Relationship between knowledge and skill for basic life support in emergency medical services, Islamic Republic of Iran

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Abstract

Background: Considering the importance of pre-hospital resuscitation, it is necessary to update staff on the relevant knowledge and skills through education, sufficient practice, good supervision and recruitment of appropriately qualified cadres.

Aims: This study aimed to determine the association between knowledge and skills for emergency medical services (EMS) of basic life support in northwest Khuzestan province, Islamic Republic of Iran, in 2016.

Methods: This cross-sectional study was conducted on all EMS (75 participants) in two emergency centers in the southwest of the Islamic Republic of Iran. The sampling was done via the available census. Three questionnaires were used: 1) demographic information (age, time of participation in retraining classes, academic degree, and employment); 2) knowledge of basic life support (BLS); and 3) checklist of BLS and automated external defibrillator (AED) skills. Data analysis was done using descriptive statistics, chi-square, ANOVA and Kruskal -Wallis test.

Results: 30.7% of the emergency medical services had poor knowledge (mean score was 19.35 ± 3.9; range: 0–34) and 42.7% of subjects had poor skills (mean score was 5.40 ± 2.39; range: 0–9). Both results are higher than the national average. The findings also indicated that 70.7% of staff did not use AED devices correctly, and there was a significant relationship between staff knowledge and skills with AED device use (P < 0.05). Among the 41 participants that had taken part in training classes 12 months previously, more than 50% had poor skills (n=21) and only 7 participants had good skills. Also, among the 11 participants who had taken part in training classes 3 months ago, 7 participants had good skills. In general, there was no relationship between staff knowledge and skill (P > 0.05).

Conclusion: The results showed that none of the participants acquired a full knowledge score and only 6 participants gained the total skill score.

Keywords: Knowledge, skill, basic life support, cardiopulmonary resuscitation (CPR), emergency medical services (EMS), Iran
Citation: Relationship between knowledge and skill for basic life support in emergency medical services, Islamic Republic of Iran. East Mediterr Health J. 2019; 25(x): xxx–xxx.
https://doi.org/10.26719/emhj.19.018

Received: 06/05/18; accepted: 09/01/19

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Introduction
Cardiovascular diseases (CVDs) are the leading cause of death globally and is the cause of mortality every 12 minutes (1). In the Islamic Republic of Iran, 50% of all deaths per year and 79% of deaths related to chronic diseases are attributed to CVDs (2). The first line of response to cardiac arrest is basic life support (BLS) (3) and is a key component of the survival chain, reducing the rate of death and increasing the hospital discharge rate. Basic life support includes steps taken by skilled personnel during a cardiac or respiratory arrest, and in general is a combination of artificial respiration, chest massage to restore cardiac function, blood circulation and respiration (4).

In-hospital survival is relatively higher (22.3–25.5%) than the out-of-hospital setting (10.8%). One of the main reasons for the disparity in survival rate is that rescuers are often performing cardiopulmonary resuscitation (CPR) at sub-optimal standards (5). Therefore, the skill of emergency medical personnel in resuscitation as the first line of assistance is an essential factor in the outcome of cardiac arrest (6). However, there is compelling evidence that personnel lack the necessary skills in resuscitation (3). Moreover, recent studies show that some emergency medical personnel fail to perform accurate and rapid resuscitation operations; therefore, it is essential that they acquire the required skills and knowledge to be effective (7).

Research by Rotenberg suggests that with regard to resuscitation outside the hospital, lack of adequate knowledge by emergency medical personnel has led to delayed medication medicines and is one of the reasons for the failure of cardiopulmonary resuscitation (8). Research by Jamshidi et al. indicated that 96.54% of subjects had good knowledge, but their skills level was very poor (9). To date, few studies have examined the relationship between knowledge and resuscitation skills in different groups (medical and nonmedical). Research by Cheah (2016) indicated a positive correlation between knowledge and resuscitation skills (10). However, there was no relationship between the two variables in research by Roh (2014) (11). Given that most studies in the field of resuscitation are done in the hospital environment, this study aimed to determine the relationship between the knowledge of BLS and emergency medical services (EMS) skills in pre-hospital resuscitation scenarios.

Methods
This is a cross-sectional study, in which the relationship between the knowledge and skills of EMS and basic life support is examined. This study was conducted in two emergency centers in the northwest of Khuzestan province in 2016. Permission was obtained from the head of the city’s health network and coordinating with the emergency medical authorities. This study was conducted on all
emergency medical personnel; therefore, sampling was done through census data and sample size was 75 participants. Inclusion criteria were EMS personnel that had at least 6 months’ experience; exclusion criteria were failure to fill out the questionnaire. Questionnaires were distributed among participants who remained anonymous.

This study included three questionnaires: 1) demographic information (age, time of participation in retraining classes, academic degree, and employment); 2) knowledge of basic life support (BLS); and 3) checklist of BLS and automated external defibrillator (AED) skills. After completing the questionnaires, the skills of the participants were assessed. For this purpose, a mannequin was placed in the room and each participant was asked to perform CPR with the assumption that it is a suspected cardiac arrest.

Measurements
The questionnaire measuring knowledge of resuscitation contained 34 questions on CPR, airway control, blood circulation control, the number of massages and breathing. A correct answer was scored as 1, an incorrect answer was scored as 0. A score of less than 17 indicated poor knowledge; between 17 and 25.5 indicated average knowledge; and scores higher than 25.5 indicated good knowledge.

To determine the validity of the knowledge questionnaire and checklist, the questions were prepared and then reviewed by 10 members of the faculty and EMS personnel. For CPR and AED skills testing, the checklist of America Heart Association (AHA) was used; AHA practices are taught by all major universities and colleges involved with training all skills related to emergency care and especially all forms of CPR (child and adult). All BLS and ACLS (Advanced cardiac life support) training centers are also based on the AHA guidelines and were therefore used to measure skills in this study. The steps included checking vigilance and response, emergency contact, checking carotid pulse, the correct placement of hands for cardiac massage, the first cycle of massage, giving two breaths, and AED and continuing CPR (second cycle of massage), respectively. The reliability of the checklist for 40 members of the staff was 0.86 using Cronbach’s alpha.

Statistical analysis
Data were analyzed using descriptive tests (mean, standard deviation, and frequency) and analytical statistics (Chi-square, Kruskal–Wallis and ANOVA). Data were analyzed using SPSS Version 22. P < 0.05 was considered significant.

Results
The results indicated that the majority of participants were in the age group of 20–30 years (50.7%). The lowest number of participants were in the age group of 41–51 years. The average age of participants was 31.50 ± 6.39 years and all were males. Among the participants, 17 (22.7%) were nurses, 35 (46.7%) were EMS personnel, and the remainder had academic qualifications not related to medicine (n=23, 30.6%). 88% of participants had 1–10 years of experience and the remainder between 11 and 21 years. 54.7% had participated in BLS classes 12 months ago, 30.7% 6 months ago,
and only 14.7% three months ago. Among the 11 participants who had participated in CPR classes 3 months ago, only one participant scored poor knowledge, while nearly half of the participants who had participated in CPR classes 12 months ago scored poor knowledge.

The results showed that the average score of knowledge for basic resuscitation was 19.35 ± 3.9 (range: 0–34) and the average score for skills was 5.40 ± 2.39 (range: 0–9), both of which are in the medium range. The knowledge level was poor in 30.7% of participants, average in 68%, and good in only 1.3%. In addition, 42.7% of the participants (n=32) had poor skills, average in 28% (n=21), and good in only 29.3% (n=22). It should be noted that none of the participants obtained a full score for knowledge and only 8% (n=6) obtained a full score for skills. Table 1 indicates that there was only a significant relationship between the time after participating in resuscitation class \( (P = 0.006) \), the field of study \( (P = 0.046) \) and the BLS knowledge mean.

Considering the relationship between demographic variables and mean of skill, only the time after participating in BLS classes was significant \( (P = 0.004) \). Among the 41 participants who had taken part in training classes 12 months ago, 21 participants had poor skills and only seven had good skills. Among the 11 participants who had participated in training classes 3 months ago, seven had excellent skills. The findings in Table 2 shows that 70.7% of the staff did not use the AED properly and only 29.3% could use it correctly. On the other hand, there was a significant relationship between staff knowledge and skills and the use of the AED device \( (P = 0.039) \). In general, the findings in Table 3 indicate that there was no significant relationship between staff knowledge and skills according to the chi-square test \( (P = 0.298) \).

**Discussion**

Knowledge of basic CPR techniques and steps can increase the chance of survival of patients. Therefore, this study was conducted in 2016 to determine the association between knowledge and skill of emergency medical services in CPR. Research by Roshana (2012) showed that the average score of knowledge of resuscitation by medical/paramedical professionals is lower than the average (12), while the current study indicates that the knowledge and skill scores of basic resuscitation are higher than the average. Furthermore, the participants who had the high knowledge score of BLS (score: 26) had the lowest frequency (1.3%).

Research by Khoshrang (2007) indicated that only 2.6% of nurses had good CPR knowledge, and none were classified as having a very good knowledge. However, if the number of people trained in CPR is higher in the community, then the survival rate and quality of life will increase (13). In studies conducted by Mustafa (2014) and Nagashima (2003), the majority of nurses had poor knowledge of CPR (14,15), but in research by Kalhori the knowledge of the majority of participants (85.6%) was good and/or excellent, and only 3% was weak. This could be because nurses with a higher level of knowledge have more experience of CPR period and resuscitation practice (16).

With regard to demographic information, research by Mustafa (2014) indicated there was no difference between the level of knowledge of basic resuscitation and age (14), which is consistent with the present study. In addition, studies by Mohsen (2010) reported that employment experience
has a positive effect on the nurse knowledge level. Considering that most of the participants have a work experience of less than 5 years, the lack of attention by the authorities to younger and less experienced nurses, lack of participation in their resuscitation and lack of motivation to improve their level of knowledge, can be explained by these reasons (17). People with more employment opportunities gain more medical emergencies experience and this factor likely impacts staff knowledge (18).

However, there is no meaningful relationship between the variables of knowledge and employment experience in the study by Mostafa (14), which is consistent with the current study. On the other hand, there is a significant relationship between knowledge and academic qualification of staff in this study; participants who have relevant degrees have a greater knowledge of CPR. An important point in this study is that nearly one-third of the participants, (n=23, 30.6%) had an academic qualification unrelated to the medical profession. This factor can affect the level of knowledge and skill of the participants and consequently affect the quality of resuscitation. Also, the training of resuscitation in those who are related to the medical profession is more effective because they have received such training in their curriculum (19).

In the study by Kalhori, there was no significant correlation between the level of education and the level of CPR awareness (16). In addition, in research conducted by Davari, the field of study did not affect students' knowledge and skill in basic CPR. This lack of difference may be due to the fact that cardiopulmonary guidelines are designed for the public and that anyone can learn it if they have enough motivation (20). Furthermore, the relationship between the knowledge and skill with the time after participating in resuscitation classes was significant, which is consistent with the findings of Kalhori (P < 0.001) (16), but it is not consistent with the findings of Borimnejad (21).

Many studies have focused on the impact of participation in the resuscitation class on increasing knowledge among individuals. CPR training should be provided every 3 to 6 months to avoid reducing the knowledge and skill of the treating staff (6). Thus, the results indicate that the smaller the interval between repeating training classes, the greater the resuscitation skills of participants. Moreover, In the study by Adlib-Haj Baghery (2014), more than two-thirds of nursing students had a good skill level in use of an AED (22), while Saghizadeh (2006) indicated only 16.1% of participants were efficient in the use of AED for resuscitation (4). In the current study, only 29.3% had a good skill in use of an AED.

Low skills can endanger the patient's life. In research by Brown et al., the knowledge of 60 emergency technicians was moderate. Although accurate knowledge of CPR is associated with increased odds of correct performance of some aspects of CPR (compression rate, compression depth, compression to ventilation ratio), overall performance remains poor, which is not consistent with this study (23). This could be due to the quality of re-training classes and educational workshops and the interval between classes as well as heavy work schedules, lack of motivation, lack of interest in the work, few encounters with medical emergencies, and feeling no need to update knowledge of CPR and not understanding its importance (9). Also, in many cases CPR is taught but feedback is not
considered, yet to improve the knowledge and skill of cardiopulmonary resuscitation, both should be developed together.

In summary, the findings indicate that there is no significant relationship between EMS personnel knowledge of CPR and their skills in doing it. These results are similar to those obtained by Roh (2014) where there was no association between CPR skills and knowledge (11). By contrast, a positive correlation between knowledge and resuscitation skills was found in research by Cheah (2016) who compared the knowledge and skill of resuscitation between the two groups. People who had a good knowledge of resuscitation had a high level of skill. There was no significant difference between the two groups ($P > 0.05$) (10). This may be due to the fact that some employees with low work experience still improve by observing the actions of skilled staff.

However, acquired skills may not be in accordance with appropriate levels of professionalism due to sub-standard training classes. Also, in some cases, new personnel have the necessary knowledge but will not be allowed to participate in the resuscitation operation by older more experiences staff. As a result, they do not acquire the necessary skill.

**Limitations**
The sample size was small and covered only two emergency medical centres. It is suggested that similar studies be done with a larger number of samples.

**Conclusions**
The findings of the research indicate that the knowledge and skill of EMS personnel are in the medium range. However, none of the participants obtained a full score of knowledge and only 8% ($n = 6$) obtained a full score of skills. Considering the importance of basic resuscitation in the pre-hospital environment, updating the knowledge and skills about resuscitation is an essential point in the medical field and should be mandatory for all medical staff. Therefore, more attention to education by authorities through high quality training classes, annual revalidation of resuscitation skills, enhancing motivation, recruitment of personnel with relevant academic qualifications, appear necessary.

**Acknowledgments**
We express our thanks and appreciation to the emergency nursing staff who generously assisted in the implementation of this research.

**Funding:** None.

**Competing interests:** None declared.
References

Table 1: Frequency of distribution and percentage of demographic variables and their relationship with the BLS knowledge and skills of emergency medical services

<table>
<thead>
<tr>
<th>Demographic variable</th>
<th>BLS Skill Mean ± SD</th>
<th>P-value</th>
<th>BLS Knowledge Mean± SD</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-30</td>
<td>5.57±1.95</td>
<td></td>
<td>19.32±4.44</td>
<td>P*=0.838</td>
</tr>
<tr>
<td>31-40</td>
<td>4.78±2.91</td>
<td>P*=0.444</td>
<td>19.47±4.52</td>
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</tr>
<tr>
<td>41-51</td>
<td>4.60±1.91</td>
<td></td>
<td>18.80±4.86</td>
<td></td>
</tr>
<tr>
<td>Job experience</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-5 years</td>
<td>5.10±1.98</td>
<td></td>
<td>18.37±4.65</td>
<td></td>
</tr>
<tr>
<td>6-10 years</td>
<td>5.33±2.96</td>
<td></td>
<td>20.25±5.75</td>
<td>P*=0.230</td>
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<tr>
<td>11-15 years</td>
<td>6.25±5.40</td>
<td></td>
<td>19.25±6.39</td>
<td></td>
</tr>
<tr>
<td>16-21 years</td>
<td>3.60±2.50</td>
<td>P*=0.411</td>
<td>18.80±4.86</td>
<td></td>
</tr>
<tr>
<td>Time of participating in retraining classes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 year ago</td>
<td>4.46±2.39</td>
<td>P*=0.004</td>
<td>18.49±4.05</td>
<td>P*=0.006</td>
</tr>
<tr>
<td>6 months ago</td>
<td>5.56±1.70</td>
<td></td>
<td>19.39±5.75</td>
<td></td>
</tr>
<tr>
<td>3 months ago</td>
<td>7.00±2.68</td>
<td></td>
<td>22.45±2.73</td>
<td></td>
</tr>
<tr>
<td>Academic degree</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>nurse</td>
<td>5.17 ± 2.03</td>
<td></td>
<td>20.75 ± 2.99</td>
<td></td>
</tr>
<tr>
<td>Emergency medical services</td>
<td>5.71 ± 5.40</td>
<td>P*=0.056</td>
<td>20.43 ± 5.12</td>
<td>P**=0.046</td>
</tr>
<tr>
<td>Bachelor degree</td>
<td>5.40 ± 5.09</td>
<td></td>
<td>19.00 ± 4.95</td>
<td></td>
</tr>
<tr>
<td>Associate degree</td>
<td>5.16 ± 1.60</td>
<td></td>
<td>22.17 ± 2.32</td>
<td></td>
</tr>
<tr>
<td>diploma</td>
<td>5.97 ± 1.90</td>
<td></td>
<td>18.06 ± 3.76</td>
<td></td>
</tr>
</tbody>
</table>

*Kruskal-Wallis
**ANOVA
Table 2: Frequency of distribution and percentage of skills to use AED and its relationship with BLS knowledge and skills of emergency medical services

<table>
<thead>
<tr>
<th>BLS skill</th>
<th>Skills to use AED</th>
<th>P-value (chi-square)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Wrong Frequency(percent)</td>
<td>Correct Frequency(percent)</td>
</tr>
<tr>
<td>poor</td>
<td>25(78.1%)</td>
<td>7(21.9 %)</td>
</tr>
<tr>
<td>fair</td>
<td>17(81%)</td>
<td>4(19 %)</td>
</tr>
<tr>
<td>good</td>
<td>11(50%)</td>
<td>11(50%)</td>
</tr>
<tr>
<td>Total</td>
<td>53(70.7%)</td>
<td>22(29.3%)</td>
</tr>
</tbody>
</table>

Table 3: Frequency of distribution and level of BLS knowledge and skills of emergency medical services and their relationship with each other

<table>
<thead>
<tr>
<th>BLS knowledge</th>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
<th>P-value (chi-square)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
<td>9(39.1%)</td>
<td>4(17.4%)</td>
<td>10(43.5%)</td>
<td>0.298</td>
</tr>
<tr>
<td>Good</td>
<td>13(25%)</td>
<td>17(32.7%)</td>
<td>22(42.3%)</td>
<td></td>
</tr>
</tbody>
</table>