Prehospital cardiopulmonary resuscitation: A survey of prehospital providers

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ABSTRACT

This study evaluated the knowledge and skills, the attitudes, the behaviors of general practitioners, paramedics, emergency medical technicians (EMT) about cardiopulmonary rescucitation (CPR) practices, and the influencing factors. A total of 451 subjects working in 112 emergency ambulance services were included in the study. Of the participants, 61.2% were female and 38.8% were male. Of the personel, 8.6% were general practitioners, 14.6% were paramedics, 61.2% were EMTs, 15.5% were nurses and medical officers. A questionnaire form composed of 36 questions about demographic data and data which could influence the knowledge level was used. Descriptive statistics were performed and marginal tables were created. The age range was 25-34 years in 48.3% of the participants; 26.2% had been working for emergency services for 7-10 years. Of the participants, 83.1% were working in 112 emergency health units, and 16.9% were working at the command control center. When the participants were asked how frequent the courses should be, 49% of the participants stated that it should be carried out once a year, 12% said that it should be given once every 5 years, and 17% stated that the course should be repeated whenever new data are added to the literature or when the CPR guidelines change. Forty-eight percent of the participants responded as 'yes', and 1% as 'absolutely no' to the question 'Do you think that you perform CPR as required?'. Our questionnaire study indicates that education programs should be developed for the personnel working at prehospital health services, and that these programs should be repeated annualy for increasing the practice and to improve the knowledge level of the workers.

1. Introduction

Turkey is a country where abrupt and immediate intervention-requiring diseases, traffic accidents and injuries, extraordinary conditions and natural disasters are common. Therefore, emergency health services constitute one of the most specialized fields. The system defined as prehospital emergency health services or 112 emergency ambulance services, is a very important public health service, which aids the maintanence of the vital functions of the subject and aims at reaching the emergency services immediately in life-threatening conditions or the conditions which require immediate health care. The most important characteristic of this unique system is its continuous functionality.

Ambulance services and the use of ambulances vary depending on local, socioeconomic and cultural conditions between developed and developing countries. Emergency ambulance services continue for 24 hours under the supervision and management of command control centers of the province or the region (Black and Davies, 2005). Paramedics who have been educated, who have the skills and authority for various interventions and medicine administration, work beside the primary care physicians in emergency ambulance services in developed and developing countries. However, the number of paramedics is insufficient in many developing countries (Kidak et al., 2009). The developments in ambulance services have begun at the end of 1980 in Turkey. Ambulance services

Table 1. Demographics and descriptive information of 451 pre-hospital providers

Age category	n	Percent
< 24 (y)	149	33
25-34 (y)	218	48.3
35-44 (y)	71	15.8
> 45 (y)	13	2.9
Sex (n=451)		
Female	276	61.2
Male	175	38.8
Professional experience		
< 1 (y)	16	3.6
1-2 (y)	84	18.6
3-4 (y)	117	25.9
5-6 (y)	52	11.5
7-10 (y)	118	26.2
> 11 (y)	64	14.2
The working department		
112 emergency health services	375	83.1
Command control center	76	16.9
Occupational groups		
General practitioner	39	8.6
Emergency medical technicians	276	61.2
Paramedics	66	14.6
Others*	70	15.5

*Nurse, medical officers, student EMT, student paramedic

have begun as patient transfer services in large provinces under the name of 'Emergency Ambulance Service' in 1986, and a new system named '112 Emergency Aid and Rescue' has been introduced in 1994. A team composed of a general practitioner (GP), a nurse and a driver has begun to work in the ambulances since 1994. Health professionals like paramedics and emergency medical technicians (EMT) have been added to this team today (Roudsari et al., 2007). Emergency health services is a team work and the role of 112 emergency health personnel is very important in prehospital health services. The increasing ambulance numbers increases the importance of immediate, correct and accurate intervention of the ambulance personnel.

Cardiopulmonary arrest is sudden termination of spontaneous respiration and circulation due to any reason. Cardiopulmonary resuscitation (CPR) comprises the whole of the efforts, decisions and procedures aiming to retrieve spontaneous circulation. CPR is a common condition for the health care workers at the hospitals and prehospital services, which requires continuous education. The interventions for CPR were first published by the American Heart Association in 1966.(Field et al., 2010). The European Resuscitation Council was established in 1989 and subgroups of this committee formed the standards and algorithms of CPR (Bossaert and Chamberlain, 2013). The International Liaison Committee on Resuscitation was established in 1992, which aims at drawing up a consensus on basic life support and advanced cardiac life support, early recognition of cardiac arrest and activation, early CPR, early defibrillation and treatment (Chamberlain, 2005). The aim of this study was to evaluate the experiences, knowledge and skills of GPs, paramedics, EMTs, nurses and health officers who were working at 112 ambulance services in Konya province in 2014.

2. Material and method

This study was conducted by the Department of Emergency Medicine, Selcuk University Medical School between January 2014 and December 2014 after having obtained ethics committee approval from the Selcuk University Medical School and from the Konya Province Directory of Health. The GPs, EMTs, paramedics, health officers and nurses who were actively working in the ambulances and command control centers of Konya Province Directory of Health and who agreed to participate were included in the study. All of the questions were prepared under the supervision of emergency medicine specialists. The questionnaires were filled out through face to face interviews after being informed about the objective of the study. The participants were told that this was not an exam, and that all data were targeted to be collected for scientific purposes and the results would not affect their professional life and their future. The participants were asked 36 questions about their duty, age, gender, title, the last date of their education, whether or not they found re-training necessary, how frequently they applied CPR, endotracheal intubation (ETI) or laryngeal mask airway (LMA) in a month, the duration of CPR application in different patient groups, how sufficient they found themselves about ETI and CPR application and their opinions about "do not resuscitate" (DNR). The study consisted of 451 healthcare workers, except those who were on vacation, ill or non-volunteering. The obtained data were analysed in the package for the Social Sciences (SPSS, Inc., Chicago, IL), version 18.0 for Windows, and descriptive statistics were calculated and marginal tables were formed.

Table 2. Distribution of the answers of the questions about CPR application and education

n=451	Yes	%	No	%
Does patient age affect the duration of CPR?	362	80	89	20
Does the current disease of the pateint affect the duration of CPR?	388	86	63	14
Did you receive an education or a course about CPR?	417	92.5	34	7.5
Do you think that CPR courses should be mandatory?	439	97.3	12	2.7
Do you think that CPR courses should be periodical?	430	95.3	21	4.7

CPR: Cardiopulmonary resuscitation

3. Results

The questionnaire was applied to 451 participants (61.2% female, 38.8% male). The vast majority of the patients were EMTs (61.2%) followed by paramedics (14.6%), the rate of GPs was only 8.6% (Table 1). Forty-eight point three percent of the participants were between 25-34 years of age (Table 1). Three point six percent of the participants were seen to have been working in emergency medicine services for shorter than one year (Table 1). Of the participants, 83.1% were working in 112 emergency health services and 16.9% were working in command control center. While 80% of the participants stated that the patient age could affect the duration of CPR application, 86% stated that the current disease of the patient could influence this. While 92.5% of the participants had attended a course for CPR, 97.3% stated that the CPR course should be mandatory. Ninety-five point

Table 3. Distribution of the answers of the questions about CPR and ETI

	n	Percent
How frequently should CPR courses be implemented?		
Once a year	222	49.2
Twice a year	97	21.5
Once in 5 years	54	12
When new data are added to literature	40	8.9
When the CPR guidelines change	38	8.4
What is the mean number of CPRs you applied in a month?		
0-10 times	395	87.7
11-20 times	48	10.6
21-40 times	4	0.9
41-60 times	2	0.4
> 60 times	2	0.4
What is the mean number of ETIs you applied in a month?		
0-2 times	293	65.0
3-5 times	122	27.0
6-10 times	33	7.3
11-20 times	3	0.7
Do you primarily prefer ETI or LMA as the airway method?		
ETI	265	58.8
LMA	78	17.3
LMA when they could not apply ETI	98	21.7
Did not have a priority	10	2.2

CPR: Cardiopulmonary resuscitation; **ETI:** Endotracheal intubation; **LMA:** Laryngeal mask airway

three percent of the participants stated that CPR educations should be done periodically (Table 2). When the participants were asked 'how frequently the CPR course should be done?', 49.2% stated 'once a year' (Table 3). While 87.7% stated that they performed CPR 1-10 times in a month, only 1.7% participants stated that they performed CPR for more than 20 times in a month (Table 3). Fifty-eight point eight percent of the participants stated that they primarily preferred ETI, 17.3% stated that they preferred LMA, 21.7% stated that they preferred LMA when they could not apply ETI and 2.2% stated that they did not have a priority (Table 3). The participants were asked the mean duration of CPR. Data about this was given as minimum and maximum and demonstrated in Table 4. Of the participants, 56.3% stated that they applied CPR for a mean of 45 min, 38.9% stated that they applied CPR in 60 min in patients below 20 years of age, 48.5% of the participants stated that they aplied CPR for a mean of 45 min for patients between 20-40 years of age, and 51.2% stated that they applied CPR for a mean of 45 min for patients between

40-60 years. Fifty-one point six percent of the participants stated that they applied CPR for a mean of 45 min for the patients above 60 years, 54.6% stated that they applied CPR for a mean of 45 min in patients who had comorbidities, 51.7% stated that they applied CPR for a mean of 45 min in patients above 60 years and 33.9% stated that they applied CPR for a mean of 45 min in patients who were in the terminal period. Of the participants, 45.1% stated that they applied CPR for mean of 45 min for the malignancy patients, 28.4% stated that they applied CPR for mean of 45 min for the terminal period malignancy patients. Seventy-one point nine percent of the participants stated that they applied CPR for a mean of 60 min in freezing and drowning situations (Table 4). The participants were asked how effectively they could perform CPR, ETI and LMA. The answers of this question were given as minimum and maximum values and have been presented in Table 5. When the participants were asked 'Do you think that you perform CPR correctly?', 48.3% responded as 'yes', and when the participants were asked 'Do you think that you perform ETI correctly?', 46.5% responded as 'yes'. When the participants were asked 'Do you think that LMA can provide an effective airway as ETI?', 49.2% stated 'not completely' (Table 5). The participants were asked which of the items include DNR, and they stated that they could mark more than one item. Eighty-three point four percent of the participants responded to this question as 'not applying cardiac massage' (Table 6).

4. Discussion

This study includes a questionnaire analysis about the experiences, knowledge and skills of the GPs, paramedics, EMTs, nurses and health officers who work in prehospital emergency health services about CPR applications. This study has some limitations. First, the results depend on the accurary of the answers, as in all questionnaire studies. The answers may not always reflect the real practices. Second, a potential bias may be present due to strong opinions or personal errors of some participants. Furthermore, only 451 out of 900 health personnel participated in our study.

Ventricular fibrillation (VF) is the first recorded rhythm in the vast majority of cardiac arrests occuring out of the hospital; each one minute of delay in defibrillation in patients with VF and pulseless ventricular tachycardia is stated to reduce survival by 5-10%; therefore, early resuscitation and early defibrillation is stated to be life saving in these patients (Eftestol et al., 2002; Bunch et al., 2003). There are numerous factors which affect the decision making in prehospital

Table 4. Answers of the ambulance personnel to the questions about the mean duration of CPR application

Category of CPR duration (n:451)	<10 min (%)	20 min (%)	30 min (%)	45 min (%)	60 min (%)	90 min (%)	120 min (%)	>120 min (%)
Duration of CPR	3.5	2.9	16.2	56.3	11.4	3.8	2.4	3.5
Case of age <20	0.8	1.2	3.0	33.1	38.9	10.9	8.1	4.0
Case of age 20-40	0	0.7	7.1	48.5	30.2	8.0	2.2	3.3
Case of age 40-60	0.9	1.3	21.1	51.2	17.3	3.8	1.1	3.3
Case of age >60	2.0	6.9	26.4	51.6	6.9	2.2	1.3	2.7
Patients who had comorbidities	2.0	5.3	18.8	54.6	12.0	2.2	3.3	1.8
Terminal period malignancy patients	11.1	13.7	23.6	33.9	7.3	4.0	1.3	5.1
Malignancy patients	7.1	8.4	21.7	45.1	10.9	3.3	1.3	2.2
Patients who were in the terminal period	18.2	13.7	26.6	28.4	4.4	1.8	1.6	5.3
Freezing and drowning	0.4	0.9	4.2	12.2	71.9	5.5	4.2	0.7

CPR: Cardiopulmonary resuscitation

Table 5. The answers of the questions about skills of CPR and ETI

n=451	Absolutely No (%)	No (%)	Not completely (%)	Yes (%)	Absolutely Yes (%)
Do you think that you apply CPR correctly?	0.9	4.2	19.1	48.3	27.5
Do you think that LMA is as effective as ETI?	2.0	6.7	22.0	46.5	22.8
Do you think that LMA is as effective as ETI?	5.5	16.2	49.2	25.3	3.8

CPR: Cardiopulmonary resuscitation; **ETI:** Endotracheal intubation; **LMA:** Laryngeal mask airway

resuscitation services. Recovery of the patients on whom CPR is performed in the prehospital setting and at the hospital depends on prehospital factors and early intervention. The success of CPR applied in case of cardiopulmonary arrest in the prehospital setting depends on early arrival at the hospital, early defibrillatrion applied by experienced personnel, and early advanced life support. Mortality and morbidity decrease in early and appropriate CPR cases (Marco and Schears, 2003; Hallstrom et al., 2004; Field et al., 2010). The vast majority of the participants were EMTs in our study. This results from the high number of EMTs working in the 112 ambulance services. Beside the young mean age, most of the participants were female. The criteria for patient selection by GPs, EMTs, paramedics or other personnel in 112 ambulances could not be pointed out according to the results of the questionnaire in our study. A sufficient comparison could not be made due to the rarity of the data from emergency services in the Konya province. A scoring was not applied to the participants and their medical knowledge was not evaluated. A self assessment was asked from the participants about their attitudes toward CPR. Identity data were not included in the questionnaire.

Most of the participants stated that CPR educations should be carried out periodically and that educations should be mandatory. The goals cannot be achieved if the ambulance personnel do not have sufficient medical knowledge and skill. Providing information to the health personnel about the scientific and technological developments in health sciences enables improvement in their knowledge and skills and thereby, improvement in the quality of services and occupational satisfaction (Aksoy and Ergun, 2002; Ulger et al., 2013). Approximately 80% of the participants stated that patient age could affect the duration of CPR application; 86% of them stated that the current disease of the patient could affect the duration of CPR application. Of the participants, 92% stated that they received a course about CPR, 97% stated that CPR courses should be mandatory and 95% stated that CPR courses should be periodical.

CPR is a procedure which requires continuous practical education beside theoretical education. The vast majority of patients on whom CPR is performed due to cardiopulmonary arrest in the prehospital setting are transferred to a hospital after CPR. The prehospital healthcare workers may be subject to many ethical dilemmas such as non-standard directives,

conflicting family opinions, and unreasonable demands of the eyewitnesses. Many factors were found to influence the decisions of the prehospital workers regarding reaching the hospital (Hick et al., 1998; Iserson, 1998; Ulger et al., 2013).

There is a significant association between basic and advanced life support and shortening of the intervention time. The most significant association is between advanced cardiac care including defibrillation, ETI, vascular access and cardiac drug application. The time elapsed to commencing of CPR is the most important parameter affecting the outcome of the prehospital cardiac arrest. In a meta-analysis including 143.000 patients, the survival rate upon presentation to the hospital was determined as 23.8% and upon discharge from the hospital, this rate was determined as 7.6% in cardiac arrests out of the hospital. In this study, witnessed cardiac arrest, CPR at the scene, return of VF/VT and spontaneous circulation were found to be good prognostic factors. CPR was applied at the scene in only 32% of the cases, although 53% of the cases were witnessed (Sasson et al., 2010). Survival seems difficult when advanced life support starts after 30 minutes or resuscitation together with transport exceeds 90 minutes (Vukmir, 2006; Behcet et al., 2013). Recent studies have reported that survival rates highly vary depending on many factors in cardiac arrest victims. These factors include the time elapsed from the time of arrest, the inital rhythm, the underlying medical condition, the response to prehospital advanced life support protocols, age and long term care (Cummins and Eisenberg, 1985; Schultz et al., 1996).

There is no legal regulation in our country about DNR defined as 'not applying CPR'. Eighty-three point four percent of the participants reported that they perceived DNR as 'not applying cardiac massage'. However, the participants were perceived as not having sufficient knowledge about DNR.

Different healthcare workers work in prehospital services in our country. While paramedics take part in prehospital health services in many developed countries, such as the USA, paramedics are planned to work in ambulances also in our country. However, while paramedics comprise only 14.6% of the workers in the ambulances in Konya province, GPs, EMTs and health officers constitute the remaining health personnel. When the results of the questionnaires were evaluated with regard to success rates, paramedics were found to be more successful, due to their development with educations and thereby, their increasing self confidence.

Paramedics working in prehospital emergency health services are more willing to undertake ETI and CPR compared to physicians. CPR is a very important intervention; however, its success rate increases with prompt applications. Update of the knowledge may be provided with education programs. Simulation studies, real time feedback and practical updates at short intervals should be implemented widely instead of certification based on theroretical education.

Table 6. The answers of the prehospital providers to questions about definition of DNR

DNR	n	%
Not applying cardiac massage	376	83.4
Not applying simple airway applications	282	62.5
Not applying advanced airway applications	304	67.4
Not applying medical treatment	265	58.8
Not applying fluid replacement	252	55.9

DNR: Do not resuscitate

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