IMPACT OF EMERGENCY MEDICINE TRAINING IMPLEMENTATION ON PREHOSPITAL MORTALITY OUTCOMES IN KAZAKHSTAN

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Summary

Introduction It has been proven that high mortality is a consequence of improper and untimely medical care. A series of experimental and clinical studies have revealed relationship between patient survival after cardiac arrest and quality of cardiopulmonary resuscitation.

The aim of the study impact of emergency medicine training implementation on mortality outcomes in Kazakhstan.

Materials and methods The National Coordination Center for Emergency Medicine of Kazakhstan's prehospital mortality data for the years 2018–2021 were analyzed. Additionally, a study was done on ambulance staff members who received emergency care training in BLS, ASLS, PHTLS, and PALS between 2018 and 2020. Statistical Analysis Used: SPSS for Windows version 21.0.

Results Data analysis showed that training EMS personnel in emergency care resulted in a reduction in prehospital mortality. Rapid, targeted interventions by trained healthcare providers have played a pivotal role in saving lives. However, the prehospital mortality rate before ambulance arrival remains high.

Conclusion The introduction of specialized emergency medicine training in Kazakhstan has been a transformative step towards enhancing healthcare delivery. To reduce prehospital death rates, continued training of emergency medical personnel is necessary, as well as training for persons without medical education.

Keywords: Advanced cardiac life support, basic life suppo rt, cardiopulmonary resuscitation training.

Резюме

ВЛИЯНИЕ ВНЕДРЕНИЯ ОБУЧЕНИЯ НАВЫКАМ ОКАЗАНИЯ НЕОТЛОЖНОЙ ПОМОЩИ НА РЕЗУЛЬТАТЫ ДОГОСПИТАЛЬНОЙ СМЕРТНОСТИ В КАЗАХСТАНЕ

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Введение Доказано, что высокая смертность является следствием неправильно и несвоевременно оказанной медицинской помощи. Ряд экспериментальных и клинических исследований выявили связь между выживаемостью пациентов после остановки сердца и качеством сердечно-легочной реанимации.

Цель исследования: влияние внедрения обучения неотложной медицинской помощи на показатели смертности в Казахстане.

Материалы и методы: Проанализированы данные Национального координационного центра экстренной медицины Казахстана по догоспитальной смертности за 2018–2021 годы. Кроме того, было проведено исследование сотрудников скорой помощи, прошедших обучение неотложной помощи по BLS, ASLS, PHTLS и PALS в период с 2018 по 2020 год. Статистический анализ проводился при помощи программы SPSS для Windows, версия 21.0.

Результаты. Внедрение обучения неотложной медицинской помощи привело к существенному снижению уровня смертности, связанной с неотложной медицинской помощью. Быстрые и целенаправленные вмешательства квалифицированных медицинских работников сыграли решающую роль в спасении жизней. Анализ данных показал, что обучение персонала скорой помощи оказанию неотложной помощи по международным стандартам привело к снижению догоспитальной смертности. Однако уровень догоспитальной смертности до приезда скорой помощи остается высоким.

Заключение Внедрение специализированного обучения неотложной медицинской помощи в Казахстане стало преобразующим шагом на пути к улучшению оказания медицинской помощи. Для снижения догоспитальной смертности необходимо дальнейшее непрерывное обучение персонала скорой медицинской помощи, а также обучение лиц без медицинского образования.

Ключевые слова: базовая сердечно-легочная реанимация, расширенная сердечно-легочная реанимация, обучение сердечно-легочной реанимации.

Түйіндеме

ҚАЗАҚСТАНДА ЖЕДЕЛ КӨМЕК КӨРСЕТУДІ ОҚЫТУДЫ ЕНГІЗУДІҢ АУРУХАНАҒА ДЕЙІНІГІ ӨЛІМ-ЖІТІМ КӨРСЕТКІШТЕРІНЕ ӘСЕРІ

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Кіріспе Жоғары өлім-жітім шұғыл көмек көрсетудің дұрыс әрі уақтылы емес әрекеттің салдары екені дәлелденген. Бірқатар эксперименттік және клиникалық зерттеулерде жүрек тоқтағаннан кейін науқастың өмір сүруі мен жүрек-өкпе реанимациясының сапасы арасындағы байланыс анықталған.

Зерттеудің мақсаты: Қазақстандағы өлім-жітім деңгейіне жедел медициналық көмекті оқытуды енгізудің әсерін анықтау.

Материалдар мен әдістер Қазақстанның шұғыл көмек көрсетудің ұлттық үйлестіру орталығының деректері бойынша 2018–2021 жылдарындағы ауруханаға дейінгі өлім-жітім көрсеткіштері талданды. Сонымен қатар, 2018 және 2020 жылдар аралығында BLS, ASLS, PHTLS және PALS бойынша тренингтерін аяқтаған жедел медициналық жәрдем қызметкерлеріне зерттеу жүргізілді. Пайдаланылған статистикалық талдау: Windows жүйесіне арналған SPSS, 21.0 нұсқасы.

Нәтижелер. Жедел медициналық көмек көрсету бойынша оқытуды енгізу жедел медициналық көмекке байланысты өлім-жітім көрсеткіштерінің айтарлықтай төмендеуіне әкелді. Тәжірибелі медицина мамандарының жылдам және нақты араласуы өмірді сақтап қалу үшін маңызды болды. Деректерді талдау жедел жәрдем қызметкерлерін шұғыл көмек көрсетуге үйрету ауруханаға дейінгі өлім-жітімді азайтуға әкелгенін көрсетті. Дегенмен, жедел жәрдем келгенге дейін ауруханаға дейінгі өлім-жітім деңгейі жоғары болып қалды.

Қорытынды Қазақстанда мамандандырылған жедел медициналық көмекті оқытуды енгізу медициналық көмек көрсетуді жақсартуға бағытталған трансформациялық қадам болды. Ауруханаға дейінгі өлім-жітімді азайту үшін жедел медициналық қызметкерлерді одан әрі оқыту, сондай-ақ медициналық емес персоналды оқыту қажет.

Түйінді сөздер: негізгі жүрек-өкпе реанимациясы, кеңейтілген жүрек-өкпе реанимациясы, жүрек-өкпе реанимациясы бойынша тренинг.

Introduction

Resuscitation education plays a significant part in raising survival rates after cardiac arrest [20]. Although resuscitation education research is gaining popularity, the available data is scarce [7]. One of the main directions of development of the EMS service is the introduction of a unified system of continuous training for emergency medical service employees in accordance with international standards (BLS/ACLS/PALS/PHTLS) [6,8,21,22]. Kazakhstan has implemented strategic efforts to strengthen the skills of its healthcare staff through specialized training programs focused at improving resuscitation techniques, realizing the urgency of the situation.

International experience in teaching emergency care skills

At the moment, the largest organizations involved in the training of medical personnel and practical skills in providing informal medical care are [5,9,15]:

• American Heart Association (AHA)
• European Resuscitation Council (ERC)
• Australia and New Zealand Committee on Resuscitation (ANZCOR).
• Resuscitation Council of Asia (RCA).

USA

The American Heart Association (AHA) is a nonprofit organization in the United States dedicated to small medical research in the fields of cardiology, health education, and public health efforts to reduce disability and mortality caused by heart disease.

American Heart Association training programs: ACLS-EP and ACLS (advanced cardiopulmonary resuscitation skills), BLS for healthcare workers (basic life support), PALS (Pediatric Advanced Cardiopulmonary Life Support), Heartsaver – Non Healthcare (life saving – for persons without medical education), Directory of Emergency Cardiovascular Care - Directory of Emergency Cardiovascular Care, PEARS - Pediatric Emergency Assessment, Recognition and Stabilization. The Association currently has 3,400 training centers in the United States, more than 900 international training centers in 92 countries, and more than 350 million volunteers worldwide [5].

Europe

European Resuscitation Council (ERC) - European Interdisciplinary Council for Resuscitation and Emergency Medicine. Each year, the ERC conducts more than 16,000 non-formal health courses worldwide and issues more than 140,000 certificates [15] (2017).

Australia and New Zealand

The Resuscitation Council of Australia publishes guidelines to achieve its goals of ensuring uniformity and simplicity in resuscitation techniques and terminology. Recommendations are drawn up after consideration of all scientific and published materials are published only after acceptance by all representative organizations.

The Resuscitation Council of Asia (RCA) was founded on July 17, 2005 at Aichi Medical University, Japan. The founding members of the RCA are the Japan Resuscitation Council (JRC) (founded 2000), the Korean Association of Cardiopulmonary Resuscitation (KACPR) (founded 2002), and the National Resuscitation Council of Singapore (NRCS) (founded 1998)), and the National Council of Resuscitation of Taiwan. (NRCT) (founded 2000). In 2006, RCA became a permanent member of the International Liaison Committee on Resuscitation (ILCOR) [9].

Primary activity of organization is work on the need for health care to educate as many people as possible through informal care to improve survival after cardiac arrest.

This study aims evaluating the impact of specialized emergency resuscitation training on successful cardiopulmonary resuscitation outcomes in Kazakhstan.

Materials and methods

A retrospective cross-sectional study design was used, including a comprehensive review of reports from 2018–2021 following specialized emergency resuscitation training. A purposive sampling strategy was used to ensure inclusion

of cases that were medical emergencies requiring CPR intervention. The primary outcome was the achievement of return of spontaneous circulation (ROSC) after CPR. Statistical Analysis Used: SPSS for Windows version 21.0.

Results

The Implementation of Emergency Medicine Training

One of the main problems that existed in the emergency medical service at the beginning of 2017 was the insufficient qualifications of medical personnel - the existing training system for emergency medical personnel paid little attention to practical training in action algorithms in emergency situations. Knowledge of practical skills in emergency care did not meet international recommendations.

The global trend of increasing the number of simulation centers has not left Kazakhstan aside. A circle of specialists in this field is being formed, and international experience is being adapted to the characteristics of the national medical education system. Simulation techniques have firmly entered the medical education system and have become an integral part of training in healthcare. In most educational institutions, new structural units have appeared - simulation centers.

In order to ensure continuous and high-quality training of emergency services employees in practical skills in providing emergency medical care, simulation centers have been created at emergency medical stations. At the moment, in the National Coordinating Center for Emergency Assistance of the Ministry of Health of the Republic of Kazakhstan, there is an Educational and Training Center for training emergency services personnel in international standards BLS, ACLS, PALS, PHTLS. Also, 5 medical universities of the Republic of Kazakhstan provide training in emergency care skills according to international standards. The European Resuscitation Council (ERC) has appointed University Medical Centre of Nazarbayev University as its first official representatives in Central Asia on November 24, 2022 [14]. There are also private organizations that provide training, such as «Kazanada». «Kazanada» is an accredited international training institution for the American Heart Association (AHA) and the National Association of Emergency Medical Technicians (NAEMT) [12]. For healthcare workers and educators, Kazanada provides a comprehensive selection of courses, including Basic Life support (BLS), Advanced Cardiopulmonary Life Support (ACLS), Pre-Hospital Trauma Life Support (PHTLS), Pediatric Advanced Life Support (PALS) and Heartsaver, Neonatal Resuscitation Program (NRP), tactical emergency casuality care (TECC), geriatric EMS, EMS vehicle operator safety (EVO), All hazard disaster response (AHDR).

In Kazakhstan, as part of the reform of the emergency care system, a number of events were carried out: the introduction of unified coordination and structural management of points of emergency medical services (urban, rural stations, air ambulance, etc.), complete GPS navigation and informatization: the introduction of a unified information Dispatch system of sanitary transport, there is a call hold system by dispatchers who give instructions on how to perform CPR.; EMS departments have been created at primary health care, implemented a call category system, EMS medical personnel are trained according to international standards (BLS/ACLS/PALS/PHTLS): - "Basis Life Support (BLS); "Advanced cardiopulmonary resuscitation" - Advanced Cardiac Life Support (ACLS); "Advanced cardiopulmonary resuscitation in pediatrics", Pediatric Advanced Life Support (PALS); "Providing medical care at the prehospital stage for injuries" - Prehospital Trauma Life Support (PHTLS). In addition, ambulance drivers are trained in accordance with the international training "Training in the standard of safe driving techniques for ambulances".

In 2018, the share of emergency medical personnel aid trained in emergency medical care standards was: BLS – 75.1%, ACLS – 50.2%, PALS – 43.6%, PhTLS – 29.1% (table 1). In 2020, the percentage of emergency medical personnel trained in emergency care skills was BLS 79%, ACLS 67.9% PHTLS 57.8%, PALS -63.8%. However, due to the unfavorable situation regarding coronavirus infection, training was suspended from the second quarter of 2020.

Table 1.

Proportion of emergency medical personnel trained in emergency medical care standards.

BLS %			ACLS %			PHTLS %			PALS		
2018	2019	2020	2018	2019	2020	2018	2019	2020	2018	2019	2020
75,1	78	79,3	50,2	66,4	67,4	29,1	56	57,8	43,6	62,5	63,8

Analysis of indicators of successful resuscitation in Kazakhstan in 2018, 2019 and 2020 was 40.1%, 39.4% and 40.8 respectively. In 2021, there was a decrease in the percentage of successful resuscitations to 38.4% (however, the data was not statistically significant), which appears to be due to an increase in overall mortality due to coronavirus infection, as well as the cessation of training due to the COVID-19 pandemic. These indicators are significantly higher compared to the data of Russian colleagues, whose percentage of successful resuscitation was 0-27% [1-4].

Each year in the United States, there are approximately 350,000 outhospital CPRs with an average survival rate of 5 to 10 percent and 750,000 patients in hospitals with a survival rate of about 20 percent [16].

There is an increase in prehospital mortality before the arrival of an ambulance from 31,242 to 37,379 people (Table 2). Table 2 shows that from 2018 to 2021, 96.3% to 97.3% of prehospital deaths occurred before ambulance arrival. The high mortality rate before the arrival of an ambulance shows the need to train people without medical education.

Discussion

Scientific research has proven the obvious effectiveness of simulation training compared to traditional training [10,19]. Recent studies conducted by Russian specialists prove the need to increase the efficiency of training medical personnel, which can be achieved through the active introduction of simulation training into the process of continuous professional education [18].

Table 2.

Analysis of indicators of successful resuscitation and pre-hospital mortality in 2018-2021.

Indicators	2018	2019	2020	2021
Number of resuscitations performed by ambulance/primary care teams, total (absolute hours):	1977	1826	1975	1681
of which the number of cases of successful resuscitation performed by emergency medical services teams, in absolute terms:	792	719	805	646
% of the number of resuscitations performed by ambulance/primary care teams	40,1	39,4	40,8	38,4
Number of prehospital deaths, total:	32435	33223	34582	38401
% of total calls	0,40	0,40	0,48	0,47
number of cases of prehospital mortality before the arrival of ambulance/primary care teams	31242	32035	33437	37379
% of total prehospital mortality	96,3	96,4	96,7	97,3
number of cases of prehospital mortality in emergency medical care/primary care teams	1193	1188	1145	1022
% of total prehospital mortality	3,7	3,6	3,3	2,7

Training emergency medical personnel of the Republic of Kazakhstan

Spontaneous circulation may be restored in up to 53% of patients in highly skilled emergency medical service (EMS) systems, which include emergency physicians with training, at least until hospital admission [17]. According to statistical information of National Coordinating Center for Emergency Assistance, at the time of the implementation of the system of widespread training of emergency medical personnel of the Republic of Kazakhstan in the skills of providing emergency medical care in accordance with international standards (BLS, ACLS, PALS, PhTLS), the level of proficiency in these skills was less than 12%, and the proportion of cases of successful resuscitation from the total number of all resuscitations performed is 27.4%.

In this regard, one of the main strategic directions of the Ministry of Health of the Republic of Kazakhstan was the modernization of the system of postgraduate professional training of medical workers, the transition to continuous medical education using simulation technologies in accordance with international practice.

According to the director of the department of organization of medical care, before the reform, the average ambulance arrival time was 25 minutes. Prehospital mortality was 42%, of which 80% mortality was due to injuries and road accidents. The share of successful resuscitation provided by ambulance staff was 25,8% (2016)[13].

Training emergency medical personnel in the skills of providing emergency medical care in accordance with international standards allowed:

- improve training and quality control of a doctor's professional skills when conducting basic and advanced cardiopulmonary resuscitation (the share of trained personnel increased from 12% to 77.7% in 2018 (compared to 2016)).

- increase the efficiency of resuscitation measures from 25,8% to 40,8%(table 2) in 2020 (compared to 2016) [13].

- reduce the number of errors when performing basic CPR.

- improve the quality of medical care in case of sudden cardiac arrest.

- Improved Response Times: Specialized training has streamlined response times to emergencies. Healthcare providers are now equipped to make critical decisions swiftly, ensuring timely interventions that can significantly influence patient outcomes

- reduce the level of pre-hospital mortality from 0.42 to 0.40% in 2018 (compared to 2016) [13]. The percentage of prehospital deaths increased in 2020-2021 to 0.48 and 0.47 (table 2), which is apparently due to the cancellation of training due to the COVID-19 pandemic and high mortality due to coronavirus infection.

Despite the increased efficiency of resuscitation measures provided by ambulance, the rate of prehospital mortality before the arrival of ambulance remains high. More than 96% of prehospital deaths occur before ambulance arrival.

Before the modernization of the emergency medical care system in the Republic of Kazakhstan, there were a number of significant problems at the level of the dispatch service: insufficiently standardized processes, erroneous data verification (errors in the location of the patient, time and dates), insufficiently effective communications, triage of patients (identification of associated factors (convulsions in history of hyperthermia, etc.) and symptoms (FAS test, etc.), lack of remote assistance before the arrival of the ambulance team, etc. All these factors inevitably influenced the level of prehospital mortality. Starting from 2017, the country has undergone a powerful modernization emergency medicine system, which resulted in the formation of an effective system of timely, high-quality and effective ambulance and emergency medical care in accordance with international standards.

The main objectives of modernization were:

1. Optimization of the management system and organization of work of all departments of ambulance and emergency medical services.

2. Increasing the level of its accessibility, timeliness and quality, especially for the rural population.

3. Improving the main operational indicators of the work of ambulance teams.

4. Solving the problem of shortage of medical personnel: improving the medical education of ambulance staff in order to form a competitive human resources potential.

5. Strengthening the material and technical base of the emergency medical service.

6. Decrease in prehospital mortality rate.

7. Improving the activities of emergency medical dispatch services.

8. Development and implementation of new mechanisms to reduce the number of unnecessary calls and redirection of patients.

Challenges and Future Directions

One of the important issues in the process of training emergency medical service employees is the continuity of increasing and maintaining the level of acquired practical skills in providing emergency medical care. In accordance with the recommendations of the American Heart Association diseases on CPR and emergency care for cardiovascular diseases frequency courses should be held more than once every 2 years [5].

The use of standardized emergency medical care algorithms is the most important factor determining the level of emergency medical care. Thus, correct and timely implementation of initial resuscitation measures in the prehospital stage may be more important than subsequent treatment. One of the important factors in increasing the patient's chain of survival is the timely and correct provision of emergency medical care, including before the arrival of the emergency medical team. Previously, a comparative analysis of the competencies of persons without medical education in various countries was published for implementation in the Republic of Kazakhstan [23].

Unfortunately, at the moment, at the level of the dispatch service for patients, the processes are not sufficiently standardized: data verification is not carried out sufficiently (errors are made in the location of the patient, time is lost when clarifying the address), effective communications are not established, patient triage is not always carried out correctly (identification of associated factors (anamnesis) and symptoms, as a result, these factors significantly influence the level of prehospital mortality.

Thus, one of the main recommendations in terms of improving the qualifications of emergency services employees is to train employees without medical education (traffic police officers, the Ministry of Emergency Situations, drivers), the dispatch service in standardized provision of assistance before the arrival of the ambulance team.

In terms of the development of the emergency medical care dispatch service, automated call management systems have been introduced, informatization has been increased, and increased attention has been paid to the quality aspect of specialist training.

An additional stage of call dispatching is the stage "Pre-arrival instructions" - briefing before the arrival of the EMS team) - these are carefully thought-out instructions carried out by the dispatcher to provide first aid before the arrival of the EMS, including BLS. The National Association of Emergency Medical Services Physicians (NAEMSP) recommends that this step be established as a "mandatory step in the dispatch process in the emergency medical service system."

One study published in 2000 found that 97% of community members surveyed would call 911 in an emergency, and 67% of respondents expected that calling 911 would result in advance instructions regarding choking, lack of breathing, bleeding, and childbirth when appropriate.

However, at that time it was noted that many of these response items did not contain such instructions [11].

At this stage of development of the emergency medical services dispatch service, the priority steps are:

- approval of step-by-step, detailed algorithms for providing assistance at the level of dispatch center 103, entering data algorithms into the information system 103, including the algorithm for conducting BLS

- introduction of a mandatory stage of call dispatching - "Pre-arrival instructions" - briefing before the arrival of the EMS team.

- development and approval of uniform standardized operating procedures for dispatchers of service 103

- ensuring 100% informatization of control room 103 (automatic determination of geolocation, call encoding, consultation algorithms)

- changes in the approaches to training dispatchers to be able to provide advisory assistance on emergency conditions.

Conclusion

Training emergency medical services staff of the Republic of Kazakhstan in the skills of providing emergency medical care in accordance with international standards made it possible to improve the training and quality control of a doctor's and paramedic's professional skills when conducting basic and advanced cardiopulmonary resuscitation, increase the efficiency of resuscitation measures, reduce the number of errors when performing basic CPR, and improve the quality medical care for sudden cardiac arrest, reduce complications in patients and reduce pre-hospital mortality. To increase the chain of survival of the patient, it is necessary to provide timely and correct emergency medical care, including before the arrival of the emergency medical team. Continuing education for emergency medical professionals and non-medical individuals is necessary in order to lower the prehospital mortality rate.

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