

ROAD TRANSPORTATION INJURIES ON THE FEDERAL HIGHWAY IN THE REGION WITH A LOW POPULATION DENSITY: RELEVANCE OF THE PROBLEM AND WAYS OF ITS SOLUTION

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Abstract. The purpose of the study is to use the example of the Arkhangelsk region to identify conditions affecting the organization of medical care for victims of road accidents on the federal highway in a region with a low population density, and to determine the main directions of its improvement.

Materials and research methods. Using the method of comparative analysis, the following review was carried out: review of the authors' studies, the subject of which was the features of road traffic injuries on the federal highway M-8 "Kholmogory" within the Arkhangelsk region; review of domestic and foreign scientific research, review of regulatory documents on the provision of medical assistance to victims of road accidents. Scientific literature search was performed in eLibrary, PubMed, Scopus systems by keywords. Scientific articles published in 1990–2020 were selected for analysis. Using the method of an organizational experiment, a scientific substantiation of a set of measures to improve the efficiency of the provision of medical care in prehospital and hospital periods to victims of road traffic accidents at federal highway in regions of the Russian Federation with a low population density was carried out. Applying the method of system analysis, on the basis of the results of this study, conceptual provisions for a systemic register of health consequences of road accidents in the Russian Federation have been developed and scientifically substantiated.

Research results and their analysis. The article describes road traffic injuries on the federal highway M-8 "Kholmogory" in the Arkhangelsk region. The factors that determine the effectiveness of the provision of medical care in prehospital and hospital periods to victims of road traffic accidents are considered. The ways of improving the provision of medical care to victims of road traffic accidents at federal highway in a region with a low population density are formulated and substantiated.

Key words: ambulance teams, Arkhangelsk region, federal highway M-8 "Kholmogory", hospital period, prehospital period, regions with low population density, road traffic accidents, road traffic injuries, victims

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ДОРОЖНО-ТРАНСПОРТНЫЙ ТРАВМАТИЗМ НА ФЕДЕРАЛЬНОЙ АВТОДОРОГЕ В РЕГИОНЕ С НИЗКОЙ ПЛОТНОСТЬЮ НАСЕЛЕНИЯ: АКТУАЛЬНОСТЬ ПРОБЛЕМЫ И ПУТИ ЕЕ РЕШЕНИЯ

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Резюме. Цель исследования – на примере Архангельской области выявить условия, влияющие на организацию оказания медицинской помощи пострадавшим в дорожно-транспортных происшествиях (ДТП) на федеральной автодороге (ФАД) в регионе с низкой плотностью населения, и определить основные направления ее совершенствования.

Материалы и методы исследования. С использованием метода компаративного анализа выполнен обзор: результатов исследований авторов, предметом которых явились особенности дорожно-транспортного травматизма (ДТТ) на ФАД М-8 «Холмогоры» в пределах Архангельской области; результатов отечественных и зарубежных научных исследований, а также анализ нормативных документов по вопросам оказания медицинской помощи пострадавшим в ДТП. Поиск научной литературы выполнен в системах eLibrary, PubMed, Scopus по ключевым словам. Для анализа были отобраны научные статьи, опубликованные в 1990–2020 гг. С использованием метода организационного эксперимента выполнено научное обоснование проведения комплекса мероприятий по повышению эффективности и оптимизации оказания медицинской помощи в догоспитальном и госпитальном периодах пострадавшим в ДТП на ФАД в регионах Российской Федерации с низкой плотностью населения. Применяя метод системного анализа, на основе результатов настоящего исследования разработаны и научно обоснованы основные концептуальные положения системного регистра медико-санитарных последствий ДТП в Российской Федерации.

Результаты исследования и их анализ. Охарактеризован дорожно-транспортный травматизм на федеральной автодороге М-8 «Холмогоры» в Архангельской области. Рассмотрены факторы, определяющие результативность оказания медицинской помощи в догоспитальном и госпитальном периодах пострадавшим в ДТП. Сформулированы и обоснованы пути совершенствования оказания медицинской помощи пострадавшим в дорожно-транспортных происшествиях на ФАД в регионе с низкой плотностью населения.

Ключевые слова: Архангельская область, бригады скорой медицинской помощи, госпитальный период, догоспитальный период, дорожно-транспортные происшествия, дорожно-транспортный травматизм, пострадавшие, регионы с низкой плотностью населения, федеральная автодорога М-8 «Холмогоры»

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Introduction. Road traffic injuries remain one of the major problems in the organization of healthcare, disaster medicine, traumatology, emergency medical care and surgery [1-3]. Russian experts gave a comprehensive description of road traffic injuries, substantiated general principles of providing medical assistance to victims of road traffic accidents. At the same time, in the northern and eastern "marginal" regions of the country, characterized by a low population density and by significant distances between settlements and between medical organizations road traffic injuries have certain features that necessitate the use of different methods of medical support for victims of road accidents. These regions include the Arkhangelsk region, the area of which, together with the Nenets Autonomous Okrug, is comparable to the area of Spain and France, and the population density is less than 2 people per 1 square kilometre.

The leading motor transport artery of the Arkhangelsk region is the federal highway M-8 "Kholmogory" (hereinafter – M-8), which has the following features inherent in most northern routes: significant total length – more than 500 km; large spans – sections of the road between the nearest settlements and, accordingly, between the nearest medical organisations; tough road conditions – frequent fogs, low visibility in the autumn-winter and spring periods, strong side winds, frequent icing of the roadway. These factors significantly increase the risk of road traffic accidents with medical and sanitary consequences and negatively affect the timeliness of medical assistance to victims [4, 5].

Until now, the factors that determine the characteristics of road traffic trauma in a region with a low population density have not been comprehensively studied; in general, the problem of developing new methods of providing victims of such road accidents with timely and high-quality medical care remains unresolved.

The purpose of the study is to identify and to analyze the features of road traffic injuries on the federal highway M-8 "Kholmogory" in the Arkhangelsk region (the region with a low population density) and to determine the main ways of improving the provision of medical care to victims of road accidents.

Materials and research methods. An overview of the author's research results, the subject of which was the features of road traffic injuries at federal highway M-8 within the Arkhangelsk region, results of domestic and foreign scientific research, as well as analysis of regulatory documents on the problems of providing medical care to victims of road accidents is presented. Scientific literature search was performed in eLibrary, PubMed, Scopus systems by keywords. Scientific articles published in 1990–2020 were selected for analysis.

The study was conducted in accordance with the ethical standards set out in the Declaration of Helsinki. The research protocol was approved by the expert council on biomedical ethics of the Northern State Medical University, Arkhangelsk, protocol No. 08 / 11-17 of November 29, 2017.

Research results and their analysis. At the beginning of the XXI century in the Russian Federation, public attention is drawn to the problems of the Arctic. The fact of turning to the original Russian northern territories is associated with global climate change, with possibilities of long-term navigation and extraction of minerals, as well as with the need to strengthen national security. The strategic importance of northern and arctic regions is great for strengthening the economic and military power of Russia, for protecting and promoting Russian arctic interests [6–8]. The Russian Arctic includes large territories: the Murmansk Region, the Nenets, Yamalo-Nenets and Chukotka Autonomous Districts (AO), the northern regions of the Arkhangelsk and Magadan Regions, the Krasnoyarsk Territory, the Republics of Sakha (Yakutia), Karelia, Komi and others. It should be noted that these territories account for more than two-thirds of the area of our country.

As of January 1, 2020, average population density in the Russian Federation is 8.57 people per 1 km², and in the studied subjects of the Russian Federation (hereinafter – subjects) it varies from 2 to 1 person per 1 km², sometimes reaching values of less than 0.1 person per 1 km². Such a low population density in these regions developed historically and is due to the social foundations and customs of indigenous population. Underdeveloped road infrastructure, tough climatic, geographic and weather conditions and a high level of alcoholization in areas with low population density predetermine the specific features of both the occurrence of road traffic injuries with medical and sanitary consequences and the organization of medical care for victims in the prehospital and hospital periods [9, 10].

Number of road traffic injuries in these regions do not tend to decrease, and the results of treatment of victims with polytrauma on federal highways, in rural areas or in remote areas of these regions are usually unsatisfactory, which can be considered as a characteristic feature of Russian regions with low population density [11, 12].

Federal highways provide connection between these regions and with the rest of the territory of Russia, but the provision of medical assistance to victims of road accidents on these routes encounters significant difficulties [13–16].

At present, considering the provision of emergency medical care to victims of road accidents on the federal highway in the Arkhangelsk region, it can be concluded that despite the division of the region's territory into medical districts, there

is an extreme unevenness in the distribution of ambulance teams, as well as a clear lack of their number — so, in three large districts of the region: Kholmogorsky, Vinogradovskiy and Shenkurskiy (total length - about 380 km), through which the federal highway passes, emergency medical care is provided only by 8 ambulance teams that are not assigned to the highway, but serve calls from the districts of the Arkhangelsk region. Also, on the investigated federal highway there are no separate emergency response teams assigned to certain sections of it, and no route points to provide medical care to victims of road accidents [17].

A big problem for small central district hospitals located on federal highways in regions with a low population density is the arrival of more than two road accident victims — such a situation simply "paralyzes" the medical organization. Thus, in most of the small central district hospitals located at the federal highway in the Arkhangelsk Region, there is only one surgeon and one anesthesiologist-resuscitator; traumatologists-orthopedists, neurosurgeons, thoracic and abdominal surgeons, functional diagnosticians are almost completely absent, and the existing doctors are forced to combine several specialties, which affects the quality of the specialized medical care they provide. In many central district hospitals located on the federal highway, the medical equipment necessary for high-quality medical care in the hospital period to victims with severe multiple and concomitant injuries sustained in road accidents is obsolete.

Taking into account the territorial and geographical features of the regions of the Russian Federation, the organization of the sanitary aviation evacuation of victims of road accidents, especially from remote and hard-to-reach areas, is one of the highest priority measures to save lives and to preserve the health of victims. In a number of subjects of the Russian Federation (hereinafter referred to as the subject), the provision of emergency medical care is generally impossible without the use of medical aviation — Khanty-Mansi Autonomous Okrug, the Republic of Sakha (Yakutia), Chukotka Autonomous Okrug, the Komi Republic, Yamalo-Nenets Autonomous Okrug, Krasnoyarsk Territory and other regions of the Arctic, The Far North and equivalent territories [18–21].

Medical evacuation of victims of road accidents at M-8 federal highway is one of the most important components of the complex of treatment and evacuation measures in the system of their medical support in a region with a low population density. Currently, all victims who need medical evacuation are sent, in accordance with the routing approved by the Ministry of Health of the Arkhangelsk Region, to the level I trauma center "Arkhangelsk Regional Clinical Hospital".

The total number of medical evacuations of severe victims at federal highway is growing annually, amounting to about 500-600 departures per year, however, due to the long distance, as well as to tough climatic conditions (bad weather, strong winds, high clouds), delivery of the victim to the level I trauma center can be delayed for 1 day or more, which cannot but affect the patient's condition. In view of this, there is a need to revise and to change the routing of victims of road accidents on the M-8 federal highway in the southern districts of the Arkhangelsk region as they are the most remote from the regional center.

To reduce the volume of medical and sanitary consequences of road accidents; to achieve the target indicators determined by the Decrees of the President and the Decrees of the Government of the Russian Federation; to improve the technologies for providing medical care to victims

of road accidents at all stages, as well as to adapt them to the regional characteristics of subjects with special climatic and geographical conditions and to develop a mechanism for interaction between medical organizations performing the functions of trauma centers — it is necessary to build a system of information exchange among trauma centers and to organize monitoring of the health consequences of road accidents. Currently, the best solution for this is provided by the use of population registers, which are developed and successfully operate in many areas of medicine [22–24]. We propose to introduce a register, of distributed database type, which would allow: to generate and to store data on the diagnosis and treatment of victims of road accidents in the prehospital and hospital periods; to dynamically monitor their condition; to analyze in detail the lethality at all stages, as well as to assess the scale of road accidents both in the subject and in Russia as a whole. This register will assist in the development and adjustment of the routing of victims and will allow assessing the need for the regional health care system in material resources and in planning of its activities.

Conclusion

As forces and means of medical organizations available on the federal highway M-8 "Kholmogory" in the Arkhangelsk region are clearly not enough to provide a full-fledged medical care to victims of road accidents in the prehospital and hospital periods, it is necessary to justify and to develop a comprehensive system for providing the region with medical care. In our opinion, it is necessary:

1. To create emergency response teams with their attachment to a certain area of the M-8 federal highway for constant duty in order to provide emergency medical assistance to victims of road accidents. Each team should include 1 doctor and 1 paramedic or 2 qualified paramedics who have undergone mandatory training in providing emergency medical care to victims with severe multiple and concomitant injuries, as well as to victims of road accidents with more than two injured, including a driver. We consider it expedient and sufficient to create on the site for round-the-clock duty:

- one emergency response team — as part of the Severodvinsk emergency health care station;

- two emergency response teams — as part of the Arkhangelsk Regional Clinical Station of the emergency health care;

- one emergency response team as part of the Kholmogorsk Central Regional Hospital;

- one emergency response team — as part of Vinogradovskaya, Shenkurskaya and Velskaya central regional hospitals.

2. To re-equip the Yemetskaya regional hospital — a branch of the Kholmogorsk central district hospital — to the level III trauma center in order to eliminate more than 200-km gap on the M-8 federal highway, with an obligatory involvement of general surgeon, traumatologist-orthopedist and anesthesiologist-resuscitator, as well as with the purchase of all necessary equipment.

3. Equip a helipad, purchase a helicopter and organize the routing of victims of road accidents at the federal highway in the Shenkur and Velskiy districts to the level II trauma center — Velskaya central district hospital;

4. Create a systemic register of the medical and sanitary consequences of road traffic accidents in the Russian Federation and to manage it on a permanent basis in the Arkhangelsk region.

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