Original Article

Bull Emerg Trauma 2023;11(3):154-161.

Bulletin of Emergency And Trauma

The General Public Awareness of Emergency Conditions and the Services Provided by Emergency Medical Services

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Received: April 12, 2023
Revised: May 23, 2023
Accepted: June 7, 2023

ABSTRACT

Objective: Considering the growing use of emergency medical services (EMS), we evaluated the level of public awareness of emergency situations in Iran.
Methods: This cross-sectional study was conducted from August 2021 to January 2023 on Iranian residents in Tehran, who were older than 18 years old. The participants were directed to a URL for an online survey link and asked to select their preferred options for the predetermined scenarios. We divided the participants into three groups: abuse, misuse, and non-use. At least 12 correct answers were required to qualify as acceptable knowledge and practice responses (KP score). Then, the relationship between participants' baseline characteristics and their level of awareness was investigated.
Results: Totally, 3864 people participated in the study, of whom 50.5% were men. The participants' ages ranged from 18 to 90 years old, with a mean age of 40.01±11.30 years. In general, the rate of abuse, misuse, and not-use in at least one scenario was 74.5%, 64%, and 70.4%, respectively. The results of the multivariable regression analysis indicated that female sex (OR=1.29), a higher education level (OR=3.36), a higher income level (OR=1.64), and Turkish ethnicity (OR=1.20) were significantly associated with the correct KP score.
Conclusion: The degree of inappropriate utilization of EMS services in Iran was significant. We found that the proper knowledge regarding the appropriate use of EMS was significantly associated with the participant's level of education, academic field, job, and income.

Keywords: Awareness; Emergency medical services; Health services Misuse; Knowledge.

Please cite this paper as:
Saberian P, Shafiee A, Hasani-Sharamin P, Rafiemanesh H, Baratloo A. The General Public Awareness of Emergency Conditions and the Services Provided by Emergency Medical Services. *Bull Emerg Trauma*. 2023;11(3):154-161. doi: 10.30476/BEAT.2023.98541.1436.

Introduction

Emergency medical services (EMS) is an organized system, which plays a key role in providing pre-hospital treatment and transferring sick or injured patients to medical centers [1]. While EMS's resources are constrained, there are numerous and growing demands for its services worldwide [2-4]. Furthermore, excessive use of EMS would lead to overcrowding in emergency departments which is a serious issue by itself [5]. Therefore, improper utilization of EMS may endanger the lives of some patients [6, 7].

It is likely that, inappropriate use of EMS is a major global issue. Several reports of "unnecessary ambulance use" were received from England, Australia, Canada, and South Africa [8]. Reports indicated that between 16-51.7% of calls were found to be improper [8]. Nevertheless, defining the "appropriate" use of EMS is still very challenging [9]. Inappropriate use of EMS usually occurs when non-emergent cases ask for EMS transport, or when such patients have an alternative means of transportation to ED but choose EMS instead [8, 10, 11]. Previous studies revealed that race, age, educational degree, healthcare background, and prior first-aid training are all strongly associated with this misuse [8]. Moreover, the caller's background is important when determining whether a call is inappropriate. Inappropriate calls are caused by a lack of knowledge, as well as the fact that the majority of these callers believe that using an ambulance and EMS is the safest and fastest way to get to the hospital [12]. It was reported that prior training regarding basic first aid procedures may also have a significant impact on reducing the increasing number of inappropriate calls [8].

Iranian researchers conducted several [13, 14] studies on this issue, and they concluded that it is critical to deliver instructional programs regarding EMS duties, particularly for people who lived in lower socioeconomic areas [13]. Furthermore, other researchers found that most people were unaware of emergency medical conditions and the description of EMS duties, which leads to calling the EMS for non-urgent missions [14]. Despite some recent studies, there is still a paucity of information regarding the level of public awareness of emergency situations and reasons for calling the EMS. Meanwhile, in recent years, there has been a significant increase in requests to use EMS [15-17]. Therefore, we aimed to investigate the level of public awareness of emergency situations and possible influencing factors for contacting EMS.

Materials and Methods

This cross-sectional study was conducted from August 2021 to January 2023 in Tehran, Iran. A questionnaire was prepared to assess public awareness about which medical circumstances they think are appropriate to contact EMS. To prepare the questionnaire, Tehran EMS dispatch archive from a year prior to the implementation of the study was evaluated. A technical committee designed 24 scenarios based on the most common frequent cause of contact. The committee consisted of members of the research team, one supervisor from the EMS center, one quality control specialist, a representative from the research section of Tehran EMS center, and an epidemiologist. Some modification was made based on available references as well as the committee members' personal experiences. In the next step, the face validity and content validity of the questionnaire for clarity, relevance, and comprehensiveness, based on the opinions of 10 experts and people with opinions on the subject under study, were examined. Then, the questionnaire was modified based on their comments. The relevance and clarity of the questionnaire were measured by both the item-level (I-CVI) and the scale-level content validity index (S-CVI), while only the S-CVI was used to determine the comprehensiveness of the questionnaire. For the content validity index (CVI), the validity indices higher than 0.80 were considered acceptable. In addition, the content validity ratios (CVR) were calculated and assessed based on Ayre and Scally's revised method [18]. Finally, the reliability of the questionnaire was assessed and confirmed using Cronbach's alpha analysis in a pilot study with 30 persons from the target population. The final questionnaire is presented in Table 1. For each scenario, the questions included four options::

1- It's an emergency, I will call EMS.
2- It's an emergency, but I won't call EMS.
3- It is not an emergency, and I won't call EMS.
4- It is not an emergency, but I will call EMS.

All people over the age of 18, who had called Tehran EMS with a legitimate phone number during a year prior to the implementation of the study, were eligible to participate in the study. No additional restrictions (such as age and sex) were implemented. Participants who did not complete their questionnaires were excluded from the study. Tehran EMS carried out around 350,000 missions during the year preceding the beginning of this study. The minimum required sample size was 10% of the target population, which was equivalent to 3,500 people.

An invitation for completing the questionnaires was sent to the target population via an SMS link, and the participants were directed to an online survey link. Considering the probability of a 5% participation rate, this SMS was sent to 700,000 individuals. All participants were identified using their telecommunication prefix and placed in a random cluster in each region. To obtain information about the characteristics of the participants, several demographic questions before the scenario questions were asked. The participants were asked to indicate their preferred options for the predetermined scenarios.

Table 1. Scenarios that have been included in the questionnaire.

No.	Scenarios
1	A 40-year-old man with a history of colon cancer has severe pain and needs painkillers.
2	A 40-year-old woman with a history of high blood pressure experiences sudden dizziness.
3	A 30-year-old woman has lower abdominal pain with irritation and frequent urination.
4	A 77-year-old person has difficulty speaking and speaks indistinctly (in a drunken state). He has not consumed any alcohol or drugs.
5	A diabetic woman has abdominal pain and loss of appetite. Her blood sugar is 350, and she is a bit lethargic.
6	A 70-year-old man died at home last night with the doctor's approval and needs a death and transfer certificate.
7	The 3-year-old fell off the bench and suffered a bruise the size of a ping pong ball.
8	An 8-month pregnant woman feels that the fetal movements are not normal.
9	Your 2-year-old child has symptoms of a cold and is drooling from the corner of their mouth while crying, his voice is hoarse, and the area around his lips is bruised.
10	An 18-year-old boy with a history of depression is sleepy this morning, and in response to your voice, he only opens his eyes and does not answer.
11	A 6-year-old child with a history of epilepsy had a seizure.
12	A 29-year-old woman experienced stomach ache, vomiting, and diarrhea two hours after eating.
13	A 19-year-old girl with a history of nervous and mental problems neither take her medications nor eat.
14	A 4-year-old boy has taken 10 acetaminophen(500 mg) tablets.
15	An 87-year-old woman with a history of arthritis has swelling and knee pain.
16	A 35-year-old woman has a feeling of heaviness in her chest and has no history of heart problems.
17	The 4-year-old child inserted a small toy in his ear.
18	Boiled water was spilled on the hand of a 40-year-old woman, and the skin of her hand became red and burned severely.
19	Your 10-year-old son develops hives while playing at a family picnic.
20	A 25-year-old man has drunk alcohol, is sober, and is vomiting.
21	A 40-year-old man with a 6-month history of back pain experiences normal back pain. He wakes up at night because of this pain, and he has run out of painkillers.
22	A 45-year-old woman has a history of high blood pressure, and her blood pressure is 90/160 during daily check-ups, and she has no symptoms.
23	A person with a history of movement problems (disability) needs help to move.
24	A 2-year-old child has taken an unknown pill.

We divided the participants into three groups, including those who continued to call EMS despite being aware of non-emergency conditions (abuse), those who called EMS in non-emergency conditions due to lack of knowledge (misuse), and those who did not call EMS despite being aware of emergency conditions (not-use). At least 12 correct answers were required to qualify as acceptable knowledge and practice (KP) responses. This cut-off point was determined based on the consensus of the experts, which was equal to the minimum correct response to half of the questions. The level of awareness was investigated based on the participant's location, sex, ethnicity, age, level of education, average income, occupation, marital status, and history of previous use of emergency services. Then, the relationship between these variables and the level of public awareness was investigated.

Statistical Analysis

Data were analyzed using IBM SPSS Statistics software version 25.0 (IBM SPSS Inc., Chicago, IL, USA). Numerical variables were expressed as mean±SD (standard deviation) and categorical variables as numbers and percentages. The independent sample T-test was used to assess mean differences in numerical variables. A p-value ≤0.05 was considered statistically significant. Additionally, univariate and multivariate logistic regression were used to identify potential factors associated with correct knowledge regarding the scenarios.

Results

The data of 3864 people were analyzed. 49.5% of the participants were female (49.5%). The mean age of the patients was 40.01±11.30 years, ranging from 18 to 90 years. Furthermore, 29.7% of the participants had a master's degree or higher, 64.6% were employed, 63.0% were Fars, and the rest were from other ethnic groups. Females had significantly higher mean correct KP scores than males (12.5 vs. 12.1; p<0.001). Additionally, there was a significant correlation between the right KP score and education, academic background, employment, and income (Table 2).

In general, despite being aware of non-emergency conditions (abuse), 74.5% of people still called EMS for at least one of the 24 designed scenarios, which ranged from 5.5% to 28.5% for different scenarios. On the other hand, 70.4% of the participants did not call EMS for at least one scenario despite being aware of emergency conditions, which ranged from 4.1% to 26.7% for different scenarios. In general, 64% of people called EMS for at least one of the 13 non-emergency scenarios, due to lack of knowledge of emergency conditions (misuse), which varied between 6.7 and 9. 48% for each scenario (Table 3).

Table 2. The distribution of demographic variables, and association of correct (knowledge and practice) KP scores for emergency scenarios in the Iranian population

Variable	Number (%)	Correct KP score[a]		Number of correct KP answers			
		Mean±SD[b]	*P* value	<8	8-15	>15	*P* value
Age category, year			<0.001				0.004
<26	330 (8.6)	11.7±2.9		20 (6.1)	280 (84.8)	30 (9.1)	
26 to 45	2509 (65.4)	12.5±3.0		117 (4.7)	2019 (80.5)	373 (14.9)	
46 to 65	899 (23.4)	12.2±3.0		55 (6.1)	723 (80.4)	121 (13.5)	
>65	101 (2.6)	12.3±3.4		10 (9.9)	84 (83.2)	7 (6.9)	
Sex			<0.001				0.031
Male	1953 (50.5)	12.1±3.1		120 (6.1)	1577 (80.7)	256 (13.1)	
Female	1911 (49.5)	12.5±3.0		84 (4.4)	1550 (81.1)	277 (14.5)	
Marriage status			0.205				0.768
Single	1177 (30.5)	12.2±3.0		60 (5.1)	963 (81.8)	154 (13.1)	
Marriage	2499 (64.7)	12.4±3.0		132 (5.3)	2011 (80.5)	356 (14.2)	
Other[c]	188 (4.9)	12.1±3.0		12 (6.4)	153 (81.4)	23 (12.2)	
Household members[d]			0.043				0.138
1 to 2	1209 (31.3)	12.4±3.0		70 (5.8)	974 (80.6)	165 (13.6)	
3 to 4	2296 (59.4)	12.3±3.0		108 (4.7)	1860 (81.0)	328 (14.3)	
5 and higher	359 (9.3)	11.9±3.2		26 (7.2)	293 (81.6)	40 (11.1)	
Education			<0.001				<0.001
Illiterate or elementary	62 (1.6)	9.7±4.6		12 (19.4)	47 (75.8)	3 (4.8)	
Under diploma	136 (3.5)	9.9±3.4		14 (10.3)	114 (83.8)	8 (5.9)	
Diploma	750 (19.4)	10.9±3.3		51 (6.8)	629 (83.9)	70 (9.3)	
Associate degree	313 (8.1)	11.8±3.0		19 (6.1)	243 (77.6)	51 (16.3)	
Bachelor	1446 (37.4)	12.2±3.1		58 (4.0)	1179 (81.5)	209 (14.5)	
Master	866 (22.4)	12.5±2.9		41 (4.7)	707 (81.6)	118 (13.6)	
M.D/Ph.D. /or higher	291 (7.5)	13.2±3.2		9 (3.1)	208 (71.5)	74 (25.4)	
Academic field of medical sciences			<0.001				<0.001
No	2525 (86.6)	12.3±2.9		118 (4.7)	2079 (82.3)	328 (13.0)	
Yes	391 (13.4)	13.9±3.2		9 (2.3)	258 (66.0)	124 (31.7)	
Occupation			<0.001				0.001
Unemployed	260 (6.7)	11.8±3.3		14 (8.6)	126 (77.3)	23 (14.1)	
Housewife	561 (14.5)	12.0±3.1		19 (6.0)	264 (83.0)	35 (11.0)	
Employed	2498 (64.6)	12.5±3.0		79 (3.9)	1616 (79.3)	344 (16.9)	
Retired	309 (8.0)	12.1±3.2		10 (4.4)	182 (79.5)	37 (16.2)	
Student	236 (6.1)	11.8±2.9		5 (3.0)	149 (89.2)	13 (7.8)	
Income[e]			<0.001				<0.001
<30	646 (16.7)	11.8±3.0		20 (5.0)	339 (84.1)	44 (10.9)	
30 to 60	1251 (32.4)	12.1±2.8		34 (4.1)	684 (83.1)	105 (12.8)	
60 to 90	869 (22.5)	12.3±3.2		36 (4.9)	573 (78.6)	120 (16.5)	
90 to 120	418 (10.8)	12.8±3.0		13 (3.5)	291 (77.8)	70 (18.7)	
>120	448 (11.6)	12.9±3.2		17 (4.1)	308 (73.9)	92 (22.1)	
Ethnicity			0.393				0.942
Fars	2435 (63.0)	12.3±3.0		83 (4.4)	1516 (80.0)	295 (15.6)	
Turkish	760 (19.7)	12.3±3.0		19 (3.6)	418 (79.9)	86 (16.4)	
Kurdish	188 (4.9)	11.9±3.1		8 (5.8)	111 (81.0)	18 (13.1)	
Lor	196 (5.1)	12.4±3.0		6 (3.9)	126 (81.3)	23 (14.8)	
Other	285 (7.4)	12.2±3.0		11 (5.3)	166 (80.2)	30 (14.5)	

[a]The number of correct answers; [b]SD: Standard Deviation; [c]widow or divorced; [d]The number of people living under the same roof; [e]Million rials (monthly)

The scenarios "A 4-year-old boy has taken ten acetaminophens (500 mg) tablets" and "Your 10-year-old son develops hives while playing at a family picnic" had the highest and lowest correct knowledge and practice scores of 86.1% and 11.1%, respectively. Moreover, the scenarios "A 77-year-old person has difficulty speaking and speaks indistinctly (like a drunk). He or she has not consumed any alcohol or drugs" and "A 40-year-old man with a history of colon cancer has severe pain and needs painkillers" had the highest and lowest correct knowledge and practice scores of 95.3% and 37.0%, respectively (Table 3).

Univariable logistic regression analysis showed that lower ages, female sex, higher education, the academic field of medical sciences, employed job status, and high income were associated with acceptable correct knowledge and practice answers (KP score>12).

Table 3. The distribution of correct knowledge and/or practice for different emergency scenarios in the Iranian population

Scenario No.	Knowledge and practice				Correct knowledge	Correct practice in correct knowledge, %
	Emergency		Non-emergency			
	Call EMS	Not call EMS	Not call EMS	May call EMS		
	Number (%)					
1	1382 (35.8)	733 (19.0)	647 (16.7)[a]	1102 (28.5)	1749 (45.3)	37.0
2	2813 (72.8)[a]	341 (8.8)	267 (6.9)	443 (11.5)	3154 (81.6)	89.2
3	1012 (26.2)	622 (16.1)	1535 (39.7)[a]	695 (18.0)	2230 (57.7)	68.8
4	3247 (84.0)[a]	159 (4.1)	247 (6.4)	211 (5.5)	3406 (88.1)	95.3
5	2187 (56.6)[a]	590 (15.3)	527 (13.6)	560 (14.5)	2777 (71.9)	78.8
6	1360 (35.2)	207 (5.4)	1590 (41.1)[a]	707 (18.3)	2297 (59.4)	69.2
7	2242 (58.0)[a]	642 (16.6)	573 (14.8)	407 (10.5)	2884 (74.6)	77.7
8	1575 (40.8)	1031 (26.7)	750 (19.4)[a]	508 (13.1)	1258 (32.6)	59.6
9	1334 (34.5)[a]	808 (20.9)	1221 (31.6)	501 (13.0)	2142 (55.4)	62.3
10	2475 (64.1)[a]	306 (7.9)	664 (17.2)	419 (10.8)	2781 (72.0)	89.0
11	2877 (74.5)[a]	412 (10.7)	263 (6.8)	312 (8.1)	3289 (85.1)	87.5
12	885 (22.9)	867 (22.4)	1516 (39.2)[a]	596 (15.4)	2112 (54.7)	71.8
13	477 (12.3)	582 (15.1)	2196 (56.8)[a]	609 (15.8)	2805 (72.6)	78.3
14	3327 (86.1)[a]	323 (8.4)	85 (2.2)	129 (3.3)	3650 (94.5)	91.2
15	325 (8.4)	418 (10.8)	2627 (68.0)[a]	494 (12.8)	3121 (80.8)	84.2
16	2405 (62.2)[a]	462 (12.0)	450 (11.6)	547 (14.2)	2867 (74.2)	83.9
17	1889 (48.9)	973 (25.2)	623 (16.1)[a]	379 (9.8)	1002 (25.9)	62.2
18	579 (15.0)	971 (25.1)	1875 (48.5)[a]	439 (11.4)	2314 (59.9)	81.0
19	430 (11.1)[a]	544 (14.1)	2375 (61.5)	515 (13.3)	974 (25.2)	44.1
20	504 (13.0)	412 (10.7)	2491 (64.5)[a]	457 (11.8)	2948 (76.3)	84.5
21	259 (6.7)	296 (7.7)	2942 (76.1)[a]	367 (9.5)	3309 (85.6)	88.9
22	810 (21.0)	696 (18.0	1711 (44.3)[a]	647 (16.7)	2358 (61.0)	72.6
23	299 (7.7)	247 (6.4)	2860 (74.0)[a]	458 (11.9)	3318 (85.9)	86.2
24	2505 (64.8)[a]	625 (16.2)	297 (7.7)	436 (11.3)	3130 (81.0)	80.0

[a]Correct answer

According to the multivariable regression analysis, female sex (OR=1.29), M.D/Ph.D and higher education (OR=3.36), higher income level (OR=1.64), and Turkish ethnicity (OR=1.20) were all significantly associated with an acceptable KP score (Table 4).

Discussion

In this study, the data from 3864 participants reflects their awareness regarding emergent situations and whether or not they call an ambulance for transporting their patients to the hospital. To the best of our knowledge, this was the largest study to date in terms of the number of survey respondents. Furthermore, we assessed each participant's knowledge using a comprehensive set of medical scenarios to address all probable circumstances that one could confront throughout their life. We evaluated several factors that could affect one's knowledge including, age, sex, marital status, household member, educational degree, previous academic education in the field of medicine, employment status, income, and ethnicity. The univariable analyses showed that the age of 26-45 years old, female sex, having a diploma or higher level of education, studying in the field of medicine, being employed, and having higher income were all significantly associated with correct KP scores. This association was still significant after performing a multivariable analysis for sex, education, income, and ethnicity. The scenarios "A 4-year-old boy has taken ten acetaminophens (500mg) tablets" and "Your 10-year-old son develops hives while playing at a family picnic' had the most and least correct KP answers, respectively.

Few studies were conducted to assess public awareness regarding the correct use of EMS in emergency situations that required ambulance presence. Mills *et al.,* contacted 544 Australian individuals to complete a 17-scenario questionnaire and found that there was a lack of knowledge among Australian participants particularly among those without first-aid training [11]. They showed education, previous healthcare experience, and age were significantly associated with accurately answering the scenarios, which was consistent with our findings. In contrast to our findings, there was no association between sex and the correct answer to the scenarios. Moreover, Kirkby *et al.,* found that female participants made more inappropriate calls with an odd of 5.96 [8].

Previous first-aid training was shown to be positively correlated with public awareness regarding appropriate EMS calls [11]. Unfortunately, we did not exactly assess this factor in our study; however, we found a significant association between prior academic education in the field of medicine and higher KP scores.

In our study, among scenarios that required an

Table 4. The logistic regression model of related factors of acceptable correct knowledge and practice answers (KP score>12) for emergency scenarios in the Iranian population

Variable	Univariable model			Multivariable model		
	Wald value	OR[a] (95% CI[b])	*P* value	Wald value	OR (95% CI)	*P* value
Age category, year						
<26	1.81	1.38 (0.86 to 2.2)	0.179	0.29	1.17 (0.67 to 2.04)	0.592
26 to 45	1.88	2.12 (1.38 to 3.24)	0.001	2.43	1.48 (0.90 to 2.43)	0.119
46 to 65	6.56	1.78 (1.14 to 2.76)	0.10	1.51	1.35 (0.84 to 2.19)	0.219
>65[c]		1.0			1.0	
Sex						
Male[c]		1.0			1.0	
Female	13.20	1.26 (1.11 to 1.44)	<0.001	10.68	1.29 (1.11 to 1.50)	0.001
Marriage status						
Single[c]		1.0				
Marriage	1.36	1.09 (0.95 to 1.25)	0.244			
Other[d]	0.76	0.87 (0.64 to 1.19)	0.383			
Household members[e]						
1 to 2		1.21 (.96 to 1.53)	0.115	1.25	1.16 (0.90 to 1.49)	0.264
3 to 4		1.40 (0.91 to 1.43)	0.256	1.10	1.14 (0.89 to 1.45)	0.294
5 and higher[c]		1.0			1.0	
Education						
Illiterate or elementary		1.0			1.0	
Under diploma	1.08	1.46 (0.71 to 2.99)	0.300	0.19	1.18 (.56 to 2.51)	0.664
Diploma	7.56	2.42 (1.29 to 4.53)	0.006	2.87	1.77 (0.91 to 3.43)	0.090
Associate degree	11.02	3.01 (1.57 to 5.77)	0.001	4.73	2.14 (1.08 to 4.27)	0.030
Bachelor	18.71	3.93 (2.11 to 7.30)	<0.001	9.07	2.75 (1.42 to 5.31)	0.003
Master	17.03	3.74 (2.0 to 6.98)	<0.001	6.29	2.35 (1.21 to 4.58)	0.012
M.D./Ph.D./ or higher	24.51	5.22 (2.71 to 10.05)	<0.001	11.49	3.36 (1.67 to 6.78)	0.001
Academic field of medical sciences[f]						
Yes	45.31	2.16 (1.73 to 2.71)	<0.001			
No		1.0				
Occupation						
Unemployed		1.0			1.0	
Housewife	0.43	1.10 (0.82 to 1.49)	0.513	0.27	0.91 (0.65 to 1.29)	0.603
Employed	4.66	1.33 (1.03 to 1.72)	0.031	0.0	1.0 (0.74 to 1.36)	0.987
Retired	0.02	0.98 (0.70 to 1.37)	0.893	0.49	0.86 (0.57 to 1.30)	0.484
Student	0.03	0.97 (0.68 to 1.38)	0.860	0.02	0.97 (0.64 to 1.47)	0.968
Income[g]						
<30		1.0			1.0	
30 to 60	3.42	1.20 (0.99 to 1.45)	0.064	2.85	1.20 (0.97 to 1.48)	0.091
60 to 90	6.35	1.30 (1.06 to 1.60)	0.012	2.64	1.21 (0.96 to 1.52)	0.104
90 to 120	15.43	1.64 (1.28 to 2.11)	<0.001	7.95	1.48 (1.13 to 1.95)	0.005
>120	27.39	1.92 (1.50 to 2.45)	<0.001	12.01	1.64 (1.24 to 2.16)	0.001
Ethnicity						
Fars		1.0			1.0	
Turkish	1.62	1.11 (0.94 to 1.31)	0.203	4.36	1.20 (1.01 to 1.43)	0.037
Kurdish	2.21	0.80 (0.59 to 1.08)	0.138	2.86	0.76 (.055 to 1.06)	0.091
Lor	0.62	1.12 (0.84 to 1.50)	0.431	1.52	1.22 (0.89 to 1.66)	0.218
Other	0.50	1.09 (0.85 to 1.39)	0.481	0.57	1.11 (0.85 to 1.44)	0.452

[a]OR: Odds Ratio; [b]CI: Confidence Interval; [c]Correct answer; [d]Widow or divorced; [e]The number of people living under the same roof; [f]The analysis was only univariate and between participants with academic education; [g]Million rials (monthly)

ambulance, only two scenarios had less than 50% of participants responding correctly, including "Your two-year-old child has symptoms of a cold and is drooling from the corner of the mouth while crying, his voice is hoarse and the area around his lips is bruised" with 34.5% and "Your 10-year-old son develops hives while playing on a family picnic" with 11.1%. One possible explanation for this could be the participant's different interpretations of the case and a lack of knowledge about these medical scenarios. Previous studies did not assess these scenarios [13, 14], therefore, there was a lack of knowledge about how other nations dealt with these unexpected issues. Furthermore, it seems that increasing awareness about emergent situations which need the attendance of an ambulance for diabetes and head trauma is mandatory. Since a large number of our participants did not seek EMS assistance in scenarios 5 and 7.

Among those scenarios which did not require an ambulance, none of the scenarios had more than 50% of participants responding that they would seek an ambulance by calling EMS. The two scenarios "An 8-month pregnant woman feels that the fetal movements are not normal" and "A four-year-old child inserted a small toy in her ear" had the highest percentage of inaccurate ambulance calls. Similarly, previous studies reported misdiagnosis of labor as an emergent condition requiring an ambulance call [8, 11, 19]. In the study by Kirkby *et al.,* nearly 50% of participants believed that labor delivery was an emergent condition. In the present study, more than 60% of the participant believed that this was an emergency condition, and about 40% decided to call EMS. Foreign object in the ear was another scenario that most people misinterpreted as an emergent situation. Mills *et al.,* reported that all of the participants decided to call EMS. We also found that 1889 out of the 3864 participants would call EMS in the aforementioned situation.

The present study evaluated the scenarios that represented stroke, myocardial infarction, drug overdose, and epilepsy. Fortunately, the participant's awareness of the necessity to seek an ambulance when facing these situations was acceptable. However, a greater emphasis on raising awareness of the urgency of these conditions would be extremely beneficial. One of the remarkable findings reported by Mills *et al.,* was that the Australian participant identified stroke as an emergent situation, yet they decided to transport their patients personally rather than waiting for an ambulance. In our study, nearly 88% of participants recognized this scenario as an emergency, and 84% decided to call EMS.

The present study has several strengths. To the best of our knowledge, this was the largest study conducted on the participants' awareness of what medical circumstances would prompt the participants to call for an ambulance. Second, we presented a comprehensive set of scenarios (24 scenarios) using the experience of both paramedics and emergency medicine specialists. Third, we used both univariable and multivariable logistic models to examine several factors associated with the odds of individuals providing correct answers. It also had some limitations. Although the present study included large sample size, it was not a nationwide study, and we only evaluated responses from the residents of Tehran. Since the majority of our participants were educated and limited information was available about those who were not; therefore, our findings cannot be generalized when applied to real-world experiences.

The amount of incorrect use of EMS services in Iran was significant. We found that the proper knowledge regarding the appropriate use of EMS was significantly associated with the participant's level of education, academic field, occupation, and income. Public awareness campaigns can implement the findings of our study to prioritize which scenarios should receive greater attention. Moreover, further studies, particularly a nationwide study on the Iranian population regarding this topic are highly recommended.

In addition, considering the high percentage of people who called EMS despite being aware of non-emergency conditions, it is suggested that a study be designed to investigate the causes of abuse to reduce the burden of unnecessary calls by identifying and modifying these factors that may lead to an increase in EMS performance quality.

Declaration

Ethics approval and consent to participate: The study protocol was approved by the ethics committee Tehran University of Medical Sciences Institutional Review Board (IR.TUMS.SINAHOSPITAL.REC.1400.051). To maintain the confidentiality of the personal information of the participants, all information was collected, analyzed, and reported anonymously. All participants were included in the study if they expressed their informed consent.

Consent for publication: All authors have expressed their consent to the publication of this manuscript.

Conflict of Interest: The authors declared that there was no conflict of interest.

Funding: There is no funding support for this study.

Authors' Contribution: The conception and design of the work by all the authors; Data acquisition by AS, PHS, and AB; Analysis and interpretation of data by HR and AB; Drafting the work by PS and AS; Revising it critically for important intellectual content by PHS, HR, and AB; All the authors approved the final version to be published; and agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work.

Acknowledgment: We would like to express our commitment and appreciation to the Prehospital and Hospital Emergency Research Center affiliated with Tehran University of Medical Sciences (Tehran, Iran).

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