)	142 (80.2)	35 (19.8)
Which of the explanations given about the agents used during CPR is wrong? (Q12)	46 (26)	131 (74)
Which drug should be used first anti-arrhythmically in resistant VF? (Q13)	24 (13.6)	153 (86.4)
After which shock should antiarrhythmic therapy be given in resistant VF? (Q14)	46 (26)	131 (74)
Which of the following is not one of the reversible causes of cardiac arrest? (Q15)	57 (32.2)	120 (67.8)
What should be the shock level when applying defibrillation on children? (Q19)	140 (79.1)	37 (20.9)
Which of the following is false regarding CPR? (Q20)	82 (46.3)	95 (53.7)

CPR: Cardiopulmonary resuscitation, VF: Ventricular fibrillation.

from 2 to 17, with a mean of 10.12±2.83 and a median of 10. CPR knowledge and skill levels range from 11.76 to 100, with a mean of 59.52±16.65 and a median of 59 (Table 3).

There is no statistically significant difference in terms of CPR knowledge and skill levels in terms of age groups and gender (p>0.05).

There is a statistically significant difference between clinics in terms of CPR knowledge and skill levels (p=0.000; p<0.05). As a result of paired comparisons performed to detect the difference, the CPR knowledge and skill levels of those in the anesthesiology clinic and the emergency department were found to be statistically significantly higher than in the other clinics (p<0.05). There is no statistically significant difference between other clinics in terms of CPR knowledge and skill levels (p>0.05) (Table 4).

Table 4. Evaluation of CPR knowledge and skill level according to age groups, gender, clinic, previous CPR training, and number of CPRs performed per month

	CPR knowledge and skill level Mean±SS (median)
Age group	
<30 years	59.43±16.03 (58.8)
≥30 years	59.76±18.31 (58.8)
p[1]	0.879
Gender	
Male	58.95±17.1 (58.8)
Female	60.11±16.26 (58.8)
p[1]	0.672
Clinic	
Internal diseases	51.31±12.41 (47.1)
General surgery	64.12±13.99 (70.6)
Family medicine	56.52±13.21 (52.9)
Emergency	80.11±8 (76.5)
Neurology	43.14±8.04 (44,1)
Gynecology	47.06±13.41 (52.9)
Urology	47.79±19.24 (55.9)
Otorhinolaryngology	47.71±4.6 (47.1)
Anesthesiology	75.19±15.04 (70.6)
Orthopedics	48.53±8.73 (50)
Eye diseases	63.53±12.75 (70.6)
Psychiatry	58.82±7.03 (55.9)
p[2]	0.000 *
Clinic	
Not trained	55.25±14.93 (52.9)
Last 6 months	67.89±14.97 (70.6)
1 year and longer	58.49±17.18 (58.8)
p[2]	0.001*
Number of CPRs performed per month in group	
Between 0 and 1	54.63±12.93 (52.9)
Between 2 and 3	66.81±20.01 (67.6)
4 and above	77.75±13.85 (76.5)
p[2]	0.001*

[1]Mann Whitney U Test. [2]Kruskal Wallis Test. *p<0.05. CPR: Cardiopulmonary resuscitation.

There is a statistically significant difference between previous training in terms of CPR knowledge and skill levels (p=0.001; p<0.05). As a result of paired comparisons performed to determine the difference, the CPR knowledge and skill levels of those who received CPR training in the last 6 months were found to be statistically significantly higher than those who did not receive training and those who received training for 1 year or more (p1=0.001; p2=0.010; p<0.05). There is no statistically significant difference in terms of CPR knowledge and skill levels between those who did not receive training and those who received training 1 year ago or longer (p>0.05).

In terms of CPR knowledge and skill levels, there is a statistically significant difference between the groups for the number of CPR performed per month (p=0.000; p<0.05). As a result of the paired comparisons to determine the difference, the CPR knowledge and skill levels of the group which perform CPR 0–1 times per month were found to be statistically significantly lower than those of the groups with 2–3 and 4 and above CPR performances per month (p1=0.003; p2=0.000; p<0.05). There is no statistically significant difference in terms of CPR knowledge and skill level between the groups who perform CPR 2–3 times/month and 4 or more times/month (p>0.05).

Discussion

SCD is the most urgent situation which we may encounter at any time in all areas of life, especially in hospitals. Meanwhile, an effective CPR applied to the patient determines the way between death and life, as well as significantly affecting the neurological survival of survivors. In cases of noneffective CPR, neurological survival deteriorates considerably and most survivors have to live confined to bed, depending on home care. This situation seriously impairs the quality of life for the patient and their relatives.

Looking at literature, it can be observed that CPR knowledge and skill levels are generally non satisfactory. In their studies, Çalışkan,[5] Demirtaş,[6] Price,[7] and Mohammed et al.,[8] reported knowledge and skill levels of participants as 49%, 50.8%, 56.6%, and 31.7%, respectively. The results in our study were found at a low level of 59.52%, consistent with the literature.

In the study conducted by Çalışkan et al.,[5] the highest success in CPR applications was achieved in the emergency medicine department, followed by pulmonology and cardiology departments. The study determined that specifically clinics which contain ICU and which performed more than 10 instances of CPR in a 6-month period had higher knowledge and skill levels.

However, Howell et al.,[9] found in their study that specialty did not have significant association with the obtained CPR knowledge scores (p=0.487), but 72% of anesthesiologists and 69% of emergency physicians got a higher score of ≥4. The median score was 5.0 for emergency physicians, 4.0 for anesthetists, 3.6 for internists, 3.5 for surgeons and 2.5 for obstetricians.

When we evaluated the inter-clinic CPR knowledge levels, we found that emergency services (80.11%) and anesthesiology and reanimation clinics (75.19%) differed from other clinics and that their knowledge and skill levels were higher. We believe that this is due to two reasons, namely that more CPR training is provided in these clinics, and that physicians in these clinics perform CPR more frequently.

To talk about an effective CPR, early warning, effective chest compression and early defibrillation must be well understood and performed in full. Survival rates increase up to 50–70% with defibrillation performed 3–5 min after collapse[3].

The Nolana et al.,[10] study reported that 16.9% of in-hospital cardiac arrest rhythms could be shocked (VF or pulseless ventricular tachycardia) while 72.3% could not (asystole or PEA), and the survival rates until discharge from the hospital were as 49.0% and 10.5%, respectively. Studies have found that only 20–35% of in-hospital cardiac arrest rhythms have a shockable rhythm such as VF/VT[11-13]. However, survival rates are much higher in shockable rhythms and especially in early defibrillation. Studies have found that survival rate is between 18% and 64% in shockable rhythms (VF/Pulseless VT), while it is between 1.2% and 14% in non-shockable rhythms (Asystole/NEA)[11-14]. As can be observed in these studies, the importance of defibrillation regarding survival is critical.

In the study conducted by Akıllı et al.,[15] with participation of 134 physicians, it was determined that 11.9% (n=16) of the participants performed defibrillation in the wrong rhythm, 20.9% (n=28) did not know the rhythm to apply and 67.2% (n=90) applied it in the correct rhythm. The Nambiar et al.,[16] study conducted with participation of 461 healthcare professionals, reported that 79 (17.1%) participants correctly knew both VF and pulseless ventricular tachycardia as a shockable rhythm. In our study, the rate of those who correctly knew the rhythms to be defibrillated was 134 (75.7%). However, 142 (80.7%) of the participants answered incorrectly when asked about the points to be considered during defibrillation. First of all, defibrillation should be performed as soon as possible, and it should be performed in line with certain rules (placing gel pads/paddles in the appropriate places and jelling, applying shock by placing weight on the chest, preventing contact from surrounding people, removing oxygen sources, etc.) to increase its effectiveness and prevent harm against the environment and the patient.

One of the most important points to gain high CPR knowledge and skill levels is the need to repeat training at low doses and frequent intervals. In the study conducted by Nambiar M et al.,[16] with participation of 461 healthcare personnel, it was found that 178 (38.6%) people who received training had significantly higher average scores compared to 283 people who never received training (9.5±3.4 vs. 8.5±3.5, p=0.002). The Mohammed et al.,[8] study found that physicians and medical students who had previously received CPR training had significantly better CPR knowledge than those who did not. Studies have shown that simple CPR knowledge and skills deteriorate within 1–6 months following the training[17]. The study conducted by Chamberlain et al.,[18] shows that a retraining frequency of 6 months was effective in terms of maintaining the CPR knowledge and skill levels. Bhatnagar et al.,[19] in their survey conducted with newly graduated young physicians, found that the success rate in the pretest increased from 63.97% to 84.74% after the training. However, in the evaluation they made after 6 months, they saw that the success rate decreased to 67.4%. The data in our study were grouped as those who did not receive training (51) (28.8%), those who did not receive training for 1 year or longer (89) (50.3%), and those who received training within the last 6 months (37) (20.9%). CPR knowledge and skill levels of these groups were found to be 55.25% in those who did not receive training, 58.49% in those who did not receive training for 1 year or longer, and 67.89% in those who received training in the last 6 months. It is observed that the knowledge and skill levels is at the lowest level in those who do not receive training, and at the highest level in those who received training in the past 6 months, whence we conclude that training should be repeated in maximum intervals of 6 months.

It is natural to have high success rate with applications which we frequently perform in our daily clinic practice. For this reason, the knowledge and skill level of healthcare

professionals who perform CPR frequently in their clinical practice is generally higher.

The Mohammed et al.,[8] study found a statistically significant positive correlation between the CPR information and the number of CPR instances performed. The study carried out by Passali et al.,[20] reported that nurses and physicians working at high-risk areas for cardiac arrest scored considerably higher points compared to those who work at low-risk areas. In our study, we found a statistically significant association between the instances of CPR performed over a month's period and high levels of knowledge and skill. It was found that the CPR knowledge and skill levels of the group with 0–1 CPR instances were statistically significantly lower than those of the groups with 2 or more instances. Therefore, we believe that it would be appropriate to eliminate these deficiencies in clinics with less CPR instances by either duty rotation (emergency or intensive care) or simulation training. Mannequins developed for simulation-based trainings have become more widely used now because they exhibit very similar properties to the physical human body, and they allow practicing of many different scenarios.

Due to its high efficiency in resuscitation training, the simulation-model CPR training has become a central component of the Resuscitation Council and the European Resuscitation Council Advanced Life Support Provider courses[21,22]. Of course, the high cost of simulators leads to limitations in their use[23]. In relation to the equipment itself, we might encounter issues such as lack of clinical reality, computer malfunction or difficulties in terms of discovering certain clinical symptoms[24].

The Mundell et al.,[25] study, where a meta-analysis was conducted on 114 studies, concluded that simulation-based training was extremely effective for CPR training.

Increasing evidence indicates that paying attention to key aspects of the CPR technique, such as proper chest compression fraction and depth, allowing chest wall retraction, minimizing interruptions, and avoiding excessive ventilation significantly improves survival[26,27].

In our study, the question about the chest compression fraction received 136 (76.8%) incorrect answers, and the question about the depth of chest compression received 117 (66.1%) incorrect answers, both of which are very high rates. This is an indication that even fundamental points of CPR can be forgotten in time, and that regular training with appropriate training material is vital to eliminate this deficiency. The McCoy et al.,[28] study which was conducted with participation of 70 medical students compared simulation-based training and standard training. The study reported that CPR performed by students in the simulation group was more in line with AHA guidelines in terms of chest compression depth and fraction.

Although CPR training requires a holistic approach, practitioners may lack more knowledge at certain points. Determining these missing points before training and focusing more on these issues can raise the quality of training to a higher level.

Mohammed et al.,[8] found in their study that the lack of knowledge regarding CPR on children and newborns was more pronounced. In our study, we found a considerable lack of knowledge in the answers given to CPR questions related to children. For this reason, it is important to prioritize focus in CPR training on issues related to children.

Conclusion

Where we are, the fact that the level of knowledge and skills for CPR practices is only at 59.52% means that we are much behind where we need to be. Where we should be, since CPR is a very important and critical intervention, targeted success level should be 90% of higher. In order to attain this level, regular CPR training should be given in all clinics. In addition, reducing the levels of clinics which practice 0–1 CPR in a month through implementation of effective rotation programs or simulation-based CPR training models in these clinics will greatly contribute to attaining our objective. Regular repetition of the trainings at <6 months will make a significant contribution to effective CPR practices by ensuring that the knowledge is updated.

Ethics Committee Approval: After the institutional and local ethics committee permissions (HNEAH-KAEK 2020/35) were obtained for our study, data were collected by the researchers in line with the 2015 ERC guideline.

Peer-review: Externally peer-reviewed.

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