

NEW PROFESSIONAL COMPETENCES OF INPATIENT EMERGENCY DEPARTMENT STAFF

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Abstract. The purpose of the study is to determine the professional competencies that are in demand among emergency medical personnel when they provide medical care in an inpatient department.

Materials and research methods. We compared the impersonal reports on the work done by 20 doctors of specialized substations of the emergency medical service in St. Petersburg for 2015–2017 with the information about work in the mode of daily activities in 2017 of 10 doctors in the intensive care unit of the inpatient department of the Emergency Medical Service of the First St. Petersburg State Medical University named after academician I.I. Pavlov, stored in the qMS medical information system of the University. The volume of instrumental examination of patients who sought medical help, received it in the required volume and were discharged in a satisfactory condition within the first day, was assessed. We compared the results of ultrasound diagnostics performed by the emergency doctors in the screening mode using portable equipment with the results of the work of a consultant-specialist. 701 medical records of inpatients from among those admitted to the Medical University were analyzed. By studying 4573 medical records, possibility and effectiveness of independent primary triage of the incoming patients by the nursing staff was determined. In addition, with the help of the FlexSim HealthCare program, which allows to effectively predict and to simulate changes in work processes within medical institutions, computer simulation of the department's work was carried out in the conditions of autonomous work of an emergency doctor.

Statistical comparison was performed using the Mann-Whitney test, Student's t-test for unrelated values, and analysis of four-field tables using the χ -square test.

Research results and their analysis. Analysis of the research results showed:

- fundamental principles of work of the staff of inpatient department – multidisciplinary, multitasking, autonomy. An ambulance doctor working in a stationary environment must be able to independently diagnose, to treat patients with various pathologies, and to simultaneously supervise several patients;
- having the level of practical and theoretical training specified in the professional standard, the emergency doctor can effectively provide resuscitation care in the volume of I – II levels, which is especially important, given the short time spent by patients in the department;
- professional standard of the emergency doctors requires to master ultrasound diagnostics to identify gross pathological conditions and to perform a number of manipulations;
- nursing staff working in the inpatient department must be able to work in an autonomous environment. Triage by nurses is effective and allows to identify patients who need an immediate examination by an EMS doctor. The use of a three-level sorting algorithm does not contradict basic principles of medical triage used in world practice.

Key words: doctors, computer simulation, emergency medical care, inpatient department, nurses, professional competence, three-level triage algorithm, triage, ultrasound screening.

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НОВОЕ В ПРОФЕССИОНАЛЬНЫХ КОМПЕТЕНЦИЯХ ПЕРСОНАЛА СТАЦИОНАРНОГО ОТДЕЛЕНИЯ СКОРОЙ МЕДИЦИНСКОЙ ПОМОЩИ

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Резюме. Цель исследования – определение профессиональных компетенций, востребованных у сотрудников скорой медицинской помощи (СМП) при оказании ими медицинской помощи в условиях стационарного отделения (отделение). **Материалы и методы исследования.** Сравнивались обезличенные отчеты о проделанной работе 20 врачей специализированных подстанций СМП г. Санкт-Петербурга за 2015–2017 гг. с информацией о работе в режиме повседневной деятельности в 2017 г. 10 врачей в палате реанимации и интенсивной терапии (ПРИТ) стационарного отделения СМП Первого Санкт-Петербургского государственного медицинского университета им. акад. И.П. Павлова (Медицинский университет, Университет), хранящейся в медицинской информационной системе (МИС) qMS Университета. Оценивался объем инструментального обследования пациентов, которые обратились за медицинской помощью, получили её в необходимом объеме и в течение первых суток были выписаны в удовлетворительном состоянии. Сравнивались результаты выполнения врачом СМП самостоятельной ультразвуковой диагностики в режиме скрининга с использованием портативной аппаратуры с результатами работы консультанта-специалиста. Была проанализирована 701 медицинская карта стационарного больного из числа поступивших в Медицинский университет. Путем изучения 4573 медицинских карт определяли возможность и эффективность проведения силами среднего медицинского персонала самостоятельной первичной медицинской сортировки поступивших пациентов. Кроме того, с помощью программы FlexSim HealthCare – программа позволяет эффективно прогнозировать и моделировать изменение рабочих процессов внутри медицинских учреждений – осуществлялось компьютерное имитационное моделирование работы отделения в условиях автономной работы врача СМП.

Статистическое сравнение осуществлялось с помощью критерия Манна-Уитни, t-критерия Стьюдента для несвязанных величин и анализа четырехпольных таблиц с использованием критерия χ^2 -квadrat.

Результаты исследования и их анализ. Анализ результатов исследования показал:

- основополагающие принципы работы сотрудника стационарного отделения – мультидисциплинарность, многозадачность, автономность. Врач СМП, работающий в стационарных условиях, должен уметь самостоятельно ставить диагноз, лечить пациентов с различной патологией, одновременно курировать несколько больных;
- имея уровень практической и теоретической подготовки, указанный в профессиональном стандарте, врач СМП может эффективно оказывать реаниматологическую помощь в объеме I–II уровня, что особенно важно, учитывая краткие сроки нахождения пациентов в отделении;
- профессиональный стандарт врача СМП требует от него владения ультразвуковой диагностикой для выявления грубых патологических состояний и выполнения ряда манипуляций;
- средний медицинский персонал, работающий в стационарном отделении, должен уметь работать в условиях автономной деятельности. Медицинская сортировка, проводимая медицинскими сестрами – эффективна и позволяет выделять пациентов, нуждающихся в немедленном осмотре врачом СМП. Применение трехуровневого сортировочного алгоритма не противоречит основным принципам медицинской сортировки, используемым в мировой практике.

Ключевые слова: врачи, компьютерное имитационное моделирование, медицинская сортировка, медицинские сестры, профессиональные компетенции, скорая медицинская помощь, стационарное отделение, трехуровневый сортировочный алгоритм, УЗ-скрининг

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Introduction

At the beginning of the XXI century one of the key events for the ambulance service was the order of the Ministry of Health of Russia dated June 20, 2013 No. 388n, which approved the Procedure for the provision of ambulance, including specialized ambulance, medical care¹. The order legalized the stationary stage of the provision of emergency medical care. The new working conditions resulted in the creation of a professional standard for emergency doctors – approved by order of the Ministry of Labor of Russia dated March 14, 2018 No. 133n. The standard presents a generalized function "Provision of ambulance, including specialized ambulance, medical care outside medical organization, as well

as on an outpatient and inpatient basis"². Changing the professional standard requires a revision of educational programs, for which it is necessary to compare competencies which are necessary in prehospital and hospital (inpatient) periods. As a long-term experience of functioning of inpatient emergency departments shows, an emergency doctor should be able to make decisions without involving related specialists, to understand a wide range of pathological conditions and to simultaneously supervise several patients. In emergency situations department staff may be assigned the task of admitting and of triaging a large number of patients. In this case it is extremely important to make right decisions quickly and – often – to implement them independently.

¹ On approval of the Procedure for the provision of ambulance, including specialized ambulance, medical care: order of the Ministry of Health of Russia dated June 20, 2013 No. 388n

² Professional standard of an ambulance doctor: Approved by order of the Ministry of Labor of Russia dated March 14, 2018 No. 133n

Work in an emergency room for nursing staff: rotation between the department zones, work in the anti-shock ward, triage process — all this requires expanding professional competencies of a nurse. The nurse often has to combine the skills of a bandage room, ward, procedural nurse, anesthetist [1]. In her work, a nurse deals with a syndromic approach to a patient, with monitoring, artificial lung ventilation, with catheterization of great vessels, with drainage of cavities, etc. At the same time, since patients are in the department for a fairly short time, long-term care skills are less in demand. While treatment tasks and clinical situations are familiar, to one degree or another, to the nursing staff, their active involvement to the triage process has practically not been considered so far.

The purpose of the study is to determine professional competencies which are in demand among ambulance workers when they provide medical care in inpatient conditions.

Research objectives

In the course of the study, skills and knowledge used by emergency doctors in prehospital and hospital periods were compared. A possibility of independent work of a doctor in intensive care unit (ICU) and of performing ultrasound diagnostics by him was assessed. We analyzed the results of independent triage performed by nurses in inpatient department of a university clinic while working in the mode of daily activities.

Materials and research methods. The impersonal reports on the work done by 20 doctors of substations of emergency medical service in St. Petersburg for 2015–2017 were compared with information about work in the mode of daily activities in 2017 of 10 doctors in the intensive care unit of the inpatient department of the emergency room of the First Saint Petersburg State Medical University named after academician I.P. Pavlov (hereinafter — Medical University, University), stored in the medical information system qMS of the University. The volume of instrumental examination of patients who sought medical help, received it in the required volume and were discharged in a satisfactory condition within the first day was assessed. We compared the results of ultrasound diagnostics performed by the emergency doctor in the screening mode using portable equipment with the results of the work of a consultant-specialist. 701 medical records of inpatients from among those admitted to the Medical University were analyzed. By studying 4573 medical records, possibility and effectiveness of independent primary triage of incoming patients by the nursing staff was determined. In addition, using the FlexSim HealthCare program — which allows to effectively predict and to simulate changes in work processes within medical institutions — computer simulation of the department's work was carried out under the conditions of autonomous work of an emergency doctor [2, 3].

Statistical comparison was performed using the Mann-Whitney test, Student's t-test for unrelated values, and analysis of four-field tables using the χ -square test.

Research results and their analysis. Comparison of the workload and comparison of the professional skills of anesthesiologists-resuscitators of a specialized emergency medical station and of an inpatient hospital department showed that in the prehospital period, emergency medical personnel were less likely to encounter patients who needed auxiliary or artificial lung ventilation, i.e. a significant part of patients and victims did not have pronounced disorders of vital functions (Table 1). This was confirmed by a significant difference in the frequency of central venous catheterization. The result was no surprise, since the decision to call a specialized brigade is made remotely, i.e. on the basis of insufficient information, and is interpreted in favor of the person seeking emergency medical care. At the same time, comparing the

groups of doctors, there was a significant difference in frequency of puncture / drainage of pleural cavity, of electrical impulse therapy, of ultrasound diagnostics; in the studied reports, there was no ultrasound data in the prehospital period — most likely due to the fact that equipping the stations with a portable ultrasound diagnostic apparatus is optional.

The study of medical records of patients discharged from the department during the first day showed that they underwent, on average, (2.82 ± 0.06) instrumental examinations. Some of them were performed or interpreted independently by emergency doctor, and some were recommended by consultants — doctors of "narrow" specialization — urologists, neurologists, surgeons, etc. The latter significantly more often prescribed additional examination methods to patients (Table 2). Since these patients did not undergo major surgical interventions and did not require long-term hospitalization, we can say that involvement of "narrow" specialists was excessive. Unfortunately, current clinical guidelines for emergency medical care and procedures for providing care for various conditions often oblige the emergency doctor to engage doctors of other specialties.

The volume of resuscitation and anesthesiological care in intensive care unit usually does not exceed level II — the minimum volume of specialized resuscitation care — according to the classification proposed by Yu.S. Polushin et al. [4]. Patients stay in intensive care units for a fairly short period of time, and the tasks solved by doctors include instrumental examination with simultaneous correction of life-threatening conditions — complex therapy of acute respiratory disorders, infusion-transfusion therapy, correction of acute circulatory failure by simple measures, etc.

Таблица 1/ Table No. 1

Применение профессиональных навыков врачами специализированных реанимационных бригад станций СМП и врачами ПРИТ стационарного отделения

Use of professional skills by doctors of specialized resuscitation teams of ambulance stations and by doctors of resuscitation and intensive care unit of the inpatient emergency department

Показатель Indicator	Врачи реанимационных бригад Resuscitation team doctors, n=4	Врачи ПРИТ отделения Inpatient department resuscitation and intensive care unit doctors, n=3
Число пациентов, пролеченных за год, чел., (M±m) Number of patients treated per year, people, (M±m)	772,3±9,5	238±4,7*
Частота случаев катетеризации центральных вен, % Incidence of central venous catheterization, %	2,8±0,2	5,5±0,8*
Частота случаев ВВЛ ¹ /ИВЛ ² , % Incidence of assisted ventilation ¹ /artificial lung ventilation ² , %	4,2±0,5	8,9±1,1*
Частота случаев ЭИТ ³ /дефибрилляции, % Electric impulse therapy ³ /defibrillation incidence, %	2,3±0,2	7,8±1,9*
Частота случаев пункции/дренирования плевральной полости, % Incidence of puncture / drainage of pleural cavity, %	0,08±0,01	0,67±0,03*
Частота случаев самостоятельного выполнения УЗИ, % Frequency of cases of self-performed ultrasound, %	0	34,4±4,2*

* различия статистически значимы, $p < 0,05$ /group differences are statistically significant

¹ ВВЛ — вспомогательная вентиляция лёгких /assisted ventilation

² ИВЛ — искусственная вентиляция лёгких /artificial lung ventilation

³ ЭИТ — электроимпульсная терапия /Electric impulse therapy

Таблица 2/ Table No. 2

Частота применения в стационарном отделении инструментальных методов обследования в зависимости от привлечения или не привлечения консультанта

Frequency of application of instrumental examination methods in the inpatient department, depending on whether or not a consultant is involved

Показатель Indicator	Консультант / Consultant	
	привлекался involved	не привлекался not involved
Число пациентов, чел. Number of patients, people	365	336
Количество инструментальных методов обследования пациента, абс., (M±m): Number of instrumental methods of patient examination, abs.:		
- выполнены врачом или м/с СтОСМП - performed by a doctor or by a nurse of the inpatient emergency department	1,31±0,04	1,38±0,05
- выполнены специалистом - performed by a specialist	1,67±0,07*	1,28±0,07
Всего / Total	2,98±0,08	2,67±0,07

* различия статистически значимы, $p < 0,05$ / group differences are statistically significant

The authors also assessed the performance of 7 doctors who worked in the intensive care unit of the emergency room of the university clinic: they compared the results of the work of four anesthesiologists-resuscitators and of three emergency doctors who had experience working in specialized intensive care teams in the prehospital period. All 7 specialists had the same monthly workload. A retrospective analysis of 272 medical records of patients admitted to the emergency room of the emergency department was carried out.

Anesthesiologists-resuscitators (group 1) provided medical care to 178 patients, including 95 men and 83 women; an average age of patients is (66.4±7.04) years; emergency doctors (group 2) – 94 patients; of them, men – 48, women – 46; an average age of the patients was (69.1±10.09) years. All patients met the red stream triage criteria. Analysis of the performance of therapeutic manipulations showed that frequency of tracheal intubation and of mechanical ventilation was the same, and differences were observed during catheterization of the great vessels (Table 3). As a result of these procedures, no cases of complications were observed. Also, in both groups of doctors, there were no significant differences in length of stay in the department, in the duration of hospitalization of patients and in the level of hospital mortality.

The autonomy of the work of emergency doctors in the inpatient department should be manifested both in the treatment and in the diagnostic process. In foreign practice, such a specialist actively uses ultrasound examination methods, without involving a specialist in radiation diagnostics. To perform screening in an inpatient emergency department, it is optimal to use portable scanners. The protocols developed in recent years make it possible to reduce the time spent for this and at the same time to obtain the most reliable amount of information. Using a "pocket" scanner, one can quickly identify a life-threatening condition and focus on significant findings. At the same time, this does not exclude the involvement of a specialist consultant to perform a full-fledged ultrasound examination to confirm the preliminary diagnosis in a complex clinical situation. The professional standard of emergency doctor, approved in 2018, presupposes ability to use ultrasound monitoring for the recognition of free fluid in the pericardium, pleural and abdominal cavities, pneumothorax, as

well as to perform puncture and catheterization of peripheral and central veins using ultrasound navigation [5–8].

For more than 5 years, the routine examination of patients seeking medical help at the inpatient department of the Medical University included a screening ultrasound study by doctors on duty. All of them are pre-trained in an 8-hour theoretical course on ultrasound diagnostics, after which together with the specialist on duty, they practiced the skills for a month. The authors analyzed the medical records of 405 surgical and therapeutic patients who were admitted to the department on an emergency basis. Upon admission, the department doctor performed screening ultrasound examination of chest and abdominal cavity organs using a portable apparatus for all patients. Immediately after the screening, a certified physician performed a full examination using a stationary apparatus.

The results obtained were compared, and the frequency of erroneous conclusions of emergency doctors was determined, which could or could not affect the treatment and diagnostic tactics. A detailed analysis of errors showed that only in 16 cases – 3.95% of the total number – an incorrect conclusion could have an impact on the course of treatment and diagnostic process (Table 4).

In addition to diagnostics in ultrasound screening mode, department staff actively used a portable device for ultrasound navigation when performing diagnostic and therapeutic punctures, as well as during catheterization of great vessels. In 2017, in the inpatient department, emergency doctors independently performed: 47 pleural punctures for hydrothorax, 2 times – puncture of tense ascites, 3 times – suprapubic punctures of bladder, and no complications were observed. The implementation of the procedures without involvement of other specialists significantly reduced the treatment time, which had a beneficial effect on the patient's condition. Currently, the department also uses portable devices for diagnosis of pulmonary embolism – expansion of the inferior vena cava, presence of floating blood clots in the veins of the lower extremities.

The authors carried out an experiment with a computer model of inpatient emergency department, made using the FlexSim HC program [9]. The emergency doctor was provided with greater autonomy in comparison to the real data obtained

Таблица 3/ Table No. 3

Сравнение результатов, полученных в исследуемых группах врачей

Comparison of results obtained in the studied groups of doctors

Показатель Indicator	Группа 1 / Group No.1, n=4	Группа 2 / Group No.2, n=3
Госпитальная летальность среди пролеченных пациентов, % Hospital mortality among treated patients, %	16,85	17,02
Длительность пребывания в СтОСМП, ч Duration of stay in the inpatient emergency department, h	5,1±0,76	5,2±1,04
Длительность пребывания в клинике, сут Length of stay in the clinic, days	16,5±1,8	15,1±2,2
Частота выполнения ЦВК ¹ , % Frequency of central venous catheterization, %	34,8±2,5	23,4±2,1*
Частота выполнения ИВЛ, % Artificial lung ventilation frequency, %	8,9±1,2	8,5±1,3

* различия статистически значимы, $p < 0,05$ / group differences are statistically significant

¹ЦВК – катетеризация центральных вен / central venous catheterization

after the analysis of the qMs medical information system data. In addition, the frequency of ultrasound examinations and consultations performed by third-party specialists was reduced – they were independently performed by a virtual emergency doctor. In the model, the frequency was empirically established: ultrasound studies – 0.15 instead of actual 0.7; consultations – 0.15 instead of 0.8 per patient with 75 admissions per day (Table 5).

As a result of the experiment, time spent by patients in yellow and green zones significantly decreased, and there was also a decrease in the load on the medical staff due to the absence of repeated examinations and of additional transportation of patients.

Ultrasound lung screening was used by the department's doctors while working in the context of the COVID-19 pandemic. Patients in stable condition, who did not have gross bilateral changes during ultrasound examination of the chest cavity, underwent computed tomography of the chest organs on the first day, not in urgency mode. This allowed us to optimize work of radiological service.

At present, in the inpatient department of the Medical University, all emergency nurses carry out triage using a simple three-level algorithm developed at the Emergency medical care research institute named after I.I. Dzhanlidze [10-15]. We studied 4,753 medical records of patients admitted to the department during the first half of 2018.

Таблица 4/Table No.4

Ошибочные заключения при выполнении УЗИ-скрининга

Erroneous conclusions when performing ultrasound screening

Не выявленная/ошибочно выявленная патология Unidentified / mistakenly identified pathology	Количество случаев, абс. Number of cases, abs.
Признаки острого холецистита – абсцесс, инфильтрат, крупный конкремент, расслоение стенки желчного пузыря Signs of acute cholecystitis – abscess, infiltration, large calculus, dissection of the gallbladder wall	5
Пневмония/Pneumonia	3
Гидроторакс /Hydrothorax	1
Гидроперикард /Hydropericardium	1
Аневризма брюшной аорты /Abdominal aortic aneurysm	1
Объемное образование органов брюшной полости /Volumetric formation of the abdominal organs	1
Поражение почек – гидронефроз, крупные кисты/Kidney damage – hydronephrosis, large cysts	4

* различия статистически значимы, $p < 0,05$ /group differences are statistically significant

Таблица 5/Table No. 5

Результаты эксперимента с расширением обязанностей врача стационарного отделения

Results of the experiment with expanding the duties of an inpatient doctor

Показатель Indicator	До эксперимента Before experiment	После эксперимента After experiment
Длительность пребывания в зонах отделения, мин, (Т±t): Duration of stay in the areas of the department, min		
- красная зона/red zone	108,5±10,1	103,9±11,8
- желтая зона/yellow zone	219,6±13,2	179,2±12,5*
- зеленая зона/green zone	288,9±13,4	239,1±12,9*

* различия статистически значимы, $p < 0,05$ /group differences are statistically significant

It was decided, using the available data, to retrospectively compare the triage of patients using a three-level scale with the RETTS scale widely used in Scandinavian countries (Table 6). Comparison with RETTS was due to the fact that the scales have a related origin and common parameters used to assess the patient's condition. The analysis showed that the time frames for starting treatment of patients were fully complied with regardless of the characteristics of a particular scale. The time from the moment of admission to the medical examination of the "red" and "green" streams did not differ significantly, the "yellow" stream was examined almost 2.5 min faster, which is significantly better compared to that for the RETTS scale, and the distribution of the "orange" stream between the "red" and "yellow" streams did not harm the patient, since the time did not exceed the required 15 minutes. In the proposed scale, a significantly larger (more than 3 times) number of patients of the "red" stream was due to the redistribution of the "orange" stream into it, as well as the requirements of the Procedures for rendering assistance to patients with a cardiological and neurological profile, according to which the examination of patients with suspected acute coronary syndrome and acute cerebrovascular accident are carried out in conditions of the intensive care unit.

In our opinion, reducing the number of groups simplified the decision-making process for nurses, which is essential for the introduction of nursing triage. The triage performed by nursing staff made it possible to ensure a competent distribution of forces and means, and attention was paid primarily to more severe patients.

The experience of triage in the admission department of an infectious hospital during COVID-19 pandemic had its own specifics, which is associated with the massiveness of admissions and with the peculiarities of working with incoming stream. The vast majority of admissions had an incoming diagnosis of U07.1 or U07.2, confirmed clinically, instrumentally or by a laboratory. Primary triage was carried out directly in the process or before the preparation of medical records. The triage nurse's attention was primarily focused on arterial blood SpO₂, as patients often had severe hypoxemia with relative external well-being, which required immediate placement in a follow-up room or to intensive care to start respiratory support.

Таблица 6/Table No 6

Результаты проведения медицинской сортировки пациентов с применением сортировочных шкал RETTS и медицинского университета и время до их врачебного осмотра

Results of triage of patients using RETTS and medical university triage scales and time to their medical examination

Показатель Indicator	Шкала RETTS/RETTS Scale		Шкала медицинского университета Scale of medical university	
	число пациентов, чел./number of patients, people	расчетное время, мин./time, min	число пациентов, чел./number of patients, people	расчетное время, мин./time, min
Сортировочный поток: Sorting stream:				
- красный/red	442	0	1407	0
- оранжевый/orange	1111	1,64±0,13	Не выделяется/Not identified	
- желтый/yellow	1548	17,3±0,6	1522	14,8±0,3*
- зеленый/green	1652	35,9±3,3	1824	34,7±4,3

* различия статистически значимы, $p < 0,05$ /group differences are statistically significant

Conclusion

1. Fundamental principles of work of an inpatient emergency department employee — multidisciplinary, multitasking, autonomy. An ambulance doctor working in a stationary environment must be able to independently diagnose, to treat patients with various pathologies, and to simultaneously supervise several patients.

2. Having the level of practical and theoretical training specified in the professional standard, an emergency doctor can effectively provide intensive care in the volume of I – II levels, which is especially important given the short time spent by patients at the inpatient emergency department stage. With the emergence of inpatient departments in a large number of multidisciplinary hospitals, the ability to work as an ambulance doctor in the intensive care

unit will reduce the shortage of anesthesiologists and resuscitators [16, 17].

3. The professional standard of an ambulance doctor requires proficiency in ultrasound diagnostics to identify gross pathological conditions and to perform a number of manipulations. The use of portable scanners in daily work ensures optimization of the workflow both when working in the mode of daily activities and in emergencies of biological and social nature.

4. The nursing staff working in inpatient emergency department must be able to work in conditions of autonomous activity. The triage performed by nurses is effective and allows to identify patients in need of immediate examination by an ambulance doctor. The use of a three-level sorting algorithm does not contradict the basic principles of medical triage used in world practice.

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