Received: 13 June 2022 / Accepted: 15 August 2022 / Published online: 31 August 2022

***DOI 10.34689/SH.2022.24.4.028***

***UDC 616-083.88- 14.882***

# COMPARATIVE ANALYSIS OF MEDICAL TECHNICIAN SERVICE SYSTEMS IN FOREIGN COUNTRIES AND THE REPUBLIC OF KAZAKHSTAN. LITERATURE REVIEW

**Diana G. Ygiyeva[1], https://orcid.org/0000-0001-8391-8842**
**Lyudmila M. Pivina[1], https://orcid.org/0000-0002-8035-4866**
**Galymzhan N. Abilov[2],**
**Asylzhan M. Messova[1], https://orcid.org/0000-0001-5373-0523**
**Almas A. Dyussupov[1], https://orcid.org/ 0000-0002-2086-8873**
**Gulnara B. Batenova[1], https://orcid.org/0000-0003-3198-1860**
**Sabit M. Zhussupov[3], https://orcid.org/0000-0002-0551-126X**
**Ayaulym E. Akhmetova[1], https://orcid.org/ 0000-0002-4593-9404**
**Maksim R. Pivin[1], https://orcid.org/ 0000-0001-7206-8029**
**Adilzhan G. Zhumagaliyev[1], https://orcid.org/0000-0002-2364-375X**
**Oxana A. Yurkovskaya[1], https://orcid.org/ 0000-0002-6251-5574**

**[1] NCJSC «Semey Medical University», Semey c., Republic of Kazakhstan;**
**[2] NCJSC "Social Health Insurance Fund", The Branch in the Abay region, Semey c., Republic of Kazakhstan;**
**[3] Pavlodar branch of NCJSC «Semey Medical University», Pavlodar city, Republic of Kazakhstan.**

**Abstract**

**Introduction.** In emergency situations, the first people on the scene may be persons who do not have a professional medical education, but who have been trained in the skills of providing primary pre-hospital medical care. Their actions in most cases are key in saving the patient's life.

**The aim** of the study is a comparative analysis of the organization of the service of medical technicians in various countries for its successful implementation in the Republic of Kazakhstan.

**Materials and methods**. A search was made for scientific publications in evidence-based medicine databases (PubMed, UpToDate, TripDatabase, ResearchGate, GoogleScholar and CyberLeninka. Search keywords: "Emergency medical technician", "emergency medical services", "emergency healthcare system", "paramedic", and " medical first responder." A total of 467 references were found, of which 49 articles were selected for further analysis.

**Results.** In foreign countries, the functions of medical technicians are limited to basic skills in the form of cardiopulmonary resuscitation, automatic external defibrillation, hemorrhage control, limb, and pelvic immobilization, and oxygen therapy; they are trained in ECG recording and interpretation in myocardial infarction and are licensed to use a limited range of drugs used in shock, myocardial infarction, hypoglycemia, or drug poisoning. The duration of the training course ranges from 40 to 84 hours, depending on the number of skills acquired. According to the Order of the Minister of Health of the Republic of Kazakhstan dated December 15, 2020, in our country, first aid can be provided by persons without medical education who have received appropriate training and are trained in first aid skills.

**Conclusion.** When introducing the service of medical technicians in the Republic of Kazakhstan, it is necessary to take into account the experience of developed foreign countries, which makes it possible to judge the high efficiency of training programs that include a wide range of competencies and skills.

***Keywords:*** *paramedics, medical technicians, emergency medicine, emergency medical care.*

**Резюме**

# СРАВНИТЕЛЬНЫЙ АНАЛИЗ СИСТЕМ СЛУЖБЫ МЕДИЦИНСКИХ ТЕХНИКОВ В ЗАРУБЕЖНЫХ СТРАНАХ И РЕСПУБЛИКЕ КАЗАХСТАН. ОБЗОР ЛИТЕРАТУРЫ

**Диана Г. Ыгиева[1], https://orcid.org/0000-0001-8391-8842**
**Людмила М. Пивина[1], https://orcid.org/0000-0002-8035-4866**
**Галымжан Н. Абилов[2],**
**Асылжан М. Месова[1], https://orcid.org/0000-0001-5373-0523**

**Алмас А. Дюсупов[1], https://orcid.org/ 0000-0002-2086-8873**
**Гульнара Б. Батенова[1], https://orcid.org/0000-0003-3198-1860**
**Сабит М. Жусупов[3], https://orcid.org/0000-0002-0551-126X**
**Аяулым Е. Ахметова[1], https://orcid.org/ 0000-0002-4593-9404**
**Максим Р. Пивин [1], https://orcid.org/ 0000-0001-7206-8029**
**Адильжан Г. Жумагалиев[1], https://orcid.org/0000-0002-2364-375X**
**Оксана А. Юрковская[1], https://orcid.org/ 0000-0002-6251-5574**

**[1] НАО «Медицинский университет Семей», г. Семей, Республика Казахстан;**
**[2] НАО «Фонд социального медицинского страхования», Филиал по области Абай, г. Семей, Республика Казахстан;**
**[3] Павлодарский филиал НАО «Медицинский университет Семей», г. Павлодар, Республика Казахстан.**

**Введение.** В экстренных ситуациях первыми на месте события могут оказаться лица, не имеющие профессионального медицинского образования, однако прошедшие обучение навыкам оказания первичной доврачебной медицинской помощи. Их действия в большинстве случаев являются ключевыми в спасении жизни пациента.

**Цель исследования** - сравнительный анализ организации службы медицинских техников в различных странах для ее успешного внедрения в Республике Казахстан.

**Материалы и методы**. Проведен поиск научных публикаций в базах данных доказательной медицины (PubMed, UpToDate, TripDatabase, ResearchGate, GoogleScholar и CyberLeninka. Ключевые слова для поиска: «Emergency medical technician», «emergency medical services», «emergency healthcare system», «paramedic», «medical first responder». Всего было найдено 467 литературных источников, из которых для последующего анализа были отобраны 51 статей.

**Результаты**. В зарубежных странах функции медицинских техников ограничены базовыми навыками в виде сердечно-легочной реанимации, автоматической наружной дефибрилляции, остановки кровотечения, иммобилизации конечностей и таза, оксигенотерапии; они обучены методике записи ЭКГ и ее интерпретации при инфаркте миокарда, имеют разрешение на использование ограниченного набора лекарственных средств, применяемых при шоковых состояниях, инфаркте миокарда, гипогликемии или отравлениях наркотическими средствами. Продолжительность курса обучения находится в диапазоне от 40 до 84 часов в зависимости от числа приобретаемых навыков. Согласно Приказу Министра здравоохранения Республики Казахстан от 15 декабря 2020 года, в нашей стране первую медицинскую помощь могут оказать лица без медицинского образования, которые прошли соответствующую подготовку и обучены навыкам оказания первой помощи.

**Заключение.** При внедрении службы медицинских техников в Республике Казахстан необходимо учитывать опыт развитых зарубежных стран, позволяющий судить о высокой эффективности программ обучения, включающих широкий спектр компетенций и навыков.

***Ключевые слова**: парамедики, медицинские техники, неотложная медицина, скорая медицинская помощь.*

**Түйіндеме**

# ШЕТ ЕЛДЕРДЕГІ ЖӘНЕ ҚАЗАҚСТАН РЕСПУБЛИКАСЫНДАҒЫ МЕДИЦИНАЛЫҚ ТЕХНИКТЕР ҚЫЗМЕТІНІҢ ЖҮЙЕСІН САЛЫСТЫРМАЛЫ ТАЛДАУ. ӘДЕБИЕТТЕРГЕ ШОЛУ

**Диана Г. Ыгиева[1], https://orcid.org/0000-0001-8391-8842**
**Людмила М. Пивина[1], https://orcid.org/0000-0002-8035-4866**
**Ғалымжан Н. Әбілов[2],**
**Асылжан М. Месова[1], https://orcid.org/0000-0001-5373-0523**
**Алмас А. Дюсупов[1], https://orcid.org/ 0000-0002-2086-8873**
**Гульнара Б. Батенова[1], https://orcid.org/0000-0003-3198-1860**
**Сабит М. Жусупов[3], https://orcid.org/0000-0002-0551-126X**
**Аяулым Е. Ахметова[1], https://orcid.org/ 0000-0002-4593-9404**
**Максим Р. Пивин [1], https://orcid.org/ 0000-0001-7206-8029**
**Адильжан Г. Жумагалиев[1], https://orcid.org/0000-0002-2364-375X**
**Оксана А. Юрковская[1], https://orcid.org/ 0000-0002-6251-5574**

**[1] «Семей медицина университеті» КеАҚ, Семей қ., Қазақстан Республикасы;**

**[2] "Әлеуметтік медициналық сақтандыру қоры" КеАҚ, Абай облысы бойынша филиалы, Семей қ., Қазақстан Республикасы;**
**[3] Павлодар филиалы «Семей медицина университеті» КеАҚ, Павлодар, Қазақстан Республикасы.**

**Кіріспе.** Төтенше жағдайларда оқиға орнында бірінші болып кәсіби медициналық білімі жоқ, алайда алғашқы медициналық көмек көрсету дағдыларына оқытылған адамдар келуі мүмкін. Медициналық техниктер пациенттердің денсаулық сақтау қызметімен өзара әрекеттесуінің алғашқы буыны болып табылады, сондықтан олардың әрекеттері көп жағдайда пациенттің өмірін сақтап қалудың кілті болып табылады.

**Зерттеу мақсаты** әртүрлі елдердегі медициналық техниктер қызметін Қазақстан Республикасында оны табысты енгізу үшін ұйымдастыруды салыстырмалы талдау болып табылады.

**Материалдар мен әдістер.** Дәлелді медицина (PubMed, UpToDate, TripDatabase, ResearchGate, GoogleScholar және CyberLeninka) деректер базасында ғылыми жарияланымдарды іздеу жүргізілді. Іздеу үшін кілт сөздер: "Төтенше медициналық техникалық", "Төтенше медициналық қызметтер", "Төтенше Денсаулық сақтау жүйесі", "парамедик", "медициналық бірінші жауап". Барлығы 467 әдеби дереккөз табылды, олардың ішінен кейінгі талдау үшін 51 мақала таңдалды.

**Нәтижелері.** Шет елдерде медициналық техниктердің функциялары: жүрек-өкпе реанимациясы, автоматты сыртқы дефибрилляция, қан кетуді тоқтату, аяқ-қол мен жамбас иммобилизациясы, оксигенотерапия; миокард инфарктісі кезінде ЭКГ жазу және оны түсіндіру, шок жағдайлары, миокард инфарктісі, гипогликемия кезінде қолданылатын дәрілік заттардың шектеулі жиынтығын пайдалануға рұқсаты бар. Оқу курсының ұзақтығы алынған дағдылардың санына байланысты 40-тан 84 сағатқа дейін. Қазақстан Республикасы Денсаулық сақтау министрінің 2020 жылғы 15 желтоқсандағы бұйрығына сәйкес біздің елімізде медициналық білімі жоқ, тиісті дайындықтан өткен және алғашқы көмек көрсету дағдыларына оқытылған адамдар алғашқы медициналық көмек көрсете алады.

**Қорытынды.** Қазақстан Республикасында медициналық техниктер қызметін енгізу кезінде құзыреттілік пен дағдылардың кең спектрін қамтитын оқыту бағдарламаларының жоғары тиімділігін бағалауға мүмкіндік беретін дамыған шет елдердің тәжірибесін ескеру қажет.

***Түйінді сөздер**: "Төтенше медициналық техник", "Төтенше медициналық қызметтер", "Төтенше Денсаулық сақтау жүйесі", "парамедик", "медициналық бірінші жауап".*

**Bibliographic citation:**

Ygiyeva D.G., Pivina L.M., Abilov G.N., Messova A.M., Dyussupov A.A., Batenova G.B., Zhussupov S.M., Akhmetova A.E., Pivin M.R., Zhumagaliyev A.G., Yurkovskaya O.A. Comparative analysis of medical technician service systems in foreign countries and the Republic of Kazakhstan. Literature review // *Nauka i Zdravookhranenie* [Science & Healthcare]. 2022, (Vol.24) 4, pp. 231-239. *doi 10.34689/SH.2022.24.4.028*

*Ыгиева Д.Г., Пивина Л.М., Абилов Г.Н., Месова А.М., Дюсупов А.А., Батенова Г.Б., Жусупов С.М., Ахметова А.Е., Пивин М.Р., Жумагалиев А.Г., Юрковская О.А.* Сравнительный анализ систем службы медицинских техников в зарубежных странах и Республике Казахстан. Обзор литературы // Наука и Здравоохранение. 2022. 4(Т.24). С. 231-239. *doi 10.34689/SH.2022.24.4.028*

*Ыгиева Д.Г., Пивина Л.М., Әбилов Ғ.Н., Месова А.М., Дюсупов А.А., Батенова Г.Б., Жусупов С.М., Ахметова А.Е., Пивин М.Р., Жумагалиев А.Г., Юрковская О.А.* Шет елдердегі және Қазақстан Республикасындағы медициналық техниктер қызметінің жүйесін салыстырмалы талдау. Әдебиеттерге шолу // Ғылым және Денсаулық сақтау. 2022. 4 (Т.24). Б. 231-239. *doi10.34689/SH.2022.24.4.028*

**Introduction**

"Emergency Medical Aid" is a broad term used either to define a certain level of certification or generally to describe individuals capable of responding to an emergency [49]. The first responder is the first health worker who comes into contact with the patient [19]. It can be a passer-by, a volunteer, a security guard, a firefighter, or a police officer, if he has the appropriate skills [5].

In Kazakhstan, as well as throughout the world, there are often emergency situations that require immediate decision-making and emergency medical care [43]. Such situations include water accidents, car, and other transport accidents, terrorist attacks, environmental impacts, fires, falls from a height, etc. [36]. In all these cases, the first on the scene may be persons who do not have a professional medical education, but who have been trained in the provision of primary pre-hospital medical care [20]. Their skillful and timely actions can help save the lives and working capacity of victims of accidents and disasters [21].

In foreign countries, a paramedic is a medical professional who provides emergency medical care in emergency and urgent situations [50]. In the structure of the paramedical service in developed countries, four levels of specialists can be distinguished - from an entry-level medical technician (first responder) to a paramedic who has the entire set of skills and competencies necessary to provide full-fledged medical care, including prescribing parenteral drugs [6]. Paramedics stand out as a separate profession, which has more advanced requirements in terms of education and qualifications. A Medical Technician is a certification level below that of a Paramedic [12]. They mainly work in private ambulance services, municipal

ambulance services, hospitals, fire departments, and law enforcement agencies [27].

In practice, paramedics constantly encounter acute conditions that require practical skills in providing emergency medical care. The patient outcome depends on the effectiveness of airway management and chest compressions [17,18]. In cases where cardiopulmonary resuscitation begins in the first 8 minutes after cardiac arrest, survival can be maintained at 20% [14], and the use of defibrillation in cardiopulmonary resuscitation in the first 3-5 minutes after cardiac arrest has a survival rate of up to 75%. Every minute without action increases the death rate by 7-10% [32]. Access to better technology, education, and organized healthcare systems will enhance survival results. Understanding the structure and scope of emergency medical service (EMS) systems is crucial to comprehend the elements that enable EMS systems to achieve the best survival outcomes.

In 2020, the Republic of Kazakhstan issued an Order “On approval of the Rules for the provision of first aid by persons without medical education, including those who have received appropriate training and the Standard for the provision of first aid”, according to which contingents such as law enforcement officers should receive compulsory training in first aid courses, interacting in the course of their activities with the population, military personnel, employees of national security agencies, troops of the national guard; representatives of the fire and rescue service, crew members of air, water and rail transport; drivers of all types of public vehicles, employees of security organizations; employees of educational organizations (teachers of educational institutions, preschool institutions), hazardous production facilities, healthcare organizations who do not have a medical education [1].

**The aim** of the study is a comparative analysis of the organization of the service of medical technicians in various countries for its successful implementation in the Republic of Kazakhstan.

**Search strategy**.

We have searched scientific publications in evidence-based medicine databases (PubMed, UpToDate, TripDatabase, ResearchGate). The search was also carried out using specialized search engines (GoogleScholar) and electronic scientific libraries (CyberLeninka). Inclusion criteria: studies performed on humans, published in English and Russian, as well as full versions of articles with abstracts published between 2000 and 2021. Exclusion Criteria: Book chapters, dissertations, conference papers, and all studies that did not report the findings of the EMS, that are not published, or that do not have an abstract and full text. Search keywords: "Emergency medical technician", "medical first responder", "emergency medical services", "emergency healthcare system", "paramedic". In total, 467 relevant sources were found, from which 51 publications were selected for further analysis.

**Research results and discussion**

**The history of the formation of the paramedical service**

In the United States, until 1970, ambulances were staffed by "orderlies" who provided first aid to patients. They were then called high-class first aid specialists [9]. For ambulances, for "orderlies" of the early primary response to emergencies, and for medical equipment carried inside, there have not yet been established clear rules of operation or standardization methods for training [13]. Around 1966, medical researchers began to notice that soldiers with severe wounds and polytrauma on the battlefield had a better survival rate than those who were seriously injured in traffic accidents on the freeways. Early studies linked this fact to a number of factors: comprehensive trauma care, rapid transport to medical stations, and a new type of medical orderly. He was trained in certain life-saving skills, such as infusions and oxygenation through the respiratory tract, which allowed the victim to survive during transport to the medical station [8].

In the 1960s, Los Angeles cardiologist Walter S. Graf raised the issue of the lack of care given to patients with coronary disease during transport to the hospital [39]. In 1969, as a president of the Los Angeles Department of the American Heart Association, he created the "Mobile Intensive Care Unit" [8]. It included: a van, a nurse, and a portable defibrillator. That same year, his influential patient, a member of the Los Angeles County Board of Supervisors, convinced supervisors to approve a pilot program to train county firefighters as "mobile critical care paramedics." A change in state law was needed to allow personnel other than doctors and nurses to provide emergency medical care. The adopted law on paramedics met with resistance from doctors, nurses, and lawyers. Despite this, paramedic training began the following month at Freeman Memorial Hospital. It was the first nationally accredited paramedic training program in the United States [3].

Other communities in the United States have also experimented with advanced emergency medicine. Freedom House Pittsburgh paramedics are considered the first emergency medical technician (EMT) trainees in the United States. Almost simultaneously and completely independently of each other, pilot programs began in three centers in the United States: Miami (Florida); Seattle (Washington); Los Angeles (California). All of them were aimed at determining the effectiveness of the use of firefighters to perform medical skills in a pre-hospital setting. The management of the fire departments was initially strongly against this concept, actively protested, and tried many times to cancel such pilot programs.

Other countries have also developed a new approach to prehospital care. In 1972 in Denver, the first civilian first aid service appeared on the Flight for Life helicopter [29]. Such ambulance helicopters soon began to be used in other parts of the United States. To this day, ambulance helicopters with paramedics and nurses are used in large metropolitan areas [51]. Throughout the 1970s and 1980s, the paramedical service continued to evolve. During the evolution of paramedicine, a significant part of the skills and curricula have changed repeatedly. Technology has also evolved and changed, as it soon became clear that pre-hospital conditions are different from hospital conditions; the standard equipment that physicians used in hospitals could not handle the stresses of the less controlled pre-hospital setting [47]. By about 1990, a significant proportion of prehospital emergency care referrals began to disappear. They have been replaced by results-based research (evidence-based medicine) as the gold standard of medicine. This marked the beginning of the development of

the practice of both paramedics and emergency physicians. Procedures and protocols were only used after studies were conducted based on results that showed their need. Paramedics began to take responsibility for their mistakes, and this also led to changes in the list of required skills and competencies [23]

**Characteristics of the specialty "medical technician"**

Medical technicians have the knowledge and skills to provide immediate life-saving measures while waiting for an ambulance to arrive. These are specially trained people for out-of-hospital emergency care [30]. Nowadays, there are many different types of emergency services, each with a different level of training, ranging from first aid to basic life support. Medical technicians have a limited amount of nursing skills, clinical experience, or clinical skills [26]. A medical technician can be any volunteer citizen, firefighter, police officer, or emergency medical officer. Some medical technicians are paid workers, while others are volunteers (especially in rural areas) and work on a voluntary basis [24]. They provide medical care in accordance with protocols, which in most cases were drawn up by medical associations [25].

These protocols vary considerably from country to country, with corresponding changes in the list of required competencies. For example, in the UK and France, the functions of medical technicians are limited to basic skills in the form of cardiopulmonary resuscitation, automatic external defibrillation, hemorrhage control, limb and pelvic immobilization, and oxygen therapy. At the same time, in the UK, medical technicians are trained in the technique of ECG recording and its interpretation in myocardial infarction. In Canada and the United States, medical technicians, in addition to the skills described, are licensed to use a limited range of drugs used for shock, myocardial infarction, hypoglycemia, or drug poisoning. At the same time, medical technicians are only entitled to use drugs only orally (aspirin, nitroglycerin in acute coronary syndrome, glucose in hypoglycemic coma) or subcutaneously (epinephrine using a syringe pen). The duration of the training course ranges from 40 to 84 hours, depending on the number of skills acquired (Table 1) [40, 15, 22, 10].

*Table 1.*

**Comparative characteristics of the competencies of medical technicians from different countries and their training programs.**

| Country | Levels of emergency medical care by medical technicians | Competences and skills of the first level of emergency medical care | Duration of education | The people who can be trained |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |
| Canada | Emergency Medical Responder (EMR), Primary Care Paramedic (PCP) | Airway oxygen supply, use and interpretation of a pulse oximeter and glucometer rates, measurement of blood pressure, chest auscultation, administration of the following drugs: antihistamines, glucose, analgesics, aspirin, nitroglycerin, nitrous oxide, salbutamol. They can also administer naloxone and epinephrine using an auto-injector. | Medical First Responder-5-days, Emergency Medical Responder – 10 days | Firefighters, employees in police departments and agencies across Canada, volunteers over the age of 18 |
| USA | Emergency medical responder (EMR), Emergency medical technician (EMT), Advanced emergency medical technician (AEMT) | EMRs provide cardiopulmonary resuscitation, semi-automated defibrillation, basic airway clearance skills (suction), oxygen therapy, and administration of essential life-saving drugs (epinephrine and naloxone). | 40–60 hours | Volunteer in rural areas or mainly work as firefighters or search and rescue workers. |
| Irish Republic | Pre-Hospital Emergency Care Council responder levels (basic life support (BLS)): Cardiac first responder (CFR), Cardiac first responder (advanced) (CFR-A), First aid responder (FAR), Emergency first responder (EFR), Basic tactical emergency care (B-TEC). | CFR- basic life support, CPR and the use of an automated external defibrillator,<br>CFR-A - use of a bag valve mask (BVM) and supraglottic airway management, pulse checks and oxygen administration,<br>FAR - common medical emergencies, injury management and shock, burns, hyper and hypothermia as well as trauma-related injuries such as the management of bleeding and fractures, etc.<br>EFR - cardiovascular emergencies, general medical emergencies, musculoskeletal head and spinal injuries, pediatrics and childbirth, oxygen therapy,<br>B-TEC - use of nasopharyngeal airways, hemostatic agents, and tourniquets. | CFR and CFR-A - one-day course, FAR - three-day course, EFR - five-day course, B-TEC - tactical course available to EFRs, EMTs, and paramedics to provide medical interventions in hostile environments | EMTs are a very important part of private, public and ancillary services |

*Continuation of Table 1.*

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| UK | Emergency care assistants (ECA) or emergency care support workers (ECSW), Ambulance technicians, or emergency medical technicians (EMTs), | Cardiopulmonary resuscitation, including manual defibrillation, chest palpation, auscultation and percussion, oral cleansing, pelvic immobilization, 12-lead ECG recording and interpretation of ST-elevation at myocardial infarction, abdominal palpation, auscultation and percussion, bleeding stops. | Emergency Medical Technician Course - 14 days | They work as assistant paramedics or technicians. |
| France | Emergency response services from the fire department, private ambulance companies (emergency home care), and ambulance technicians | First aid for airway obstruction; bleeding, wounds, burns; cardiac arrest; drowning; automatic external defibrillation; limb immobilization. | Program for the first responders - 35 hours | Firefighters or Ambulance Association Volunteers |

**Organization of service of medical technicians in different countries.**

In foreign countries, there are many emergency medical services at the pre-hospital level before the arrival of an ambulance. These services include Emergency Medical Responder (EMR), Primary Care Paramedic (PCP), Emergency medical technician (EMT), Advanced emergency medical technician (AEMT), Cardiac first responder (CFR), Cardiac first responder (advanced) (CFR-A), First aid responder (FAR), Emergency first responder (EFR), Basic tactical emergency care (B-TEC), Emergency care assistants (ECA) or emergency care support workers (ECSW), Ambulance technicians, or emergency medical technicians (EMTs).

Medical technicians are the first link between patients and the health service, so their actions in most cases are key to saving a patient's life. There are now allied professionals in many countries with medical technician skills for on-scene decision-making [38, 33] or treatment of minor injuries [44]. These countries include the USA, Canada, and France (Table 1). Depending on the country, emergency medical care may be provided by one service or several different types of services. In some countries, the ambulance service operates separately from services such as firefighters or law enforcement officers [34]. In other countries, employees of these services can provide emergency medical care, as they have the certificate of "medical technician" required for employment [35]. For example, in France, firefighters provide first aid to the population. Each country has its own volume of necessary practical skills, which affects the length of training for medical technicians [11].

In the United States, members of the fire, police, and emergency medical services must complete emergency medical training and pass examinations in order to be eligible to serve in the public service [37].

In developed countries, volunteers over 18 years old, and employees of private and municipal organizations can be trained as "medical technicians". Some emergency organizations set up volunteer teams that can be sent to the scene to provide emergency medical care before the arrival of an ambulance. Such organizations include community response teams operated by ambulance services in the UK [4], and volunteer groups operated by fire services in France [28]. In some countries, such as the USA, and France, there may be autonomous groups of volunteers who have been trained as medical technicians. For some citizens this is a paid job, others are just volunteers [7].

To save money in rural areas, many countries use the combined emergency service feature, which is that all personnel are trained not only to provide emergency medical care but also to perform basic fire and police functions. This is very convenient for neighborhoods where demand or budget is too low to support all kinds of emergency services [48]. This arrangement maximizes the use of limited resources or budget and, with a unified team, can effectively respond to any emergency.

Pre-hospital emergency medical service can be largely divided into Franco-German or Anglo-American approaches. The "stay and stabilize" tenet underpins the Franco-German concept of EMS delivery. This model's goal is to make the hospital accessible to patients. It is often operated by doctors, who have a broad range of expertise and access to cutting-edge equipment [31]. Less patients need to be transported to hospitals because emergency physicians can make clinical decisions at the site incident. When a patient needs hospitalization, the emergency department is bypassed and they are immediately admitted to hospital wards. Franco-German EMS system is well developed in nations like Germany, France, Greece, Malta, and Austria.

In contrast to the Franco-German model Anglo-American model is based on «load and go» principle. This means rapid transportation of patients to Emergency Department with fewer pre-hospital interventions by trained paramedics and medical technicians [16, 46]. The US, Canada, New Zealand, Australia, and the Sultanate of Oman are among the nations that use this type of EMS delivery [46, 45]. Both models are the subject of debate to this day. The first approach is mainly used for trauma care, the second approach is more convenient for therapeutic situations such as respiratory and cardiac arrest.

Asia-Pacific countries have unique EMS systems that differ greatly from the Franco-German or Anglo-American models. EMS systems are underdeveloped and, on average, have a short history of less than 15 years. In Southeast Asian nations (Thailand, Malaysia, Singapore) and East Asian nations/regions, fire-based EMS systems

are prevalent (Taiwan, Japan, Korea). The majority of nations run their EMS systems on a public budget. With the exception of Thailand and Turkey, the majority of the countries' ambulance personnel are emergency medical technicians (EMTs) and paramedics. In Thailand, an ambulance service consists of a nurse, two intermediate EMTs, and, if necessary, an emergency physician. All ambulance staff have received training in using AEDs and performing basic possess certification in basic cardiac life support and possess abilities such as managing airways [42]

In practice, paramedics constantly encounter acute conditions that require practical skills in providing emergency medical care. Patient outcome depends on the effectiveness of airway management and chest compressions [17, 18]. In cases where cardiopulmonary resuscitation begins in the first 8 minutes after cardiac arrest, survival can be maintained at 20% [14], the use of defibrillation in cardiopulmonary resuscitation in the first 3-5 minutes after cardiac arrest has a survival rate of up to 75%. Every minute without action increases the death rate by 7-10% [32]. Access to better technology, education, and organized healthcare systems will enhance survival results. Understanding the structure and scope of emergency medical service (EMS) systems is crucial to comprehend the elements that enable EMS systems to achieve the best survival outcomes.

Emergency medical care in Kazakhstan is provided by paramedics and specialized (medical) teams in accordance with the Order of the Minister of Health of the Republic of Kazakhstan dated July 03, 2017y. The paramedic's team includes two paramedics and a driver. The specialized (medical) team includes a doctor, a paramedic, and a driver. Thus in Kazakhstan, there is a combination of the Franco-German and Anglo-American systems. According to the results of the survey data, instrumental diagnostics, the dynamics of the patient's condition in the background or after the therapeutic measures, in accordance with the preliminary diagnosis, reflecting the causes of this condition, the paramedic or physician of the ambulance team takes one of the following decisions: transportation of the patient to a medical organization providing inpatient care; the patient is left at the call site; the patient is left at home (in fact of residence) [2].

**Training of persons without medical education in first aid in the Republic of Kazakhstan.**

Kazakhstan, a developing country with an economy in transition, has a number of problems in the field of emergency care. In Kazakhstan, the number of people per ambulance brigade is 10,000 people. Whereas one brigade in Austria and the USA serves 3,500 people, in Finland 7,000, and in Bulgaria 7,500 people. However, in Canada 1 ambulance serve 12,000, in Sweden 11,250, in Lithuania 11,700, in Netherlands 25,000, in Estonia 15,000, in Norway 25,000, in Netherlands 25 000, in UK 19,000 and in Turkey 32,600 people [41].

According to the Order of the Minister of Health of the Republic of Kazakhstan dated December 15, 2020, in our country, first aid can be provided by persons without medical education who have received appropriate training and are trained in first aid skills. First aid training should only be conducted by a certified trainer, with proof of completion of the course at the end of the training. Training of entry-level medical technicians in first aid skills is carried out in person, in the form of theoretical and practical training using simulation equipment (stretcher; cervical corset; hemostatic tourniquets; mannequin for simulating a foreign body in the upper respiratory tract; Ambu mask with a check valve for artificial ventilation of the lungs; collapsible tires; hypothermic packages; first aid kits for studying the contents and practicing actions for its use). Training of employees of an organization (enterprise) in first aid to victims must be provided by the employer in accordance with the order. If the employee first gets a job in the organization, the employer is obliged to provide training for the employee within the time limits established by the employer (or a person authorized by him), but no later than one month after hiring [1]. Subsequently, training of persons without medical education in first aid skills is carried out once every 3 years.

These courses are paid at the expense of the budget, employer's funds or own funds of citizens of the Republic of Kazakhstan. The training program includes algorithms for providing primary medical care for the following emergency conditions: lack of consciousness; cessation of breathing and circulation; external bleeding; foreign bodies of the upper respiratory tract; injuries to various areas of the body; burns, effects of exposure to high temperatures; frostbite and other effects of exposure to low temperatures; poisoning; convulsions; bites. The training program is 18 hours, which is much less than in developed countries, and does not allow one to acquire such necessary skills as providing first aid with the use of drugs for myocardial infarction or shock conditions that require very fast assistance.

**Conclusion.**

While there is no one model that is superior to the others, each community should choose the one that best suits its resources, targets, and objectives. The ultimate criterion for choosing which is better, nevertheless, should be patient satisfaction. When introducing the service of medical technicians in the Republic of Kazakhstan, it is necessary to take into account the experience of developed foreign countries, which makes it possible to judge the high efficiency of training programs that include a wide range of competencies and skills.

***Author Disclosures***

*The authors report there are no competing interests to declare*

***Funding.*** *The study is performed in the frame of the Project AP 14871609 "Optimizing the structure and improving the efficiency of the emergency medicine service in Kazakhstan by conducting training for people without medical education (medical technicians)".*

***Ethical approval details****. The study has approval of the Local Ethics Commission of the Semey Medical University on March 16, 2022*

***Литература:***

1. Приказ Министра здравоохранения Республики Казахстан от 15 декабря 2020 года № ҚР ДСМ-269/2020. Зарегистрирован в Министерстве юстиции Республики Казахстан 20 декабря 2020 года № 21814. «Об утверждении Правил оказания первой помощи

лицами без медицинского образования, в том числе прошедшими соответствующую подготовку и Стандарта оказания первой помощи»

2. Приказ Министра здравоохранения Республики Казахстан от 3 июля 2017 года № 450 «Об утверждении Правил оказания скорой медицинской помощи в Республике Казахстан». Дата обращения 18.02.2020. http://adilet.zan.kz/rus/docs/V1800016283

3. "Advanced Practice Paramedic". Archived from the original on 6 October 2011. Retrieved 18 September 2011.

4. "Ambulance Practitioner Qualification | Ambulance Technician | Emergency Medical Technician EMT". FutureQuals. Retrieved 11 February 2020.

5. "Emergency medical services workers: how employers can prevent injuries and exposures". 26 November 2018.

6. "Emergency Medical Technicians and Paramedics". United States Department of Labor, Bureau of Labor Statistics. Retrieved 12 July 2018.

7. "European Committee for Standards website". Retrieved 2008-09-19.

8. "History of EMS". wvde.state.wv.us. Retrieved 2 November 2016.

9. "National Standard Curriculum". National Highway Transportation Safety Administration. Archived from the original on 16 September 2008. Retrieved 10 March 2008.

10. "OFA to FAR Update". www.phecit.ie. Retrieved 9 May 2020.

11. "Paris Fire Department". Retrieved 2008-09-18.

12. "What's the Difference Between an EMT and a Paramedic?". UCLA Center for Prehospital Care. 28 December 2019.

13. Abram T. "Legal Opinion: Certification v. Licensure". National Registry of Emergency Medical Technicians. Archived from the original on 27 October 2007. Retrieved 10 March 2008.

14. American Heart Association | To be a relentless force for a world of longer, healthier lives

15. American Paramedic Association (americanparamedics.org),

16. *Arnold J.L.* International emergency medicine and the recent development of emergency medicine worldwide // J Ann Emerg Med 1999. Vol.33. N1. P. 97-103.

17. *Berden H.J., Willems F.F., Hendrick J.M., Pijls N.H., Knape J.T.* How frequently should basic cardiopulmonary resuscitation training be repeated to maintain adequate skills? // J BMJ. 1993. Vol.306 N6892. P. 1576-1577.

18. *Berg R.A., Hilwig R.W., Kern K.B., Ewy G.A.* Precountershock cardiopulmonary resuscitation improves ventricular fibrillation median frequency and myocardial readiness for successful defibrillation from prolonged ventricular fibrillation: a randomized, controlled swine study // J Ann Emerg Med. 2002. Vol. 40 N6. P.563-570.

19. *Bigham B.L., Jensen J.L., Tavares W., Drennan I.R., Saleem H., Dainty K.N., et al.* Paramedic self reported exposure to violence in the emergency medical services (EMS) workplace: A mixed methods cross sectional survey // J Prehosp Emerg Care 2014. Vol.18. N489. P. 94.

20. Board Of Critical Care Transport Paramedic. The Board for Critical Care Transport Certification. 2011. P. 34

21. *Booker M., Voss S.* Models of paramedic involvement in general practice // Br J Gen Pract. 2019// Vol. 69. N687. P. 477-478.

22. British Columbia Paramedic Association – Professional Body for Clinical Paramedic Practice in British Columbia Canada (paramedicsbc.ca)

23. *Burton John H.* (June 2006). "Out-of-Hospital Endotracheal Intubation: Half Empty or Half Full?". J Annals of Emergency Medicine // 2006. Vol. 47. N6. P. 542–544

24. CDC (11 February 2020). "Interim Recommendations for Emergency Medical Services (EMS) Systems and 911 Public Safety Answering Points/Emergency Communication Centers (PSAP/ECCs) in the United States During the Coronavirus Disease (COVID-19) Pandemic". Centers for Disease Control and Prevention. Retrieved 23 July 2020.

25. CDC (30 April 2020). "First Responders, Law Enforcement, and Public Services". Centers for Disease Control and Prevention. Retrieved 23 July 2020.

26. *Christopher Page, Keila Vazquez, Majd Sbat, Zeynep Deniz Yalcin.* Analysis of Emergency Medical Systems Across the World. Worcester Polytechnic Institute. Archived from the original on 24 December 2017. Retrieved 24 November 2017.

27. Emergency Medical Technician (EMT) (Speedy Study Guide). Speedy Publishing LLC. 2014. p. 1. ISBN 9781635011951.

28. Fleischmann T., Fulde G. "Emergency medicine in modern Europe". J Emergency Medicine Australasia // 2007. Vol.19. N4. P. 300–302.

29. *Grenvik A., Kochanek P.M.* "The incredible career of Peter J. Safar, MD: the Michelangelo of acute medicine" // J Critical Care Medicine // 2004. Vol.32. N2. P. 3–7.

30. Handbook for EMS Medical Directors, United States Department of Homeland Security Office of Health Affairs and U.S. Fire Administration.

31. *Huiyi T.* A study on prehospital emergency medical service system status in Guangzhou. Hong Kong: University of Hong Kong; 2007.

32. International Liaison Committee on Resuscitation (ilcor.org)

33. *Linwood R., Day G., FitzGerald G., Oldenburg B.* Quality improvement and paramedic care - What does the literature reveal for pre-hospital emergency care in Australia? // Int J Health Care Qual Assur. 2007. Vol. 20. N5. P. 405–415.

34. *Long D.N., Lea J., Devenish S.* The conundrum of defining paramedicine: more than just what paramedics “do” // J Australas Paramed. 2018. Vol.15. N1. P. 1–3.

35. *MacFarlane C.* The advances and evidence base for prehospital care // J. Emerg Med. 2003. Vol. 20. N2. P. 114–115.

36. *Messova A.M., Zhunusov Ye.T., Pivina L.M., Yolcu S.* TRIAGE system: literature review, problems and solutions in Kazakhstan // J Science & Healthcare. 2018. Vol.20. N5. P. 23-30.

37. *Myers J.B., Slovis C.M., Eckstein M., Goodloe J.M., Isaacs S.M., Loflin J.R., et al.* Evidence-based performance measures for emergency medical services

systems: a model for expanded EMS benchmarking // J Prehospital Emerg Care. 2008. Vol. 12. N2. P. 141–151.

38. National Audit Office. Transforming NHS ambulance services. In: London; 2011

39. *Newgard C.D., Schmicker R.H., Hedges J.R., Trickett J.P., Davis D.P., Bulger E.M. et al.* Emergency medical services intervals and survival in trauma: Assessment of the "golden hour" in a North American prospective cohor // J Ann Emerg Med. 2010. Vol. 55. N235. P. 46.

40. Paramedic Association of Canada – Paramedic Association of Canada.

41. Physicians (per 1,000 people) | Data (worldbank.org)

42. *Pivina L., Messova A.M., Zhunussov Y.T., Urazalina Z., Muzdubayeva Z., Ygiyeva D., Muratoglu M., Batenova G., Uisenbayeva S., Semenova Y.* Comparative analysis of triage systems at emergency departments of different countries: Implementation in Kazakhstan // J ROMJ. 2021. Vol. 10. N3.

43. *Pivina L.M., Batenova G.B., Baibusinova Zh.T., Manarbekov Ye.M., Dyussupov A.A., Urazalina Zh.M., Uysenbaeva Sh.O.* Analysis of the current situation of the emergency medical emergency and paramedic training system in the world and in the Republic of Kazakhstan. Literature review // J Science & Healthcare. 2020. Vol.22. N2. P. 5-15.

44. *Price R., Bendall J.C., Patterson J.A., Middleton P.M.* What causes adverse events in prehospital care? A human-factors approach // J Emerg Med. 2013. Vol. 30. N7. P. 583–588.

45. *Roessler M., Zuzan O.* EMS systems in Germany // J Resuscitation. 2006. Vol. 68. N1. P. 45-49

46. *Roudsari B.S., Nathens A.B., Arreola-Risa C., Cameron P., Civil I., Grigoriou G., et al.* Emergency Medical Service (EMS) systems in developed and developing countries // J Injury. 2007. Vol. 38. N9. P. 1001-1013.

47. *Sackett David L., Rosenberg William M.C., Gray J.A. Muir, Haynes R., Brian Richardson.* Evidence-based medicine: what it is and what it isn't // British Medical Journal. Vol. 312. N7023. P. 71–72.

48. *Turner J*. Building the evidence base in pre-hospital urgent and emergency care: a review of research evidence and priorities for further research. Sheffield: University of Sheffield Medical Care Research Unit; 2010.

49. V*arghese M., Sasser S., Kellermann A., Lormand J.D., Organization W.H.* Prehospital trauma care systems: Geneva: World Health Organization; 2005.

50. *Ventura Christian* (20 January 2021). The Emergency Medical Responder: Training and Succeeding as an EMT/EMR. Springer International Publishing.

51. *Wasserberger J.* The EMT's Training and Future. In Findeiss, C.J. (ed). Emergency Medical Care, Symposia Specialists. New York, International Medical Book Corp. 1974. P. 297-304

***References: [1-2]***

1.Prikaz Ministra zdravookhraneniya Respubliki Kazakhstan ot 15 dekabrya 2020 goda № ҚR DSM-269/2020. Zaregistrirovan v Ministerstve yustitsii Respubliki Kazakhstan 20 dekabrya 2020 goda № 21814. «Ob utverzhdenii Pravil okazaniya pervoy pomoshhi litsami bez meditsinskogo obrazovaniya, v tom chisle proshedshimi sootvetstvuyushhuyu podgotovku i Standarta okazaniya pervoy pomoshhi» [Order of the Minister of Health of the Republic of Kazakhstan dated December 15, 2020 No. ҚР ДСМ-269/2020. Registered with the Ministry of Justice of the Republic of Kazakhstan on December 20, 2020 No. 21814. "On approval of the Rules for the provision of first aid by persons without medical education, including those who have undergone appropriate training and the First Aid Standard"]

2.Prikaz Ministra zdravookhraneniya Respubliki Kazakhstan ot 3 iyulya 2017 goda № 450 «Ob utverzhdenii Pravil okazaniya skoroi meditsinskoi pomoshhi v Respublike Kazakhstan». Data obrashheniya 18.02.2020. [Order of the Minister of Health of the Republic of Kazakhstan dated July 3, 2017 No. 450 "On approval of the Rules for the provision of emergency medical care in the Republic of Kazakhstan". Retrieved 02/18/2020.] http://adilet.zan.kz/rus/docs/V1800016283

**Contact Information**

**Pivina Lyudmila M. –** Professor, Emergency Department, NCJSC «Semey Medical University», Semey c., Republic of Kazakhstan;

**Address:** Republic of Kazakhstan, 071400, Semey c., Abaya 103.

**Phone:** +7 705-522-73-00

**E-mail:** semskluda@rambler.ru