

Knowledge Level of Pre-Hospital Emergency Staff about Acute Stroke and Indications of Code 724

Meisam Moezzi¹, Javad Mozafari¹, Hassan Barzegari^{1*}, Afsane Hossaini Motlagh²

¹*Emergency Medicine, Department of Emergency Medicine, School of Medicine, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran.*

²*School of Medicine, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran.*

ABSTRACT

Caring for stroke patients causes a high level of stress for the caregiver. The increasing level of knowledge of care principles can lead to self-esteem in caregivers and help improve the patient's condition. Thus, the present study aimed to evaluate the level of knowledge of pre-hospital emergency staff about the signs and symptoms of acute stroke and indications of Code 724. In this descriptive-analytical study, 260 pre-hospital emergency staff in Ahvaz were selected based on the Morgan table by a convenience random sampling method. Data were collected by a researcher-made questionnaire consisting of 22 questions in 3 subscales and a 5-point Likert scale. Then, they were analyzed by SPSS25 software and descriptive statistics.

126 (48.46%) pre-hospital emergency staff aged 30 to 40 years old participated in the study. The levels of knowledge of emergency staff about the symptoms of acute stroke based on education level and employment history were not significantly different ($P > 0.05$), but it had a significant relationship with age ($P < 0.05$). Their levels of knowledge of the signs and indications of acute stroke were not significantly correlated with age, education level, and employment history ($P > 0.05$). In general, the level of knowledge of the emergency staff was equal to 7.78 ± 76.12 and was at a high level. The level of knowledge of pre-hospital emergency staff about the signs, symptoms, and indications of acute stroke is high and it is necessary to update their information by holding training sessions to become familiar with new treatment methods.

Keywords: Prehospital emergency, Acute stroke, Indication, Code 724.

HOW TO CITE THIS ARTICLE: Moezzi M, Mozafari J, Barzegari H, Motlagh AH. Knowledge Level of Pre-Hospital Emergency Staff about Acute Stroke and Indications of Code 724. *Entomol Appl Sci Lett.* 2021;8(2):9-15. <https://doi.org/10.51847/9z6XinTgE6>

Corresponding author: Hassan Barzegari

E-mail ✉ H_b1979@yahoo.com

Received: 28/02/2021

Accepted: 23/05/2021

INTRODUCTION

Cardiovascular diseases are the second most common cause of death around the world and are the sixth leading cause of disease around the world, which is expected to rank fourth by 2020 [1]. More than 5.5 million people around the world and thousands in Iran die because of stroke annually and two-thirds of deaths occur in developing countries. The rate of stroke-caused death varies from one country to another, depending on social class and geographical area. In industrialized countries, the rate of stroke is 5 per 1000 people, but it is about 5-10 per 1000 people in developing

countries [2]. Despite several epidemiological studies, population-based information is still low in developing countries. In recent studies on differences between males and females, the general incidence of stroke was 33% higher in males than that in females and few studies conducted in this regard used small sample sizes and yielded poor results. In Europe, the annual incidence of stroke is 1.0 to 9.2 per 1000 people in males and 6.0 to 9.1 per 1000 people in females [3]. The rate of strokes is likely to increase with epidemiological changes and with increasing age. According to a study conducted by Ferry *et al.* in 2011, the general rate of strokes in urban areas was higher than that in

rural areas, and the levels of disability and dependency among stroke survivors were significantly higher in urban areas [4]. Cerebrovascular disease is a disorder in the cerebrovascular system in the form of ischemia, infarction, or bleeding that is manifested with different symptoms.

However, stroke symptoms are usually sudden and without warning, but the warning signs occur slowly [5]. Pre-hospital emergency staff, who are at the first-line of caring for patients, must be able to analyze a situation, quickly assess a situation, and implement effective and life-saving treatment approaches [6]. One of the most important activities of the pre-hospital emergency department is dealing with patients who suffer an acute stroke. This emergency department is known as Code 724, which is a sign of 24-hour activity for 7 days of a week. With any delay, nerve lesions increase and once the lesions emerged, no treatment will be effective [7]. The benefits of the pre-hospital unit include reducing transfer time, performing supportive and therapeutic measures in the ambulance, activating the stroke code and transfer to the appropriate hospital, accelerating vital measures in the hospital in golden time, and recording information, and improving planning based on it. Accordingly, the importance of familiarizing pre-hospital staff with the signs and symptoms of acute stroke and the indications of Code 724 is highlighted [8]. Indications for this code announcement include the presence of measurable neurological impairment according to the FAST protocol, the time interval between the last healthy visit of the patient and reaching the hospital triage less than 3 hours, age over 18 years, and relevant calls according to the local protocol. Absolute indications for transfer also include a change in consciousness, shortness of breath or abnormal breathing, and the presence of any symptoms or stroke [9]. Given what was stated above and considering the importance of initial dealing with patients and the importance of activities provided by the pre-hospital emergency and since limited studies have been conducted in this area, the importance of this evaluation and reviewing the results are highlighted. Thus, in the present study, the aim was to evaluate the level of knowledge of pre-hospital emergency staffs about the signs and symptoms of acute

stroke and the indications of Code 724 to provide appropriate policies to increase the level of knowledge of pre-hospital staffs to improve the health of people exposed to this system.

MATERIALS AND METHODS

The present study is a descriptive-analytical one conducted in 2019 on pre-hospital emergency staff working in the emergency department of Ahvaz Jundishapur University of Medical Sciences. The total number of staff during the study was 600. Using the Morgan table and considering the probability of 10% dropout in samples, 260 people were randomly selected and entered into the study. Inclusion criteria of the study included having personal consent to participate in the study and being male. The staff willing to participate in the study were excluded from the study. The data collection tool was a researcher-made questionnaire that included demographic variables and questions related to the level of knowledge on the signs and symptoms of acute cerebrovascular conditions and indications of Code 724. This questionnaire includes 22 questions in 3 subscales (staffs knowledge of stroke symptoms = 8 questions, staffs knowledge of stroke signs = 9 questions, and staffs knowledge of indications of Code 724 = 5 questions). The questions were scored on a 5-point Likert scale (very low = 1, low = 2, medium = 3, high = 4 and very high = 5). The highest score obtained from the questionnaire was 110 and the lowest score was 22. Therefore, the highest score obtained from stroke symptoms was 40 and the lowest score was 8. Besides, the highest score obtained from stroke signs was 45 and the lowest score was 9. The highest score obtained from indications of Code 724 was 25 and the lowest score was 5. This questionnaire was designed using other similar studies and national protocol 724. To evaluate its validity, the opinions of experts such as supervisors and advisors were used. The CVI obtained from the questionnaire was higher than 70%, which indicated the good validity of the questionnaire. To examine its reliability, the test-retest method was used. For this purpose, 26 people or 10% of the samples (pre-hospital emergency staffs) completed the questionnaire and they completed it again after two weeks.

The reliability of the questionnaire was obtained at 0.82, indicating good reliability of the questionnaire. Sampling started after obtaining permission from the ethics committee of Ahvaz University of Medical Sciences and the permission of emergency department officials. To observe the ethical standards, questionnaires were collected anonymously. The researcher distributed the questionnaire among the staff by attending the research environment (pre-hospital emergency) and by submitting an informed consent form and taking measures such as informing the samples of the confidentiality of their information, and they took the questionnaire after completing it. Finally, the data were analyzed using SPSS 25 software and Chi-square test at a significance level of 0.05.

RESULTS AND DISCUSSION

Out of 260 studied staff, 126 (48.46%) were pre-hospital emergency staff between 30 to 40 years old. 108 of the staff (40.5%) had a bachelor's degree and 137 (52.7%) had an employment history of 5 to 10 years (**Table 1**). In terms of knowledge of pre-hospital emergency staffs about the symptoms of acute stroke, results of the Mann-Whitney test showed that question 6, entitled "Can imbalance be one of the symptoms of an acute stroke?" had the highest mean of 3.88 and question 3 entitled "Can difficulty in swallowing one of the symptoms of an acute stroke?" with a mean of 3.32 had the lowest mean of pre-hospital emergency staffs information about the symptoms of acute stroke (**Table 2**). Results on pre-hospital emergency staffs' level of knowledge of the signs of acute stroke based on the Mann-Whitney test showed that question 9, entitled "Can paralysis be one of the signs of an acute stroke?" with a mean of 3.67 had the highest mean and question 3 entitled "Can sense of touching be one of the signs of an acute stroke?" with a mean of 3.15 had the lowest mean in pre-hospital emergency staffs' level of knowledge signs of acute stroke (**Table 3**). Besides, the results obtained about the level of knowledge of pre-hospital

emergency staffs about the indications of Code 724 based on the Mann-Whitney test showed that question 2 entitled "Are measurable neurological disorders including sensory and motor disorders indications of Code 724?" with a mean of 3.60 had the highest and question 5 entitled "Are the relevant calls and the announcement of acute stroke according to the local protocol indications for the announcement of Code 724?" with a mean of 3.21 had the lowest mean knowledge of pre-hospital emergency staffs of the indications of Code 724 (**Table 4**). The results of multivariate analysis of variance showed that the level of knowledge of pre-hospital emergency staffs about the symptoms of acute stroke had no significant relationship with demographic variables of the level of education and employment history ($P < 0.05$), but it showed a significant relationship with age ($P < 0.05$). The knowledge of pre-hospital emergency staff about the signs of acute stroke and indications of Code 724 did not show a significant relationship with demographic variables of age, level of education, and employment history ($P > 0.05$) (**Table 5**). Finally, the level of knowledge of pre-hospital emergency staff separately based on dimensions showed that the knowledge of staff with a mean of 3.13 ± 27.40 was at the desired level (**Table 5**).

Table 1. Distribution and Frequency Percentage of the Sample Group in terms of Demographic Information

age	Statistical Indicators	Abundance	Frequency
30-40 age		126	48.46
40-50 age		98	37.69
50-60 age		36	13.85
Education			
20		52	Diploma
25.4		66	Associate Degree
40.5		108	Bachelor
13.1		34	MA
work experience			
27.3		71	Less than 5 years
52.7		137	Between 5 and 10 years
20		52	More than 10 years

Table 2. Pre-hospital Emergency Staffs Level of Knowledge of Symptoms of Acute stroke

Row	Questions	Statistical Indicators	Very Low	Low	Medium	High	Very High	Average
1	How do you assess your knowledge of the	Abundance	32	43	44	45	96	3.50

	symptoms of an acute stroke?	Percent	12.4	16.5	16.5	17.3	36.9	
2	Is the weakness in one or more upper and lower organs can be a symptom of an acute stroke?	Abundance	35	39	41	61	84	3.46
		Percent	13.5	15	15.8	23.5	32.2	
3	Can swallowing problems be a symptom of an acute stroke?	Abundance	50	41	44	24	101	3.32
		Percent	19.2	15.8	16.9	9.2	38.8	
4	Is speech disorder can be a symptom of acute stroke?	Abundance	31	37	39	65	88	3.54
		Percent	11.9	14.3	15	25	33.8	
5	Does dysfunction in understanding the words can be a symptom of an acute stroke?	Abundance	29	40	36	85	70	3.48
		Percent	11.2	15.4	13.8	32.7	26.9	
6	Can imbalance be a symptom of an acute stroke?	Abundance	25	20	53	25	173	3.88
		Percent	9.6	7.7	20.4	9.2	52.7	
7	Can urinary and fecal incontinence be a symptom of an acute stroke?	Abundance	22	32	45	73	88	3.66
		Percent	8.5	12.3	17.3	28.1	33.8	
8	Can sudden mood swings be a symptom of an acute stroke?	Abundance	31	31	44	59	95	3.60
		Percent	11.9	11.9	16.9	22.7	36.5	

Table 3. Pre-hospital Emergency Staff Level of Knowledge about the Signs of Acute Stroke

Row	Questions	Statistical Indicators	Very Low	Low	Medium	High	Very High	Average
1	How do you assess your knowledge of the signs of an acute stroke?	Abundance	13	62	44	68	73	3.22
		Percent	5	23.8	16.9	26.2	28.1	
2	Can asymmetry of the face be a sign of acute stroke?	Abundance	39	41	60	62	58	3.22
		Percent	58	15.8	23.1	23.8	22.3	
3	Can a reduction in sense of touching be a sign of acute stroke?	Abundance	42	56	42	61	59	3.15
		Percent	16.2	21.5	16.2	23.5	22.7	
4	Can dizziness be a sign of acute stroke?	Abundance	32	32	43	69	84	3.54
		Percent	12.3	12.3	16.5	26.5	32.3	
5	Can diplopia be a sign of an acute stroke?	Abundance	27	45	62	54	72	3.38
		Percent	10.4	17.3	23.8	20.8	27.7	
6	Can visual impairment of one or two eyes be one of the signs of an acute stroke?	Abundance	25	29	65	40	101	3.62
		Percent	9.6	11.2	25	15.4	38.8	
7	Can deviation in the coordination of eyes be a sign of acute stroke?	Abundance	24	35	57	73	71	3.50
		Percent	9.2	13.5	21.9	28.1	27.3	
8	Can a reduction in the level of consciousness be a sign of acute stroke?	Abundance	41	41	37	73	68	3.33
		Percent	15.8	15.8	28.1	14.2	26.2	
9	Could paralysis be one of the symptoms of an acute stroke?	Abundance	29	37	39	40	115	3.67
		Percent	11.2	14.2	15	15.4	44.2	

Table 4. Level of Knowledge of Pre-hospital Emergency Staff about the Indications of Code 724

Row	Questions	Statistical Indicators	Very Low	Low	Medium	High	Very High	Average
1	How do you assess your knowledge of indications of Code 724?	Abundance	36	42	55	53	74	3.33
		Percent	13.8	16.2	21.2	20.4	28.5	
2	Is the presence of measurable neurological disorders including sensory and motor disorders among the indications of Code 724?	Abundance	29	34	47	52	98	3.60
		Percent	11.2	13.1	18.1	20	37.7	
3	If the time interval between the last healthy visit of the patient and reaching the hospital triage is less than 3 hours, will it one of the indications of Code 724?	Abundance	41	44	54	41	80	3.28
		Percent	15.8	16.9	20.8	15.8	30.8	
4	Is age over 18 years one of the indications Code 724?	Abundance	38	33	26	74	89	3.55
		Percent	14.6	12.7	10	28.5	34.2	
5	Are the relevant calls and the announcement of an	Abundance	47	53	30	57	73	3.21

acute stroke based on the local protocol one of the indications of Code 724?	Percent	18.1	20.4	11.5	21.9	28.1
--	---------	------	------	------	------	------

Table 5. Level of Knowledge of Pre-hospital Emergency Staffs about the Signs, Symptoms, and Indications of Code 724 of Acute Stroke according to Demographic Variables and Level of their Knowledge

Variables	F	Mean of Squares	df	Sum of Squares	Significance Level
Symptoms of Acute Stroke					
Age	1.969	0.922	21	19.371	0.008
Level of Education	1.160	1.047	21	21.998	0.288
Employment History	1.137	0.528	21	11.086	0.311
Symptoms of Acute Stroke					
Age	0.747	0.385	21	8.087	0.782
Level of Education	1.266	1.133	21	23.796	0.199
Employment History	0.732	0.351	21	7.377	0.798
Code 724 Indications					
Age	1.348	0.655	18	11.969	0.159
Level of Education	1.052	0.959	18	17.255	0.403
Employment History	0.010	0.474	18	8.529	0.449
The Level of Knowledge of Pre-hospital Emergency Staffs Separately for Dimensions					
Dimonsions		undesired			desired
Knowledge of Symptoms		1.83±21.83			3.69±30.24
Knowledge of Signs		3.69±30.24			3.14±32.43
Knowledge of Indications 724		2.11±12.74			2.56±19.55
Level of Knowledge of Pre-hospital Emergency Staffs		1.95±19.86			3.13±27.40

Multivariate Analysis of Variance

The present study aimed to evaluate the knowledge of pre-hospital emergency staff about the signs and symptoms of acute stroke and the indications of Code 724. The general results of this study showed that the level of knowledge of pre-hospital emergency staff about the signs, symptoms, and indications of acute stroke was at the desired level. Moreover, age, level of education, and employment history variables affected their knowledge. The results of studies have yielded contradictory results in this regard. For example, Georgia *et al.* in 2012 showed that nurses' information and knowledge about the signs and symptoms of patients with acute stroke were at the desired level [10]. In an experimental study in the United Kingdom, Monroe (2016) examined pre-hospital emergency staff for one month with the ABCD2 standard (designed to evaluate stroke cases in hospitals) to evaluate suspected acute stroke cases. The results of the study showed that the level of knowledge of the pre-hospital staff was at a moderate level [11], which is not consistent with the results of the present study in which the level of knowledge of the staff was obtained

at the desired level. This inconsistency in results can be due to differences in training staff.

Mazaheri *et al.* stated that their familiarity with the symptoms of acute stroke risk is very low [12]. This result is not consistent with the results of the present study. Lack of consistency in results can be attributed to differences in performance, training courses, and different training needs in the present study. In fact, despite the great emphasis on the importance of training medical staff, including pre-hospital staff on acute diseases, including acute stroke, there is still a training gap in this area. Insufficient knowledge of the signs and symptoms of the disease hurts the care process. Thus, holding training courses on acute diseases, encouraging staff to attend congresses, seminars, workshops, as well as providing pamphlets and training booklets in this area to raise the level of knowledge of medical staff seems necessary. Results of the multivariate linear regression model in the present study showed that the level of knowledge of pre-hospital staff about signs and symptoms of acute stroke was significantly associated with an

increased level of education and employment history so that with increasing education, the level of knowledge of subjects about the signs and symptoms of the disease increased. In this regard, the results of a study conducted by Abootalebi *et al.* showed that pre-hospital emergency staff with higher leveler literacy obtained higher knowledge scores [13]. Besides, Gorji *et al.* (2012) conducted a study on patients with acute stroke. The mean age of the respondents was 32.1 ± 16 years and the mean and standard deviation was 54 ± 22 . Decreased level of consciousness, dizziness, and imbalance were the most common symptoms that people were familiar with them. Accordingly, they examined the level of knowledge of people and stated that based on this study, the importance of the increasing level of knowledge of individuals is highlighted. It seems that with increasing age, the mean level of knowledge of staff will increase, but in the present study, a significant relationship was not found between age and mean level of knowledge of disease symptoms [10].

Considering the correlation between employment history and the level of knowledge about the signs and symptoms of the disease, the mean knowledge in people with more than two years of employment history is higher than that of people with less employment history, and this difference was statistically significant. It means that with increasing pre-hospital emergency employment history, staff level of knowledge of the signs and symptoms of the disease increases. It is consistent with a study conducted by Young *et al.* and concluded that pre-hospital staff level of knowledge is associated with their employment history [14]. Another study investigated the level of knowledge of medical staff about the signs and indications of acute stroke and concluded that the level of basic knowledge is poor in most aspects of diagnosis and management of acute stroke and the educational lecture can increase the level of knowledge of prehospital staff [15], which was not consistent with the results of the present study. In the present study, based on the provided training, the level of knowledge of the pre-hospital emergency staff was at the desired level. In an intervention study, Lewis (2001) trained all pre-hospital emergency staff for 6 weeks on the clinical signs of acute stroke, CT

scan, acute stroke, pathophysiology, and treatment cases of acute stroke. Then, for one year, they collected the relevant information of the patients in the areas of training and compared them at the end of the year. The results of the present study showed that the provided training could significantly increase the management of pre-hospital staff in dealing with cases of acute stroke. Researchers have also recommended a higher and more complete level of knowledge to improve the work of pre-hospital emergency staff [16], which is consistent with the results of the present study. The difference between the two studies was that the Lewis study was conducted as an intervention and examined the effect of training before and after its implementation. The present study also had some limitations, such as mental state and individual differences of staff that affected their response and they were out of control of the researcher.

CONCLUSION

Based on the results, the level of knowledge of pre-hospital emergency staff about the signs, symptoms, and indications of stroke was at the desired level. It is recommended to correct the incorrect methods by using appropriate training methods and to improve and maintain the quality of pre-hospital emergency services in the form of Code 724 with implementing maneuvers. We hope that the implementation of this research project can be used by medical officials to empower pre-hospital emergency staff in the area of fast identification and referral of patients with stroke.

ACKNOWLEDGMENTS: This study was derived from a research project of the Student Research Committee and was approved by the Ethics Committee (IR.AJUMS.REC.1398.073) in the Research Center of Ahwaz University of Medical Sciences under the code of U-98002. We thereby appreciate the officials and staff of the pre-hospital emergency department of Ahwaz University of Medical Sciences for their participation in this study.

CONFLICT OF INTEREST: None

FINANCIAL SUPPORT: None

ETHICS STATEMENT: None

REFERENCES

1. Dong Y, Ye H, Shen H, Wang Y, Li H, Ma S, et al. Which Patients with Acute Ischemic Stroke Benefit from the Lower Dosage of Intravenous Tissue Plasminogen Activator? A Cluster Data Analysis. *Stroke*. 2018;49(Suppl_1):A48-. doi:10.1161/str.49.suppl_1.48
2. Smith EE, Saposnik G, Biessels GJ, Doubal FN, Fornage M, Gorelick PB, et al. Prevention of stroke in patients with silent cerebrovascular disease: a scientific statement for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke*. 2017;48(2):e44-71.
3. Fugate JE, Rabinstein AA. Posterior reversible encephalopathy syndrome: clinical and radiological manifestations, pathophysiology, and outstanding questions. *Lancet Neurol*. 2015;14(9):914-25. doi:10.1016/S1474-4422(15)00111-8
4. Kim SK, Lee SY, Bae HJ, Lee YS, Kim SY, Kang MJ, et al. Pre-hospital notification reduced the door-to-needle time for IV t-PA in acute ischaemic stroke. *Eur J Neurol*. 2009;16(12):1331-5.
5. Khatri P, Tayama D, Cohen G, Lindley RI, Wardlaw JM, Yeatts SD, et al. Effect of intravenous recombinant tissue-type plasminogen activator in patients with mild stroke in the third international stroke trial-3: post hoc analysis. *Stroke*. 2015;46(8):2325-7. doi:10.1161/STROKEAHA.115.009951
6. Khodisiave M, Mohamadkhani M, Amini R, Karami M. Factors predicting the standard precautions for infection control among pre-hospital emergency staff of Hamadan based on the Health Belief Model. *J Educ Community Health*. 2017;4(3):12-8.
7. Dadashzadeh A, Dehghannejhad J, Shams Vahdati S, Soheili A, Sadeghi Bazarghani H. The nature of prehospital medical interventions delivered to traumatic patients in Tabriz. *Nurs Midwifery J*. 2017;15(3):159-67.
8. Diringner MN, Videen TO, Yundt K, Zazulia AR, Aiyagari V, Dacey RG, et al. Regional cerebrovascular and metabolic effects of hyperventilation after severe traumatic brain injury. *J Neurosurg*. 2002;96(1):103-8. doi:10.3171/jns.2002.96.1.0103.
9. Adnet F, Jouriles NJ, Le Toumelin P, Hennequin B, Taillandier C, Rayeh F, et al. Survey of out-of-hospital emergency intubations in the French prehospital medical system: a multicenter study. *Ann Emerg Med*. 1998;32(4):454-60. doi:10.1016/s0196-0644(98)70175-1.
10. Aboutalebi S, Moradi A, Pazoki R. The knowledge assessment of stroke in over age 25 years old habitants of Bushehr port 2005. *ISMJ*. 2006;9(1):59-65.
11. Munro S, Rodbard S, Ali K, Horsfield C, Knibb W, Holah J, et al. A pilot study evaluating the use of ABCD2 score in pre-hospital assessment of patients with suspected transient ischaemic attack: experience and lessons learned. *Exp Transl Stroke Med*. 2016;8(1):1-8. doi:10.1186/s13231-016-0020-3
12. Mazaheri S, Beheshti F, Hosseinzadeh A, Mazdeh M, Ghiasian M. Epidemiologic study of cardinal risk factors of stroke in patients who referred to Farshchian hospital of Hamadan during 2014-2015. *Avicenna J Clin Med*. 2016;22(4):331-7.
13. Aboutalebi S, Moradi A, Pazoki R. The knowledge assessment of stroke in over age 25 years old habitants of Bushehr port 2005. *ISMJ*. 2006;9(1):59-65.
14. Boet S, Bould MD, Sharma B, Revees S, Naik VN, Tribby E, et al. Within-team debriefing versus instructor-led debriefing for simulation-based education: a randomized controlled trial. *Ann Surg*. 2013;258(1):53-8. doi:10.1097/SLA.0b013e31829659e4.
15. Shire F, Kasim Z, Alrukn S, Khan M. Stroke awareness among Dubai emergency medical service staff and impact of an educational intervention. *BMC Res Notes*. 2017;10(1):1-6. doi:10.1186/s13104-017-2585-x
16. Luiz T, Moosmann A, Koch C, Behrens S, Daffertshofer M, Ellinger K. Optimized logistics in the prehospital management of acute stroke. *Anesthesiol Intensivmed Notfallmed Schmerzther*. 2001;36(12):735-41.