

Current Problems of Interaction between Emergency Medical Service and Population: Organizational, Financial, and Supply Chain Management

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Abstract. At the current stage quality of emergency medical services (EMS) implies not only the professionalism of paramedics, but also the timeliness of their provision. The methods that allow for minimization of the patient's waiting time for assistance are acquiring particular relevance. The purpose of this paper is to identify factors increasing the waiting time of EMS and prove the need to implement recommendations given on the reverse side of the first aid alert sheet for the citizens after calling an ambulance. The paper analyzes operation of Vladivostok EMS during 2016 – 2018 based on the data of the annual statistics report. In the process of solving these tasks of the thesis, the following research methods were used: analytical, descriptive, comparative, observation, simulation and generalization. nine ambulance crew shifts in Vladivostok city were studied with the help of observation and simulation methods. The results of this study were used as a basis for calculating time, which could be shortened in case if patients use our recommendations. The factors negatively affecting the delivery time of emergency medical service are drafted. The measures that can increase delivery of a quality medical service are offered. The developed recommendations can reduce time spent by an ambulance crew on the call, and improve efficiency of interaction between the ambulance crew and the patient.

Keywords: emergency medical services (EMC), recommendations for citizens, legal problems, supply chain management, statutory instruments.

1. Introduction

The key point in provision of EMS is the time from the operator's taking a call till the first contact of the ambulance crew with the patient [1- 4]. Despite the fact that EMS can be both urgent and emergency and the time of arrival is different, a medical crew tries to get to the patient as soon as possible [5- 7]. However, nowadays there are some factors that extend the time of waiting for a crew by the patient [3]. Such factors include:

- absence of unified and precise instructions for the citizens calling an ambulance (table 1), [2];
- shortage of health personnel (table 7);

- increase of calls without results and unreasonable calls (that also cause financial damage to the emergency ward [8- 15]), including unreasonable recalls) (table 8);
- Workload of ambulance crews [1].

2. Literature Review

The Order of the Ministry for Public Health and Social Development of the RF dd. December 2, 2009 No. 942 "On Approval of the Statistical Tools of the Ward (Department) of the Emergency Care Hospital" defines a call without result as:

- an absence of the patient at the place of the call, the call is false (emergency medical service was not called at such address);
- the address was not found;
- the patient indicated in the call was almost healthy and did not require any help;
- the patient was taken away before the arrival of the ambulance crew;
- the patient refused from help (check-up);
- The call was cancelled.

One of the underlying documents regulating operation of the emergency paramedics is the Order of the Ministry for Public Health of the Russian Federation dd. June 20, 2013 No. 388n (as amended on January 22, 2016) "On Approval of the Procedure of Emergency, Including Specialized, Medical Service Delivery". On the basis of analysis of this statutory instrument it should be noted that the wording sets out:

- the rules for organizing the activities of the ambulance crew,
- recommended ward staff standards,
- emergency departments,
- standard for ward, department equipment,

- Standard for inpatient department equipment, whereas nothing is mentioned on how the citizen calling an ambulance should act. However, depending on the constituent entity of the Russian Federation the

presence of these recommendations in the local decisions can be traced (table 1).

Table 1. Statutory instruments regulating the procedures for calling an ambulance

Statutory Instrument	Recommendations for calling an ambulance
The Order dd. March 3, 2014 No. 163-o on the rules of calling an ambulance crew in the territory of the Primorsky region [9]	1) If possible, arrange reception of the ambulance crew at the gate or at the entry, prepare beforehand a chair for the doctor, a place for the medical box and a clean towel; 2) Isolate all pets that can complicate delivery of medical service to the patient and cause harm to health and property of the ambulance staff.
The Enactment dd. August 23, 2000 No. 3691 "On Approval of the Rules of Calling an Ambulance Crew in Ufa city" [10]	1) The person calling an ambulance crew should, if possible, meet the crew at the gate or at the entry in order to prompt arrival of the medical staff to the patient or casualty and to ensure free passage to such person with equipment and in shoes. In case of presence of pets that may cause harm to health and property of emergency crew staff, such pets must be isolated. The person who made a call must also assist to the doctor in transporting the patient to the ambulance car.
The Enactment dd. June 3, 1996 No. 1264 On the Rules of Calling an Ambulance Crew in Kaliningrad city [11]	1) In case of necessity to transport the patient on a stretcher, the patient's relatives shall assist medical staff and get the patient to the ambulance car.
The Enactment dd. November 13, 2008 No. 618 On Approval of the Rules of Calling an Ambulance Crew in Maikop city [12]	The calling party (patient, casualty, relatives, other persons) is obliged to: 1) provide an ambulance crew with a free passage to the patient or casualty and the conditions necessary for medical service delivery; 2) isolate pets that can complicate delivery of medical services to the patient or casualty and cause harm to health and property of the ambulance staff; 3) assist in transporting the patient or casualty to the ambulance car; 4) furnish the ambulance crew with the documents (passport and certificate of insurance) of the patient or casualty in case of his/her transportation to the in-patient facility; 5) if possible, arrange reception of the called ambulance crew at the gate or at the entry, help carrying medical bag and equipment from the car to the place of medical service delivery.
The Order dd. June 13, 2013 No. 6/264 on Approval of the "Rules for Calling an Ambulance" in the Republic of Komi [13]	1) arrange reception of the called ambulance crew at the gate or at the entry in order to prompt arrival of the medical staff to the patient or casualty. In case of obstacles at the entrance to the adjacent territory (yard), such as auto barrier, guard "chain", arrange their opening, if possible. 2) provide a free passage to the patient or casualty with the equipment and in shoes; 3) provide the conditions necessary for service delivery; 4) isolate pets that may cause harm to health and property of the ambulance staff; 5) assist the doctor in transporting the patient or casualty to the car, engaging relatives, family members, neighbors, and surrounding persons; 6) furnish the emergency medical service crew with the documents (passport, certificate of insurance, personal insurance policy number) of the patient or casualty in case of his/her transportation to the in-patient facility. In the absence of the documents, provide with exact information: surname, name, patronymic; day, month and year of birth; place of birth; permanent place of residence (requirement of the Federal Compulsory Medical Insurance Fund).
The Enactment dd. April 25, 2013 No. 1340 on Approval of the uniform rules of calling and delivery of the emergency medical services by state-financed health institution "Sysert CDH" (Sverdlovsk Region) within the territory of Sysert Urban District [14]	1) The person calling an ambulance crew shall arrange: reception of the ambulance crew at the gate or at the entry in order to prompt arrival of the medical staff to the patient or casualty; free passage to the patient or casualty; conditions necessary for medical service delivery; isolation of pets; assist ambulance staff in transportation of the patient or casualty to the ambulance car, engaging relatives or family members.

From table 1 it can be concluded that the amount and volume of requirements vary depending on the region. Recommendations for the citizens who have called an ambulance that are stated in some statutory instruments are not always binding; moreover, no penalties and consequences in case of default are spelt out.

3. Research Methods

Despite the absence of clear recommendations for the citizens calling an ambulance in the statutory instruments that were reviewed earlier, the problem of drafting and distribution thereof among the

population of the Russian Federation remains an urgent challenge. Thus, an online-survey of the doctors (10 persons), paramedics (20 persons), and dressers (10 persons) of the emergency wards of the Russian Federation which was conducted by the authors revealed the situations increasing the time the crew spent on the call. Tables 2, 3, and 4 represent the survey results.

Table 2. Number of calls received by the respondents during 1 shift

Number of calls	1-9	10-14	15-17	18-20	More than 20
Number of respondents (persons)	1	16	15	5	3

Table 2 shows that on the average doctors and paramedics receive from 10 to 17 calls per day, which is reported by 77% of the total number of respondents.

Table 3. Number of cases of free passage of an ambulance crew from the auto barrier/intercom door to the patient during a shift

Number of cases of free passage	0	1-3	4-7	In half of the cases	Always
Number of respondents (persons)	6	16	7	6	5

Table 3 shows that most frequently the number of cases of the crew's free passage to the patient is extremely low and comprises about 14% of the average number of calls.

Table 4. Frequency of assistance of the patient's relatives/neighbors in his/her transportation from the apartment to the ambulance car on a stretcher.

Frequency of assistance	0-30%	31-60%	61-90%	91-100%
Number of respondents (persons)	1	5	13	21

Table 4 shows that in more than half of the cases not only medical staff, but also the patient's relatives/neighbors take part in transportation of the casualty to the ambulance car. Majority of respondents (31 persons) noted that presence of children or pets in the same room with the patient disturbed diagnosis of the disease and first aid delivery to the casualty. Moreover, 25 respondents noted absence of prepared documents of the patient: obligatory medical insurance policy, passport, and medical records of the patient, if available. In paper [16] the authors developed recommendations for the citizens to take measures after calling an ambulance (scheme 8). They identified the aspects that extended the time the crew spent on the call. Recommendations for citizens after calling an ambulance include:

1) Arrange reception of an ambulance crew or a free passage of the ambulance crew from the gates or at the entry to the patient:

- advise the guard/concierge of arrival of ambulance requesting reception and seeing the crew to the patient's door.

If there is no guard/concierge in your house:

- open the auto-barrier, intercom door propping it by the stone or other item
- Make sure the door of your apartment bears its number, otherwise, indicate your apartment number or leave the door half-opened

2) Isolate pets in the next room, so that they do not slow down medical services delivery to the patient and

cause harm to health and property of the ambulance staff.

3) Prepare the patient's documents that may be necessary to the EMS doctor beforehand:

- Passport and certificate of insurance;
- Hospital discharges over the past year;
- Alert sheets from ambulance doctor over the past year;
- ECG strip.

4) Provide the conditions necessary for service delivery:

- take away everything that can prevent passage of the ambulance crew from the door to the patient;
- prepare a chair for the doctor and paramedic.

5) If a service was delivered prior to the ambulance crew arrival, inform the ambulance doctor of:

- The names and amount of medicines taken;
- Manipulations to the patient.

6) In case of patient's transportation to the in-patient department and impossibility of the latter to get to the ambulance car by himself/herself:

- invite 4 persons that can help get the patient to the ambulance car.

Moreover, the authors undertook a one-month study during which the time of standard ambulance calling was compared with the same "perfect" calling where implementation of earlier given recommendations was taken into account.

Table 6. The results of comparison of standard shifts of an ambulance crew with "perfect shifts"

Shift number	Number of calls	Average time spent for 1 call (minutes)	Average time spent for 1 "perfect" call (minutes)	Amount of average "saved" time (minutes)
1	15	57	50	7
2	14	55	49	6
3	17	58	51	7

4	14	64	48	16
5	15	53	47	6
6	18	59	51	8
7	15	63	49	14
8	16	55	50	5
9	16	53	46	7
Total	15.6	57.4	49.0	8.4

Table 6 shows that if citizens calling an ambulance follow the drafted recommendations, an average calling time decreases by 8.4 minutes, which in total comprises up to 130 minutes of “saved” time for one crew during one shift (24 hours). As a result, the time spent by the crew on a call may be reduced in case of active assistance of the patient’s relatives or neighbors. The offered recommendations printed on the reverse side of an alert sheet may reduce time spent by an ambulance crew on the call and improve efficiency of

interaction between the ambulance crew and the patient. Particularly, such alert sheets are provided to patients only after EMS has been called. As for recommendations, patients can find them on information desk in ambulatory-care clinic.

4. Results

Another topical problem that nowadays increases the time of the patient’s waiting for help is low staffing level of Vladivostok EMS wards (table 7).

Table 7. Indicators of staffing level in ambulance crews (by personnel) in Vladivostok city for 2016-2018

	Total number of personnel according to organizational chart			Actual number of personnel			Personnel in ambulance crews			Staffing level percentage		
	2016	2017	2018	2016	2017	2018	2016	2017	2018	2016	2017	2018
Doctors	218	218	222	113	144	118	98	78	90	49	66	53
Nursing staff	485	487	487	212	336	355	173	164	227	49	53	73
Paramedics	321	327	310	142	169	239	130	117	128	49	52	77
Nurses	156	157	207	70	85	134	42	45	99	48	54	65

As may be seen from table 7, in 2016 average percentage of crew staffing with doctors and nursing staff was less than 50%. Then there was a slight growth in 2017 (on average for all categories by 10%). In 2018 the number of nursing staff significantly increased by

37%, but the number of doctors decreased by 20% as compared to the 2017 level. Let us study indicators of Vladivostok EMS activities during 2016 – 2018 (table 8).

Table 8. Indicators of Vladivostok EMS activities during 2016 – 2018.

Indicators of EMS activities	Operating years					
	2016		2017		2018	
	abs.	%	abs.	%	abs.	%
Total number of calls (together with the calls without result)	135,570		138,932		149,874	
urgent	100,842	74.4	62,062	44.7	69,391	46.3
emergency	22,425	16.5	68,469	49.3	70,166	46.8
Without results	12,303	9.1	8,399	6.0	10,317	6.9
Total number of calls (with results)	123,267		130,533		139,557	
Recalls	1,766		2,337		2,448	
Reasonable recalls	648		301		312	

Table 8 shows that over the course of three years the number of ambulance calls was increasing, while the share of the calls without results was increasing as well. It should be noted that as compared with 2016 the number of recalls decreased by 32% (2017) and 38% (2018), while the share of reasonable recalls decreased and comprised just 12% of the total number of recalls (2018). In paper [16] the authors analyzed the cases of calls without result. The overwhelming majority of their vast number was street calls, where eyewitnesses

to the incident called an ambulance from their mobile phones and went away, leaving the casualty to wait for the ambulance alone, thus not giving an ambulance crew the opportunity to find the casualty, if he/she changed his/her position. It is also worth noting that citizens called an ambulance to people who were intoxicated, with the wording that a person was unconscious or felt unwell on the street not on the basis of inspection and interview of the probable casualty, but only based on a visual contact. It is also worth

noting that the unreasonable call for an ambulance is not a violation of the law, which is traced in the loyal attitude of citizens to this special service [17].

5. Discussion

Table 9. Indicators of ambulance crew performance in Vladivostok city for 2016-2018

Performance indicators	2016	2017	2018
	abs.	abs.	abs.
Daily average number of calls	370	380	410
Daily average workload on an ambulance crew	12.4	15	16
Average time spent for 1 call (minutes)	57	54	57.2

Table 9 shows that over the past three years the average daily number of calls for ambulance crews has grown, which resulted in the increase in the average daily workload on the ambulance crew and also in the average time spent by the crew on the call. Unreasonable calls bear not only a social problem, but also a financial one. Thus, in 2018 more than 32 million rubles were spent on the calls without results in Vladivostok. At the same time, those who unreasonably called an ambulance cannot be brought to responsibility and thereby compensate for a part of the money spent.

6. Conclusion

Exclusion of the factors negatively affecting the delivery time of emergency medical service will accelerate the delivery of quality medical service to those in need.

First of all, implementation of the recommendations for citizens after calling an ambulance offered by the authors and printed on the reverse side of an alert sheet will not only enable to increase the speed of diagnosis and delivery of emergency medical services, but also will reduce a daily average workload on an ambulance crew.

Secondly, reducing the workload on the crew will attract new personnel owing to the improved working conditions. At the same time, a daily average workload on an ambulance staff will be reduced due to the increase in the number of ambulance crews.

Thirdly, carrying out sanitary and educational work among the population on the rules and criteria for calling an ambulance can increase the legal and regulatory literacy of citizens and reduce the number of unreasonable calls and calls without results, which in turn will also reduce the burden on ambulance crews and will make it possible to deliver urgent and emergency medical service faster and better. In turn, the reduction of calls without results can save the budget of the EMS wards, which will enable to use funds to improve working conditions, purchase new equipment and enhance qualification of ambulance staff.

An increase in the number of calls and a decrease in the availability of medical staff at the EMS wards, in turn, reduce the effectiveness of EMS crews (table 9).

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