TYUMEN STATE MEDICAL UNIVERSITY

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SCIENTIFIC SUBSTANTIATION OF IMPROVEMENT OF THE SYSTEM OF NEUROLOGICAL CARE ORGANIZATION RURAL POPULATION IN MODERN CONDITIONS

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INTRODUCTION

Relevance of the research topic

Regardless of the region or the level of economic development of a particular country, the most important goal of the health care system is to meet the needs of the entire population (Boychenko Y. Y., 2018). These needs include the need for access to the full range of qualified health care, timely provided by experienced and professional health care workers, with the achievement of maximum results at the lowest possible cost (Zudin A. B., 2017). This need is even greater when working with low-income and vulnerable populations, especially when living in remote and rural areas (Yakushenko S. S., 2014).

The WHO Global Strategy "Health for All in the 21st Century", adopted back in 1998, implies achieving the highest possible level of health for all inhabitants of the world's regions.

Health protection of the rural population is currently of particular importance, since medico-social and legal problems of health care are mostly pronounced in rural areas (Bogma K. A., 2015; 2013; Danilova N. V., 2017; Musaev F. A., 2012; Shurshukov Y. Y., 2007). Insufficient accessibility of healthcare in rural areas has a significant negative impact on the level of health of the rural population (Sozonov A. I., 2017). The rural population in the Russian Federation is culturally heterogeneous, distributed over a wide area and has different demographic characteristics (Dyachkovsky N. S., 2019). Due to the above, it is necessary to implement specific improvements according to the needs of each particular rural population.

As far back as 1978, at the Alma-Ata Conference was stated that the main tool for achieving health for all is primary health care, which should be available to both individuals and families in the community. Some of the basic principles of primary health care are to educate the public on basic health issues and how to prevent health problems by drawing attention to or controlling these problems. To achieve the goal of health for all, it is important to orient the health care system towards prevention, health promotion, treatment and rehabilitation (Alma-Ata Conference on Primary Health Care, 1979).

Degree of development of the research topic

Diseases of the nervous system and diseases of the circulatory system, primarily stroke, represent one of the most serious problems in practical health care due to their high prevalence, especially among the able-bodied population, mortality and disability. The President of the Russian Federation V. V. Putin instructed the Government of the Russian Federation to ensure a reduction in mortality due to cardiovascular diseases to 551.4 per 100,000 population in 2020 based on the development of a set of measures aimed at improving the provision of medical care [110]. However, there is currently no scientifically substantiated system of neurological care for the population living in rural areas.

Thus, the relevance of the problem under study is to increase the availability and efficiency of specialized neurological medical care to the population of the Tyumen Oblast (without autonomous districts – AD) during the period of reforming the health care system of the Russian Federation by means of timely and qualified medical care through the development of intra-oblast inter-territorial centers and wide introduction of telemedical therapies into the practice of visiting crews of medical specialists, optimally equipped with the necessary equipment.

Purpose and objectives of the study

The aim of the study is to develop a scientifically substantiated set of measures aimed at improving the system of organization of neurological care for rural population in modern conditions.

In order to realize the set goal, the following research objectives were formulated:

1. To assess the experience of organization of neurological care for rural population in the world and in the Russian Federation for its compliance with the modern conditions of health care development.
2. To identify epidemiological features of morbidity, disability, mortality of urban and rural population of the Tyumen region due to neurological pathology.
3. To assess the organization and activities of the regional vascular center, primary vascular departments, visiting multidisciplinary crews, epileptology center, interterritorial epileptology offices, telemedicine consultations to the rural population of the Tyumen Oblast.
4. To develop a scientifically substantiated set of measures aimed at improving the system of organization of neurological care for rural population in modern conditions using the epidemiological method.

Scientific novelty of the study

A comprehensive approach to improving the system of organization of neurological care for rural population has been scientifically substantiated for the first time.

An epidemiological assessment of morbidity and disability of the population of the Tyumen region from cerebrovascular disease and epilepsy, as well as an assessment of the organization of neurological care for rural population were given for the first time in modern conditions.

The concept of routing of neurological patients at all stages of medical care was scientifically substantiated, developed and implemented for the first time.

On the basis of the results obtained in the course of the study, the scientific and substantiated directions for improving the regional system of organization of neurological care for the rural population of the Tyumen Oblast and regional models for improving the system of organization of vascular centers and departments, multidisciplinary visiting crews, epileptological center and interterritorial epileptological offices for the organization of specialized medical care in the Tyumen Oblast were implemented.

Scientifically substantiated directions for improving the system of organization of neurological care for the rural population of the Tyumen Oblast have been developed and implemented for the first time in the Tyumen Oblast, including by combining children's and adult epileptological services and creating an epileptological center and inter-territorial epileptological offices.

A model of organization of neurological care for patients with acute cerebral circulatory failure and epilepsy, including the use of visiting multidisciplinary crews and telemedicine technologies, was developed and implemented in the course of the study.

Theoretical and practical significance of the work

We have studied the state of the problem of organization of neurological medical care for rural population and generalized the available experience in the Russian Federation and foreign countries, identified the existing problems in this area.

The results of the study were used in the development of the regional program "Organization of interterritorial centers of specialized medical care for the population".

The data on the study of epidemiological features (morbidity, mortality, disability) of the course of acute cerebral circulatory failure in the population of the Tyumen region allow a timely correction of preventive programs, purposeful planning and improvement of the system of organization of medical care for patients with this pathology.

The results of the analysis of morbidity, mortality and mortality rates, frequency of hospitalizations, neuroimaging studies, and specialized methods of treatment formed the basis for the development of a qualified system of treatment and preventive measures.

The developed and implemented plan for the location of the network of vascular departments, regional vascular center and routing of patients with acute cerebral circulatory failure allowed to optimize the availability of medical care for this category of patients at the level of a large constituent entity of the Russian Federation and can be used in other regions with similar socio-economic and demographic characteristics.

The activity of multidisciplinary visiting crews in providing neurological care to the rural population of the Tyumen Oblast has been analyzed.

Questionnaires were developed to assess the satisfaction of the population with the organization of neurological care, both at the level of inpatient and outpatient forms of neurological care.

A comprehensive sociological study was conducted among patients and their relatives with acute cerebral circulation disorder and epilepsy in organized health schools to assess the quality of the organization of the educational services provided.

The unified antiepileptic service, the opening of an epileptology center, inter-territorial epileptology offices, and the register developed and implemented have improved the detection and registration of epileptic patients, both children and adults.

The results of scientific research can serve as information support for making managerial decisions to improve the system of organization of neurological care for the population.

The study materials were used by the Department of Public Health of the Tyumen Oblast in the preparation of Orders No. 640 dated 06.10.2009 "On the appointment of curators of state medical and preventive institutions of the Tyumen Oblast" and No. 486 dated 21.04.2015 "On the organization of specialized medical care for patients with epilepsy in the Tyumen Oblast". The results of the study were used by the Department of Health Care of Tyumen in the development of orders № 58os dated March 10, 2011. "On the organization of medical care for patients with acute disorders of cerebral circulation", No. 60os of March 10, 2011. "On the implementation of measures to improve the provision of medical care to patients with acute vascular diseases in the Tyumen Oblast", No. 682 of 28.10.13 "On the approval of the procedure for the provision of monitoring on the indicators of morbidity and mortality of the population of the Tyumen Oblast from diseases of the circulatory system" and No. 379 of 14.06.2018. "On Interaction of Medical Organizations of the Tyumen Oblast in Providing Medical Care to Patients with Acute Cerebral Circulatory Disorder".

Implementation of the study results in the practice of health care

The results of the study are implemented in the practical activity of the executive authority of the subject of the Russian Federation in the field of health protection – the Department of Health Care of the Tyumen region (act of implementation b/n from 04.09.2020g; in the practice of institutions of the Department of Health Care of the Tyumen region: SAUZ TO "Regional treatment and rehabilitation center" (acts of implementation in the number of 4 b/n from 15.01.2020), GBUZ TO "Regional Clinical Hospital No. 2" (act of implementation № 20 from 20.07.2020), GBUZ TO "Regional Hospital № 3" (Tobolsk) (acts of introduction in number of 3 b / n from 19.08.2020g), GBUZ TO "Regional Hospital № 4" (Ishim) (acts of introduction in number of 4 b / n from 14.07.2020g), GBUZ TO "Regional Hospital № 23" (Yalutorovsk) (acts of introduction in number of 4 b / n from 28.08.2020g), as well as in the educational process of the departments of medical prevention and rehabilitation (act of introduction b / n from 04.09.2020g), public health and health care of the Institute of Continuing Professional Development (act of implementation b / n from 14.01.2020g), as well as the Department of Hygiene, Ecology and Epidemiology of the Institute of Public Health and Digital Medicine FSBEI HE "Tyumen State Medical University" (act of implementation b / n from 15.12.2023g); Department of Neurology and Medical Genetics FSBEI HE "Perm State Medical University. Academician Wagner" of the Ministry of Health of the Russian Federation (act of implementation b/n from 22.07.2020g); Department of Nervous Diseases, Neurosurgery and Medical Genetics FGBOUE "Ural State Medical University" of the Ministry of Health of the Russian Federation (act of implementation b/n from 25.06.2021g); Department of Public Health and Health Care, Medical Prevention and Informatics FGBOU VO "Stavropol State Medical University" of the Ministry of Health of the Russian Federation (act of implementation b/n from 05.09.2022g); Department of Neurology, Neurosurgery and Medical Genetics FGBOU VO "Stavropol State Medical University" of the Ministry of Health of the Russian Federation (act of implementation b/n from 14.09.2022g).

Research methodology and methods

Theoretical and methodological basis of the study was the works of domestic and foreign scientists in the field of public health, health care organization, epidemiology, regulatory legal acts of the Russian Federation. The methodology of complex medical, social and epidemiological research was used in the development and implementation.

The study was carried out taking into account theoretical and empirical principles, based on modern methodological techniques in the field of public health and health organization.

Methods of epidemiological research were applied in the research work: analytical and descriptive-evaluative, graphical method, statistical method. For the period from 2009 to 2022, an operational and retrospective epidemiological comparative analysis of the development of the organization of neurological care for rural population in the Tyumen Oblast was carried out. The following statistical approaches were used in the epidemiological analysis: calculation of intensive (morbidity, disability) and extensive indicators (structure, ratio, shares), comparison of average morbidity levels in the period before the pandemic of new coronavirus infection (2009-2019) and during the pandemic (2020-2022). To analyze the changes in the indicators and to identify the regularity of the studied process in time, the indicators of the dynamic series were calculated: the average annual level, its 95% confidence range, the rate of increase, the average absolute increase/decline, the average annual rate of increase/decline. The structure and patterns of morbidity in the class of diseases of the nervous system in the territory of the Tyumen region for 2009-2022 were investigated by means of time series analysis, the indicators up to 2030 were modeled and forecasted. All materials were analyzed and statistically processed in Microsoft Excel (Microsoft, USA), IBM SPSS Statistics 21.0 (StatSoft Inc., USA).

The methods of descriptive statistics with calculation of the mean values of the dynamic series (m) and standard deviation (SD) or median (Me) and interquartile range [Q25-Q75], depending on the distribution of the data, were used in the calculation of statistical data. Comparison of mean values was performed by Student's t-test or Mann-Whitney test, fractions were compared by Pearson's $\chi 2$ test, and in the case of a minimum expected frequency for each group of less than 5, by Fisher's exact F-criterion. The Spearman correlation coefficient was used to assess the strength and significance of the influence of factors, and the strength of the relationship between the coefficients was assessed using the Cheddock closeness scale. The comparison results were considered statistically significant at $p<0.01$.

Provisions for defense

1. The study of the world experience in the organization of neurological care for rural population, as well as its organization in the Russian Federation, allowed us to identify high mortality and disability rates of the rural population from neurological diseases and a low level of detection of new cases.
2. Development of hospitalization routes, introduction of telemedicine, educational technologies, study of the population's opinion on the quality of services provided are essential to ensure the provision of necessary medical care to the rural population in the current conditions of health care development.
3. The regional epileptological center and interterritorial epileptological offices are a modern highly effective form of providing specialized medical care to patients with epilepsy and epileptic syndromes.
4. The use of epidemiological method to study the morbidity of the population with neurological pathology allowed to scientifically substantiate a set of measures to improve neurological care for rural population in modern conditions.

Main scientific results

The scientific study was carried out on the basis of an indicative sample using the method of study and generalization of experience, analysis of documents, expert assessments, epidemiological method, comparative, statistical, system analysis, as well as questionnaires in the period 2009-2022. The statistical population was formed using the solid and sampling methods.

The recommendations proposed based on the results of the work, aimed at improving the system of organization of neurological care for the population, were implemented in the practical activities of medical organizations of the Tyumen Oblast without AD.

1. It has been demonstrated that the neurological practice has undergone significant organizational changes in the care of patients with such disabling diseases as multiple sclerosis, epilepsy, etc., for which special rooms have been created and expensive drugs have been provided. Success in the development of neurological service allowed to create a structured system of organization of specialized neurological care for the population in the Tyumen Oblast [100, p. 123-124]. It is shown that the main directions of the development of rural health care in the Tyumen Oblast are to increase the accessibility of medical care through the introduction of multidisciplinary crews; to optimize the routing of patient movement for the timely receipt of high-tech and rehabilitation medical care; to purchase diagnostic equipment for hospitals; to provide medicines in rural areas; to attract young specialists to work in rural settlements [104, p. 119]. The author's personal participation in obtaining these results: collecting material, analyzing the obtained data, analyzing the literature data, interpreting the results, writing the article.

2. A decision was made to create step-by-step assistance to patients in accordance with the Procedure for providing medical care to patients with acute cerebrovascular accidents (Order of the Ministry of Health and Social Development of Russia No. 389n dated July 6, 2009 “On approval of the Procedure for providing medical

care to patients with acute cerebrovascular accidents”) [96, p. 165], the unified program of which was regulated by order of the Department of Health of the Tyumen Region dated March 10, 2011 No. 58os “On the organization of medical care for patients with acute cerebrovascular accidents” [99, p.61]. It was revealed that mortality from circulatory diseases and cerebrovascular disease in the Oblast were lower than the Russian average, with the rural population having a significantly higher mortality rate than the urban population. Mortality among men from these diseases is also significantly higher compared to women [102, c.50-51], while in 2016 mortality from cerebrovascular disease significantly decreased in both men and women, which demonstrates the effectiveness of the health care system in organizing rehabilitation and preventive measures carried out in the Oblast [106, c. 76-77], including during the COVID-19 pandemic [94, p. 28 and 30]. Further implementation of strategies aimed at improving epidemiological indicators will reduce the burden of cerebrovascular disease [115, pp. 47-48]. The author's personal participation in obtaining these results: collecting material, analyzing the obtained data, analyzing the literature data, interpreting the results, writing the article.

3. It is shown that the developed and implemented plan for the location of the regional vascular center and routing of patients with acute cerebrovascular disorders allowed to optimize the availability of medical care for this category of patients and increased the detection of cerebrovascular disease [95, c.917-918; 210, p. 810-811]. High attendance of educational events for stroke patients and their relatives was revealed. The conducted questionnaire revealed that the material provided was sufficient for the majority of respondents, accessible, the listeners possessed practical skills in patient care and knew how to provide first aid in case of suspected stroke [110, c.110-111]. It was recommended to continue conducting educational schools for patients and their relatives, as well as questionnaires to improve the quality and efficiency of services [156, p. 42-47]. The second stage of rehabilitation was organized for patients with stroke [98, pp. 106-107]. The author's personal participation in obtaining these results: collection of material, analysis of the obtained data, analysis of literature data, interpretation of the results, writing the article.

4. The most promising areas of optimization that have shown their effectiveness both abroad and in the Russian Federation, including the Tyumen Oblast, are the creation of multidisciplinary visiting crews and the use of telecommunication technologies. The introduction of these methods will improve the availability of specialized medical care for rural population [103, c. 76-77; 108, p. 90-91]. The data of questionnaire survey of residents of Vikulovsky district of Tyumen Oblast have been analyzed, which showed an improvement in the quality and availability of medical care as a result of the introduction of mobile forms of work by specialists of the regional center [92, p. 128; 113, c.70-71]. The effectiveness of the work of traveling crews was demonstrated, which was manifested in the form of a decrease in morbidity and sickness due to diseases of the nervous system, musculoskeletal system and CVD [109, p. 40-41]. In addition, high social satisfaction of the population with the quality of services provided was revealed [114, pp. 156-157]. The effectiveness of the introduction of telemedicine technologies for neurological patients is shown. It is shown that the remote management of patients with epilepsy allowed to reduce the burden on medical personnel by automating the appointment and reducing the traffic of personal visits, as well as the costs of treatment of patients due to timely provision of medical care [97, p. 119-120]. The author's personal participation in obtaining these results: collection of material, analysis of the obtained data, analysis of literature data, interpretation of the results, and writing the article.

5. It is shown that it is more expedient to solve the problems of organizing the treatment of epilepsy patients at the level of the administrative region [93, c.83], since this state structure contains all the necessary conditions for the rapid and rational implementation of the most successful developments of specialized care for the population [118, p. 72]. It has been demonstrated that the opening of an epileptological center and interterritorial epileptological offices will improve the quality and availability of specialized epileptological care for the population of Tyumen and the south of the Tyumen region [101, p. 75 and 77; 158, c. 38]. It has been shown that keeping a register allows us to evaluate the effectiveness of antiepileptologic measures, which will allow us to develop further measures to improve them [107, p. 28-29]. The author demonstrates

the demand for the conducted schools for epileptic patients and their relatives in the regional epileptology center of Tyumen in the period 2015-2017, which was determined by stable attendance, as well as a high degree of satisfaction with the organization of events and the quality of services [111, p. 59-60]. The author's personal participation in obtaining these results: collecting material, analyzing the obtained data, analyzing the literature data, interpreting the results, writing the article.

Degree of reliability and approbation of the results

The degree of reliability of the obtained results is confirmed by the general population in the evaluation study and content analysis, sufficient volumes of representative samples in sociological, empirical and experimental studies, the use of adequate and modern methods of analysis and statistical processing of data.

The main results of the dissertation in the form of oral reports and speeches were reported, discussed and approved at various public scientific-practical events of Russian and international levels, including the Congresses of neurologists of the Urals (Yekaterinburg, I – December 2014; II – November 2015; III – December 2016; IV – November-December 2017); regional scientific-practical conferences "Topical issues of epileptology" (Tyumen, March 2016, May 2017, March 2018, April 2019); regional scientific-practical conferences "Topical issues of angioneurology" (Tyumen, March 2015, May 2016, March 2017, April 2018); Interregional scientific-practical symposia "Modern technologies of preventive and rehabilitative medicine" (Tyumen, VIII – 2016, I X – March 2017, X – May 2018, May 2019); Forum of expert neurologists of the Ural Federal District (Yekaterinburg, March 2017); Russian Conference with international participation of the Association of Epileptologists and Patients "Innovations in Epileptology VII+", "The goal of epilepsy treatment-multi-year seizure control and high quality of life of patients" (Moscow, November 2016); meeting of the Russian Anti-epileptological League (Tyumen, November 2017); IX Therapeutic Forum "Actual issues of diagnosis and treatment of the most common diseases of internal organs" (Tyumen, November 2017); Annual All-Russian Scientific and Practical Conference with International Participation NACCI ("National Association of Infectious and Non-Infectious Disease Control Specialists") "New technologies in diagnostics, treatment and prevention: ISMP, Infections, Parasitoses" (Tyumen, April 2018); Regional Scientific and Practical Conference "Focus of the patient with paroxysmal brain activity" – Epilepsy: from childhood to adulthood (Tyumen, October 2020); XI Therapeutic Forum "Actual issues of diagnostics and treatment of the most common diseases of internal organs" (Tyumen, November 2020); Congress "Man and Medicine. Ural-2021" dedicated to the memory of academician of the Russian Academy of Sciences, Doctor of Medical Sciences, Professor, Honored Scientist of the Russian Federation I. V. Medvedeva (Tyumen, November 2021); 85th Interregional Scientific and Practical Conference of RNMOT (Tyumen, March 2022).

Author's personal contribution

The author's personal contribution consists in choosing the focus of the work, setting the goal and objectives of the study, developing the research design. The author mastered the methods used to obtain and evaluate the results, performed statistical processing and description of the obtained data, interpretation of the study results, formulated conclusions and the main provisions for defense.

The share of the author's participation in the collection and processing of statistical material – 95%. The author has a determining role in the implementation of the results of the work in the region, scientific publications and reports on the research materials.

Publication of the study results

A total of 108 scientific papers have been published, including 75 on the subject of the thesis, 38 of them in peer-reviewed editions from the List of VAK under the Ministry of Education and Science of Russia and 16 in journals indexed by Scopus, 3 patents have been registered, 1 monograph, 5 methodological recommendations and teaching aids have been written.

Compliance of the thesis with passports of scientific specialties

The presented dissertation corresponds to the formulas of the specialty 3.2.3. Public health, organization and sociology of public health, medical and social expertise, in particular p.4 «Medical and social research of demographic processes and determination of the role of demographic indicators for analyzing and planning the activities of health care bodies and institutions», p.5 «Medical and social research of morbidity indicators of the population, determination of the regularity of their changes. Study of the most important socially significant diseases and diseases that pose a danger to others in order to develop the main directions of medical and social prevention of their spread», p.17 «Development of theoretical and methodological foundations for ensuring accessibility, quality and safety of medical care for the population» and 3.2.2 Epidemiology, in particular p.3.3 «Study of general regularities and regional peculiarities of the formation of morbidity of the population by non-communicable diseases to identify the causes, conditions and mechanisms of its formation», p. 5 «Development and improvement of systems of epidemiological surveillance and socio-hygienic monitoring, pre-epidemic diagnostics for effective management of morbidity and preservation of public health» and p. 6 «Development of new and improved preventive, anti-epidemic means and measures, as well as new organizational forms and methods of preventive and anti-epidemic measures».

Scope and structure of the thesis

The dissertation is set out on 376 pages of typewritten text and consists of an introduction, literature review, research methodology, five chapters of own research, discussion, conclusions, practical recommendations and an appendix. The list of literature contains 358 sources, including 217 domestic and 141 foreign authors. The work is illustrated with 71 figures and contains 104 tables.

CHAPTER 1. CURRENT STATE OF THE SYSTEM OF ORGANIZATION OF MEDICAL CARE PROVISION TO RURAL POPULATION ACCORDING TO THE MATERIALS OF DOMESTIC AND FOREIGN AUTHORS (LITERATURE REVIEW)

1.1. Epidemiology of neurological diseases

Epidemiology is a basic medical science [26, 206], belonging to the field of preventive medicine and studying the causes of occurrence and characteristics of the spread of diseases in society in order to apply the knowledge obtained to solve public health problems, which includes 2 sections with the same research methodology: epidemiology of infectious and epidemiology of non-infectious diseases [60].

Recent decades have seen significant advances in understanding the epidemiology of neurologic diseases in terms of incidence, prevalence, mortality, and risk factors, which has helped to facilitate health care planning, prevention, and treatment. These advances have been made possible by the development of standardized methods [227].

For the basis and cumulative assessment of the effectiveness of the preventive measures used, the results of epidemiological studies serve as a basis for the study and analysis of existing public health and public health problems [10], as well as for planning and conducting research and making management decisions [175].

In addition, one of the fundamental components of the system of epidemiological surveillance of non-communicable diseases is the monitoring of risk factors, the knowledge of which enables targeted intervention in the spread of diseases, which, in turn, can reduce mortality and disability due to these diseases [27].

The incidence of diseases of the nervous system in 2021 in Russia amounted to 5,346.8 cases per 100,000 population [84]. In the Republic of Tatarstan from 2011 to 2017, 2479 patients with migraine, 927 with trigeminal neuralgia, 5816 with cervical neuralgia, 4455 with cervical osteochondrosis, 221 with vascular myelopathy and 8640 with hypertensive encephalopathy sought medical care in the State Autonomous Institution "RKB MH RT". The incidence of these diseases in the Republic was 39, 15, 102, 90, 1.7, and 134 per 100,000 population [195].

Epidemiology of acute cerebral circulatory failure

The Global Burden of Disease study found that in 2017, there were 24.1 million new cases of stroke, 15.7 million fewer patients with a reduction in disability-adjusted life years (DALYs), as well as 700,000 more stroke-related deaths compared to the previous year [263, 286]. In both Europe and the United States, stroke is the leading neurologic disease in terms of DALYs [262, 246]. In 2019, the incidence of stroke was 12.2 million and the prevalence was 101 million.The corresponding percentage changes from 1990 to 2019 were +70% and +85%, respectively [263]. Similarly, the absolute number of stroke deaths increased by 43% over this period, and the number of additional disability-adjusted life years (DALYs) lost increased by 32% [263].

About 200 million people are expected to have a stroke by 2050, and every year thereafter there will be more than 30 million new strokes, of which 12 million will be fatal [231]. These epidemiologic perspectives are alarming regarding the ability of health care systems to cope with future increases in the number of stroke patients [49]. Although the incidence of stroke in young adults is increasing, stroke is more prevalent in elderly patients [228, 251]. The increasing number of aging populations in low – and middle-income countries will continue to dramatically increase the global burden of stroke, and special attention needs to be paid to prevention policies in such regions [311].

In the Chuvash Republic, the maximum increase in the number of STEMI occurred in 2020 and amounted in absolute value to 3466 patients (286.9 per 100 thousand population), which was 6.8% more than in 2018. The increase in the incidence rates of intracerebral and other intracranial hemorrhage was 22.8%, cerebral infarction – 4.9%, and in 2021 increased by another 2.9% and decreased by 7.6% compared to the previous year, respectively. Mortality in 2020 in patients with intracerebral and other intracranial hemorrhage increased 9.2% compared with 2018, and with cerebral infarction decreased 12.5% [40].

In St. Petersburg in the period 2016-2021, the share of in-hospital ischemic stroke (IS) in the structure of all IS was 1.4-2.0% [29].

In the city of Taraz (Kazakhstan), the incidence of stroke in 2020 was 2.9 per 1,000 people (mainly in people over 50 years old), mortality – 0.5 per 1,000 people [91].

Epidemiology of epilepsy

Epilepsy is one of the most common neurological diseases that affects people of all ages, races, and social classes in all geographic locations on the planet.

In a systematic review and meta-analysis of incidence studies, the pooled incidence rate of epilepsy was 61.4 per 100,000 person-years (95% CI 50.7-74.4) [255]. The incidence was higher in low/middle-income countries than in high-income countries: 139.0 (95% CI 69.4-278.2) vs. 48.9 (95% CI 39.0-61.1). This can be explained by the different structure of risk groups and greater exposure to perinatal risk factors, higher incidence of central nervous system infectious pathologies and craniocerebral injury in low – and middle-income countries. The incidence of epilepsy is also higher among the lowest socioeconomic classes in low/middle-income countries and among people of different ethnic backgrounds within the same population [225].

The prevalence of epilepsy varies considerably between countries, depending on the local distribution of risk and etiologic factors, the number of seizures at the time of diagnosis, and whether only active epilepsy (active prevalence) or remission (lifetime prevalence) is counted [135, 166]. In a study co-authored by K. M. Fiest (2017), the overall lifetime prevalence of epilepsy was 7.6 per 1000 population (95% CI 6.2-9.4) and was higher in low – and middle-income countries (8.8 per 1000; 95% CI 7.2-10.6) than in high-income countries (5.2 per 1000; 95% CI 3.8-7.2) [255]. The point prevalence of active epilepsy was 6.4 per 1000 (95% CI 5.6-7.3). The median prevalence of active epilepsy in low – and middle-income countries was 6.7 (95% CI 5.5-8.1) and in high-income countries was 5.5 per 1000 population (4.2-7.3). Within individual populations, prevalence estimates also vary and, in general, the incidence of epilepsy is higher in individuals of certain ethnic groups [281], people with poor health and socially disadvantaged groups [280]. In addition to the underlying issues, the demographic structure of the study population, the prevalence of environmental risk factors and the quality of health care management may be affected by the study design.

In the Republic of Bashkortostan the prevalence of epilepsy for 2013-2017 was 291.7-325.8 cases per 100 thousand population. Symptomatic epilepsy was detected most often: 2013 – 74%, 2014 – 82,2%, 2015 – 82,6%, 2016 – 46.5% and 2017 – 47% [139].

Epidemiology of neurologic disease during the period of of the new COVID-19 coronavirus infection

During the COVID-19 pandemic, the prevalence and mortality risk for several neurologic diseases increased. Neurologic disorders are detected in 31-42% of patients with COVID-19, with stroke being one of the common complications of COVID-19 and representing an independent risk factor for poor prognosis [94].

For example, J. M. Park et al. reviewed 1184 studies, of which 44 meta-analyses involving 9,228,588 patients with COVID-19 were finally included in the review. The cumulative pooled prevalence of each neurologic disorder was as follows: stroke 3.4% (95% confidence interval 1.5-5.3), dementia 6.4% (1.4-11.5), multiple sclerosis 4.0% (2.5-5.0), epilepsy 5.4% (– 0.6-11.3), Parkinson's disease 0.7% (-1.1-2.5), encephalitis 0.7% (-0.4-1.8), Guillain-Barré syndrome 3.8% (-0.1-7.8). In addition, the following mortality risks have been demonstrated for patients with COVID-19 co-infection: due to stroke odds ratio (OR) 1.6 (1.2-2.0), epilepsy OR 1.7 (1.0-2.4), dementia OR 1.9 (1.3-2.5), Parkinson's disease OR 3.9 (-2.1-10.0) [313].

Patients with a confirmed diagnosis of COVID-19 have been shown to be more prone to develop neurologic complications within 6 months of illness compared with patients without new coronavirus infection, but the incidence of these complications is currently unknown [150].

Future studies should elucidate the exact mechanisms of the association between COVID-19 and neurological diseases [119], determine which patient characteristics predispose patients to neurologic disease, and consider global management options.

1.2. Peculiarities of medical care to rural population

The health status of a population is determined by a wide range of factors, including indicators such as income and social status, social support programs, education and literacy [107], working conditions, social environment, environmental conditions, personal health and lifestyle, proper development in childhood, biological and genetic background, health care system, etc. [107]. [14, 65, 72, 140, 205]. Living in an urban or rural area has a significant effect on all of the above factors[17, 37, 131, 142, 217].

Currently, the issue of health inequalities between urban and rural areas is not sufficiently studied [108, 148]. The urban population enjoys the advantage of easy and quick access to a wide range of medical services. Other advantages include the availability of a highly skilled medical workforce, access to specialized medical care, access to disease prevention and healthy lifestyle interventions, access to pharmacies and availability of a wide range of medications, higher income levels compared to rural populations, efficiency of emergency care, quality of infrastructure including hospital equipment [1, 46, 67, 74, 124, 137, 187, 188].

Living in rural areas is often associated with lower household income [149]. According to WHO, about 1.4 billion people worldwide live in extreme poverty, with more than 70% of them in rural areas in developing countries [275]. The rate of urbanization and urban population growth predicts that for many more decades the poor will continue to live in rural areas [322, 347].

The social determinants of health – the conditions, in which people are born, grow, live, work and age – are major causes of health inequalities, as well as inequitable and potentially avoidable health disparities both within and between countries [233, 297, 315, 327, 346].

In rural areas, poor general health is also a cause of low income. The health care system, which determines the health of the nation, in rural areas is often understaffed to meet the needs of the population, further contributing to urban-rural disparities [121].

The formation of health of the rural population occurs in the interaction of various factors, such as production conditions (high unemployment due to the destruction of agricultural infrastructure), lifestyle and way of life (high prevalence of bad habits such as alcohol consumption and smoking), environment (drinking water from open sources), heredity, the level of organization and accessibility of medical care (unsatisfactory state of road transport connections), and low wages19, 24, 52, 76, 80, 85, 146, 184].

According to Rosstat, statistical materials of FGBU "Central Research Institute of Health Care Organization and Information" of the Ministry of Health of the Russian Federation from 2005 to 2015 in the Russian Federation there was a decrease in the rural population by 2.0% (from 38754860 to 37985068 people respectively), while the birth rate increased from 11.0 to 14.4, and mortality rate decreased from 18.6 to 14.5 per 1000 people respectively [45, 162, 202, 203].

In the Russian Federation, the leading positions in the mortality structure in 2014 were occupied by diseases of the circulatory system, neoplasms, as well as symptoms, signs and abnormalities detected during clinical and laboratory tests, not classified in other headings: 692.9, 181.6 and 170.8 per 100000 population. It should be noted that the mortality of the rural population of the Russian Federation since 2005. from diseases of the circulatory system decreased from 1061.3 to 692.9, from neoplasms from 181.9 to 181.6, from external causes – from 256.1 to 160.4 and from respiratory diseases – from 87.2 to 76.5 per 100,000 rural population, while from symptoms, signs and deviations from the norm, detected during clinical and laboratory investigations not classified in other headings increased from 108.0 to 170.8 per 100,000 rural population [126, 127, 208].

In 2014, the natural decline of the rural population was -0.1 per 1,000 people, which is significantly less than in 2005, when this indicator was -7.6 [162].

When developing health programs for rural populations in all countries, they are often faced with problems of health care delivery, lack of human resources, financing, communication, management, transportation problems, and in some regions, corruption [64]. In almost every country, the health status of individuals living in rural areas is worse than that of the urban population [221, 224, 229, 230, 324, 337]. Limited access to the health care system is a major cause of this situation, especially in low-income and developing countries[229, 279, 293, 307]. Even in countries where the majority of the population lives in rural areas, the main health resources are concentrated in large cities [218, 224, 245, 284, 324, 336, 343, 357]. In all countries, there are transportation and communication problems between rural areas and large population centers, and there is also a problem with a shortage of doctors and other health care workers in remote and rural areas [224, 229, 234, 245, 279, 284, 293, 310]. The functioning of the health care system in rural areas is widely debated, with a growing number of published papers assessing and analyzing the key problems that limit access to care – and developing concepts for improving care for diverse rural populations [9].

Problems related to the provision of medical care to the rural population have led to a decrease in the level of social protection of the population [147]. Thus, for example, in Nizhny Novgorod Oblast a significant decrease in the number of visits per 1 inhabitant per year was revealed in the period from 1989 to 7.8 visits, which is significantly lower than the target indicator (9.9 visits per 1 inhabitant per year). In connection with the decrease in the indicators of outpatient and polyclinic care provision and reduction of the bed fund, the number of ambulance calls increased to 360.7. In addition, there was a decrease in the number of persons referred for medical and social expertise (against the background of the population morbidity growth) [41].

Thus, the main problems of rural areas in the Russian Federation are a significant decrease in the number of rural settlements with a simultaneous increase in the number of settlements without population living in them, high unemployment, poor condition of roads and, as a consequence, low transport accessibility, significant aging of the rural population [108]. All the above-mentioned problems have led to the following socio-medical consequences: inaccessibility of medical organizations, poor resource capacity of feldsher and midwifery centres, low quality of medical care, turnover of medical personnel in rural areas, low coverage of the population with dispensary observations. As a result, the medical consequences of these problems are the low level of health of the rural population, increased gender disparities due to high male mortality, insufficient information on the morbidity of the rural population [43, 108, 191].

1.3. The role of primary health care structural units in the provision of medical care in rural areas

Primary health care is now an integral part of the process of economic social development of the state. The following definition of primary health care was given at the Alma-Ata Conference (1978) – "an important part of health care, which is based on practical scientifically sound and socially acceptable methods and technologies that should be accessible to all (individuals, family in the community), with full participation in this work and at such costs as the community and the country as a whole can afford at each stage of its development in a spirit of autonomy and self-determination" [52]. [52].

In order to ensure state guarantees of access to medical care for the population living in rural areas, it is necessary to improve the system of organization of the health care system by improving personnel, drug, medical and technical policy, as well as strategic planning and increasing the efficiency of the use of resources [58, 168].

Improving the delivery of health care to rural populations should be based on the characteristics of rural areas [62, 79]. For example, the number of the population served is significantly less than in the city, while the territory of residence is larger and not uniform. In addition, rural residents have practically no opportunity to exercise the right to choose a medical organization and a doctor [107, 129].

Many authors show that one of the major problems of rural health care is the accessibility of health care [107], especially high-tech [165]. In this regard, the organization of medical care should combine accessibility of receipt and efficiency [13].

As a consequence of the decrease in budget funding, rural health organizations (RHOs) have been reduced, as well as the outflow of medical personnel and even the closure of RHOs [180]. The analysis of medical organizations in the Russian Federation providing care to rural population revealed that in the period from 2005 to 2012 the number of central district hospitals decreased by 0.9%, the number of beds in them decreased by 18.6%. The number of district hospitals decreased by 11.1 times, the number of organizations providing outpatient and polyclinic care – by 15.6 times. This led to the fact that the bed capacity of the rural population in 2012 amounted to 36.2 per 10000 population, while in 2011 this indicator amounted to 49.6 [213].

Feldsher-midwifery stations

Feldsher-midwifery stations (FAS) are traditionally considered to be the first stage of medical care for residents of rural settlements (organized in settlements with a population of 700 or more people at a distance of >2 km from a medical center) [66, 117]. The main duties of the medical staff of the FAS is to provide pre-hospital care both at outpatient appointments and at home, taking into account the competence and rights of the paramedics and midwives working there [186]. Since 2005, their number in the country has been gradually decreasing [8, 161]. However, in 2013 at a meeting of the Presidium of the State Duma it was proposed to introduce FASs in rural areas due to the fact that residents were deprived of the opportunity to receive primary health care. In many remote settlements of the country, FASs are actively engaged in work, which often involves visiting medical workers of central district hospitals, who assist both in the organization of work and in the diagnosis and treatment of the population [30, 213].

Central district/regional hospital

Represents the second stage of medical care and provides all types of specialized medical care [134]. The capacity of the CDH depends on the population [20, 163]. When analyzing the main problems faced by medical personnel in the CDHs of Kirov Oblast, it was found that they include lack of doctors, unsatisfied material and technical base, insufficient financing of CDHs, and low salaries of personnel. The authors concluded that the solution of these problems should be a priority in the modernization of CDHs [132].

Dispensary

One of the directions to improve the provision of medical care to the rural population is dispensary [77]. The main objectives of this program are dynamic monitoring of the health status of certain population groups in order to detect diseases at early stages and subsequent registration and treatment, carrying out activities that contribute to the improvement of everyday life and labor, prevention of the emergence and spread of diseases, and the formation of a healthy lifestyle [2, 193, 209-211].

Various strategies have now been proposed to improve the quality of population-based dispensary care:

- improving the quality of training in prevention, dispensary and rehabilitation of district doctors [75];
- continuous professional development of district doctors and nursing staff [11];

- in order to increase the efficiency of dispensary monitoring, introduction of incentives for physicians and the population;
- the need to introduce criteria for dispensary and follow-up of patients;
- improvement of technical support of the medical organization (diagnostic equipment);
- strengthening the relationship between narrow specialty physicians and district physicians;
- implementation of standards for preventive services;
- improvement of information and organizational and methodological support on issues related to medical examinations;
- reorientation of district doctors towards increasing dispensary work [171].

G. V. Artemieva (2014) assessed the quality of medical care in remote areas of the Ryazan region. The obtained data showed that 8.8% of people who underwent medical examination and treatment needed inpatient examination and treatment, 14.5% needed outpatient treatment and 50.5% needed additional examination to clarify the diagnosis [6].

Thus, the development of dispensaryization of the rural population contributes to the reduction of morbidity and mortality [212].

General practitioner

The general practitioner (GP) provides medical care at the primary level, the introduction of this specialty in the health care system is associated with a significant increase in "lifestyle" diseases, the prevention and treatment of which are engaged in GP [31, 32]. According to V. F. Sheshko (2008), GPs play a significant role in solving medical and social problems of rural population; the main tasks of GPs in rural areas are to increase the volume and improve the quality of medical care, to ensure its availability, disease prevention [207].

Within the framework of the Belarusian-Dutch MATRA project "Improvement of Primary Health Care in Minsk Oblast", using the adapted QUOTE (Quality of care through the patient's eyes) evaluation questionnaire, it was revealed that patients positively evaluated the work of a district doctor working on the principle of a GP. According to the patients, the most important aspects in the organization of the GP's work are short waiting time, availability of emergency care at home, possibility to consult a doctor by phone, availability of prescribed medicines in the local pharmacy, treatment by a regular doctor, accessibility of the outpatient clinic for patients with reduced mobility, coordination of all medical care for the patient, good information support of the outpatient clinic [164].

Field crews

One of the main objectives of health care modernization is to provide affordable and qualified medical care, including in regions with low density of population [63, 78, 90, 114, 159, 215].

In November 2013, the Minister of Health of the Russian Federation V. I. Skvortsova reported at the meeting of the Government Commission on the quality of mobile forms of medical care and on ensuring accessibility of medical care. It was noted that by that time there are about 8,500 mobile medical crews in the Russian Federation and medical care and preventive examinations are provided by 187 mobile medical complexes.

Itinerant forms of medical care (sanitary aviation, traveling medical crews), which are essential for regions with uneven population and low population density, began to be actively introduced in the 1970s in the process of improving the district health care system.120, 122, 138, 141, 152, 153]. This allowed for the expansion of specialization of outpatient care for rural residents [69]. Currently, there is an experience of implementation of both multifunctional and specialized visiting crews on the territory of the Russian Federation [57, 89, 213].

The main tasks of specialist physicians involved in itinerant forms of medical care are:

- providing primary specialized medical care to patients in remote rural areas;
- early detection of various pathologies;
- timely referral of patients for follow-up examinations and hospitalization;
- selection of patients for specialized, including high-tech medical care;
- consulting assistance to primary care physicians in the field;
- fccepting patients with disabilities;
- examination of dispensary patients with severe and rare pathology [7, 114, 170].

O. V. Osokina (2006) analyzed the work of "a visiting crew formed in Surgut District on the basis of the Central District Clinical Hospital (CDCH) and staffed by general practitioners, pediatricians, surgeons, obstetricians-gynecologists, neurologists, ophthalmologists and otolaryngologists – which carried out examinations and provided medical care to the population in hard-to-reach settlements of the district. During the examination of the population by the visiting crew, 30.6 diseases were detected per 100 persons examined". When surveying the population about the effectiveness of the visiting crews, the majority of responses were positive. In addition, the respondents reported that due to the low frequency of visits, insufficient equipment and the absence of some specialized doctors, mobile crews are not able to solve all the problems related to the provision of the required amount of medical care to the population [142].

According to A. A. Karpunov (2014), the work of traveling crews carried out for preventive examinations of the peoples of the Far North is one of the most effective methods of providing medical care to this area [68].

In the Far East since 2006, the mobile consultative and diagnostic center "Therapist Matvey Mudrov" has been working in the territory of the Far East, making trips covering remote areas of various regions of the region, in the cars of which there are equipped offices of doctors of various specialties. The work of the center has demonstrated its high efficiency [47].

Among specialized visiting crews, pediatric, oncology, dental, ophthalmology, psychiatric, etc. crews are described [18, 48, 50, 55, 88, 136, 154].

Teslenko V. R. (2013) substantiated the effectiveness of a visiting pediatric brigade carrying out its work in the Chelyabinsk region. As a result of the examination of children in 2008, diseases of the musculoskeletal system, digestive organs and vision were predominantly identified.

The Tyumen Oncological Dispensary organized visiting crews, which participated in the examination of the rural population, conducting medical examinations of cancer patients registered with the dispensary; consulted patients; supervised the work and provided methodological assistance to district oncologists; held classes with doctors of district hospitals on topical issues of oncology, as well as health education work among the population on the prevention and early diagnosis of malignant neoplasms [179]

In the Republic of Sakha during the implementation of the program "Modernization of Health Care in the Republic of Sakha (Yakutia) 2011-2012" the staff of the visiting ophthalmology team performed 3011 surgeries in the period 2002-2012. The work of the surgical team allowed increasing the number of treated patients by 31.1%, improving the quality of medical services and significantly reducing the republic's budget expenditures (no need to reimburse travel expenses to patients and their escorts) [56].

Scheduled high-tech medical care for patients living in remote areas can also be planned by traveling crews. For example, in the regions of the Far Eastern Federal District, visiting crews selected patients in need of high-tech medical care in the profile "Cardiovascular Surgery", which significantly improved the demographic indicators [145].

The Tyumen Regional Treatment and Rehabilitation Center provides neurological care using visiting crews for consultative and diagnostic assistance, which also contributes to improving the accessibility of medical care, optimizing the routing of patients to receive it in a timely manner, as well as expanding the coverage of rural MIs with telemedicine technologies [108, 113].

The organizational process of visits is a complex task and begins with the preparation of a detailed plan, which should formulate the purpose of the visit; the composition of the team, taking into account the need to include specialist physicians appropriate to the purpose of the visit and the prevailing morbidity of the district population; and the necessary set of equipment for diagnostic/treatment activities. The next stage is to inform the medical organizations of the rayon in advance about the timing and purpose of the visit. When traveling directly to a settlement (village, hamlet), it is important to find premises for medical personnel to work [108, 201].

One of the biggest challenges of such visits is the limited staffing of physicians in central district hospitals, as well as the low or absent staffing of physicians of "narrow" specialties. This situation leads to the fact that doctors of the main specialties are included in the visiting crews, while "narrow" specialists have to cancel their appointments at the central district hospital to participate in the visits [108, 213].

Thus, itinerant forms of medical care for the population make it possible to improve the availability of specialized medical care for the rural population, which leads to improved indicators of quality and accessibility of medical care and health of the population [108].

K. K. Rogalev (2008) found that in hard-to-reach areas of the Arkhangelsk Oblast "systematic visits of medical teams are the optimal form of medical care for rural population". Occupational examinations, dispensary examinations, as well as consultations were carried out [159].

In addition, itinerant forms of medical care are of great importance for elderly and senile persons, due to the fact that dynamic monitoring of health status allows to reduce the risk of various complications, which, in turn, not only improves the health status of the elderly, but also reduces the cost of treatment, which was shown in the work of V. V. Gryzunov (2009) [39].

Telemedicine

Over the last 100 years, medicine has moved a long way forward, but the main changes and achievements have mainly affected large medical centers located in big cities. The problem of providing quality and highly specialized medical care to those living in remote areas remains. In the United States alone, more than 2,500 rural areas are characterized by an inadequate ratio of primary care physicians to specialty physicians [316]. In a 2005 study, the ratio of specialists to general practitioners in small regional towns was 1 to 2.4. In small rural settlements the ratio is 1 to 12 [259]. The problem becomes especially acute in view of the fact that more than 25% of elderly people, who are more often in need of specialized medical care, live outside of cities [116, 239].

Telemedicine most commonly refers to the delivery of health care using electronic communication between a health care professional (e.g., a physician or nurse practitioner) and a patient in a remote location [25, 108, 198, 220, 299, 309]. The earliest references to the use of telemedicine date back to the 1940s, but it is only today that the provision of remote health care is experiencing dramatic growth, fueled by increased access to broadband Internet and technological advances in many areas of medicine, including neurology [83, 117, 197].

Neurological medical care belongs to medical specialties largely concentrated in large cities, which complicates the provision of both emergency care and long-term observation and supportive therapy for patients with chronic neurological diseases.

Today, there is a distinct lack of neurologists and availability of neurological care, which is especially true in rural areas of many countries [241, 260]. Telemedicine can provide rural residents with access to highly specialized medicine, which tends to gravitate towards large medical centers located, as a rule, in urban areas. Telemedicine can be used in the treatment of patients with stroke, Parkinson's disease, epilepsy, and other neurological diseases [28, 108, 264].

To date, telemedicine techniques have been used in a variety of medical situations, including emergency situations, routine examinations, and long-term multi-year follow-up of patients with neurologic diseases [16, 54, 351]. Telemedicine can be applied in the form of real-time videoconferencing, data storage and transmission format for asynchronous transmission of medical information to health care professionals, and remote monitoring [80, 128].

The most common application of telemedicine in neurology is remote emergency examination for suspected acute cerebral circulatory failure [4]. In the modern understanding, telemedicine network ensures the receipt of highly specialized consultations in hospitals located in rural areas and do not have vascular specialists of the appropriate level, experienced in the diagnosis and treatment of patients with acute cerebral circulatory failure. It should be noted that the use of the National Institutes of Health Stroke Scale, which is the standard of examination for suspected acute stroke, when applied within the framework of telemedicine, reveals a high degree of correlation with personal physician examination in both the acute and remote periods [108, 271, 300].

Telemedicine networks within neurological care can be organized in two ways. In one model, a single head medical center provides remote consultations with a vascular specialist to several smaller, rural clinical centers. Use of this model allows thrombolysis or inclusion in clinical trials to be provided within a single group of neurologists involved in decision making at both the parent organization and the remote office. In the second model, a group of neurologists or a private medical company provides teleconsultation for a large and remote group of medical organizations that have patient transport and hospitalization agreements with local vascular neurological centers.

The long-term cost-effectiveness of telemedicine care in neurology comes from increasing the prevalence of intravenous thrombolysis use and reducing disability and improving outcomes after a SNMD [339]. Increased costs in the early stages are more than offset by savings in the long term and increased quality-adjusted life years. The main barriers to telemedicine implementation include restrictions on reimbursement by insurance companies, difficulties with licensure, credentialing issues, and liability for decisions made. At the same time, the benefits of telemedicine are likely to increase the prevalence of telemedicine networks worldwide in the near future.

A UK comparative study found that patients who consulted a neurologist had fewer inaccurate diagnoses, less frequent hospitalizations, fewer diagnostic tests, fewer medications, and fewer additional examinations and consultations compared to general practitioners. The researchers concluded that specialist neurologists provided better, more effective and less costly treatment for neurological disorders [314].

In a US study, the use of a telemedicine approach was evaluated in 354 consecutive patients with chronic neurologic disease over a 2-year period, utilizing the strength and resources of medical staff in outpatient departments in a remote rural area. The results confirmed the success of using a telemedicine approach for follow-up of patients with chronic neurologic disease [219, 238, 320, 328]. Only in 5% of cases the complexity of neurologic pathology did not allow for effective treatment using a telemedicine approach. At the same time, the frequency of hospitalizations was reduced by 19% and the duration of inpatient treatment by 25% [243].

K. K. Rogalev (2008) revealed that telemedicine consultations with 22 studios and the regional hospital were actively conducted in the Arkhangelsk region. Due to the use of telemedicine networks doctors had the opportunity to transfer "X-ray images and computer tomography data. In addition, remote training of medical staff was conducted." The use of telemedicine technologies saved money for regional, municipal budgets and district medical organizations (DMOs) [159].

1.4. Level of satisfaction of the population with accessibility and quality of organization of medical care

Currently, many studies assess the population's satisfaction with the quality of health care delivery and its accessibility [34, 53, 82, 173, 177, 181, 185, 194, 200, 204, 216]. Thus, the study by G. V. Artemieva (2014) showed that only 55.4% of respondents living in the Ryazan region were satisfied with the quality and accessibility of outpatient and polyclinic care, and 19.3% were not satisfied with it [6]. V. V. Serafimov (2016) demonstrated that residents living in separated districts of the Leningrad region, in 64.7% of cases it is not convenient to get to the hospital to receive ophthalmic medical care, 27.5% noted that the transport accessibility of the medical organization is insufficient. Among the respondents, the highest rates of dissatisfaction were noted among people over 70 years old, as well as among patients with disabilities [176].

K. K. Rogalev (2008) in his study conducted a survey of the population about satisfaction with the work of the day hospital at the consultative polyclinic in the regional hospital of the Arkhangelsk region. The author noted that 94.6% of respondents were satisfied with the quality of treatment and diagnostic process. The author concluded that "patient questionnaires provide an opportunity to conduct a screening assessment of the quality of medical care and take measures to eliminate" the identified shortcomings in a prompt manner [159].

1.5. International experience in organizing medical care for rural population and ways of solving problematic issues

The Alma-Ata Conference (1978) made it possible to critically evaluate the experience of providing health care to the population accumulated by different countries, both in the conditions of public, insurance, private and mixed systems of health care at different levels [5].

The shortage of qualified health personnel and the need to actively seek effective strategies to recruit and retain such personnel in remote rural areas is a priority for health systems in many countries around the world. In Georgia, for example, there are ongoing challenges related to the geographic distribution of health personnel; despite ongoing attempts to incentivize GPs to work in rural areas, rural populations continue to experience a lack of health care [234]. Armenia also has a shortage of health workers in rural areas, with about two-thirds of all health workers concentrated in the capital (which does not match the distribution of population density in the country) [167, 270].

In Bulgaria, there is often only one GP providing health care in rural areas. This limits the ability of patients to exercise their right to choose their primary care physician or to obtain a second opinion when necessary [248, 265]. Patients living in rural areas in Latvia also have unequal access to medical care due to the insufficient number of health care professionals, as family physicians are reluctant to agree to practice in rural areas [190, 342].

The shortage of qualified medical personnel in Ukraine is associated with low salaries in health care organizations located in rural areas compared to urban areas [35, 36, 130, 169, 344]. In Norway, the problem of providing qualified medical personnel, especially physicians, to the less populated northern regions of the country has persisted for many years [144, 199, 338].

A study of public health and health care in rural areas undertaken by the European Association of Rural and Isolated Practitioners [254], demonstrated that the health care system faces not only a lower supply of physicians, but also increased workload, lack of resources, and insufficient access to continuing professional education and training. These challenges impact the willingness of health care professionals to work in rural settings.

There is evidence that in some countries, access to a pharmacy, essential medicines and specialized care is difficult in rural areas. In Romania, there are three times as many registered pharmacies in urban areas as in rural areas, despite the fact that almost half of the population lives outside urban areas [349]. Specialized medical services, such as mental health services, are also unevenly distributed throughout the country [349]. In Georgia, almost all types of medicines are available in Tbilisi, while in rural areas and remote mountainous areas with smaller populations and lower per capita incomes, the full range of medicines may be unavailable [234]. In Armenia, obstetric care is provided in obstetric-gynecological departments of hospitals, in regional maternity hospitals, and in republican centers of specialized care, which are usually located within the city limits. And, although most women in Armenia have access to obstetric care, the limited access to obstetric care in rural areas results in a significant urban-rural imbalance [270].

The accessibility of rehabilitation medicine in Estonia varies depending on the region: patients living in large cities receive more than 65% more medical rehabilitation than those living in rural areas [87, 285].

Due to the fact that some rural areas have significantly lower income levels than urban areas, high levels of unemployment or self-employment in agriculture, there is a large segment of the population without health insurance and difficulties in paying for health care. Transportation and living expenses related to medical care further aggravate financial difficulties. In Latvia, the income of the rural population is lower than the national average, and the availability of medical care in rural areas is limited. These factors lead to low rates of health care utilization and expenditures on medicines among people living in rural areas [342]. Low accessibility of medical care leads to the fact that rural residents in Latvia are categorized as persons with a high probability of critical costs of medical care.

In Moldova, about 75% of the population has health insurance, among the remaining 25%, most of them live in rural areas [278]. The rural population without health insurance has insufficient access to medical care due to financial and transportation difficulties, and also falls into the risk group of critical out-of-pocket treatment costs [278].278]. In December 2009, Law No. 128-XVIII was adopted, according to which all citizens of the Republic of Moldova have the right to full access to primary health care regardless of insurance.

In Romania and Greece, there are also fewer citizens with health insurance in rural areas, as well as citizens with lower incomes (agricultural workers, small farmers with low incomes and pensions), which creates barriers to access to health care [249].

In Bosnia and Herzegovina, the unequal ratio of people with health insurance in urban and rural areas forms the basis for unequal access to health care [352]. The quality of health care delivery in rural areas may also be lower due to infrastructure (lack of specialized equipment, information and communication systems, condition of the bed stock). In rural areas, insufficient quality of emergency medical care is also noted, which is related to both limitations at the level of the health care system and external factors: in Bulgaria, for example, insufficient road network and communication infrastructure are obstacles to the provision of effective emergency care in rural areas. The mountainous terrain and lack of airports in remote rural areas makes transportation of critical patients very difficult [265]. In some EU countries, waiting times for emergency care in rural areas are significantly higher than the national average [249].

The WHO Commission on Social Determinants of Health recommends that governments direct resources to address urban-rural health inequalities through continued investment in rural infrastructure development, and to address the political factors and processes that contribute to low living standards in rural areas.

The health system is the set of private and public organizations, institutions and resources needed to improve, maintain or restore health. The health system encompasses both individual and population means, as well as interventions aimed at policy change or actions by other sectors to address the social, environmental, and economic problems that determine the health status of a nation [278].

The health system has four functions: financing, leadership, service delivery, and resource creation.

Resource building involves preparing and deploying the necessary human resources, maintaining the competence and productivity of diverse health professionals through continuing education and training programs, ensuring the necessary investment in infrastructure and equipment, and ensuring the most effective combination of medicines and medical technologies.

Despite nearly half of the world's population living in rural areas, only 38% of nursing staff and less than 25% of physician staff are employed outside of cities [352]. Most countries face the difficulty of providing rural areas with the necessary number of health personnel. Measures to increase the availability of qualified health personnel in rural health care include training, regulation, financing, and personal and professional support. For example, WHO recommends the use of targeted training policies for personnel in various health disciplines with the inclusion of students of rural origin to increase the likelihood that graduates will choose to practice in rural areas. It is also suggested that medical schools, campuses, and family physician training programs be located outside metropolitan and large cities to increase the likelihood of graduates working in rural areas [319, 345]. As a measure to attract specialists to work in rural areas, it is suggested that students from various medical disciplines rotate to rural hospitals and clinics to familiarize themselves with the workplace and create a positive impression. WHO proposes to revise the curricula of universities and postgraduate education programs to include topics related to rural health care in order to improve the competence of health professionals working in rural areas, thus ensuring increased satisfaction with their work. Continuing postgraduate training and professional development programs should be tailored to the needs of rural health workers, with accessibility to such programs based on the geographical location of their workplaces and places of residence [240, 273, 276, 277, 333, 350].

As regulatory interventions, WHO proposes the establishment of various scholarships, grants and other training programs with a mandatory return-to-work contract in rural or remote areas to improve staffing availability. Mandatory requirement for a certain duration of work in rural areas should be accompanied by adequate support and funding to increase the proportion of health workers in rural areas and to retain the existing workforce. Expansion of specializations of health workers working in rural areas is also recommended to increase job satisfaction and ensure retention [247, 272, 333, 348].

Financial initiatives proposed include a combination of allowances, grants, lodging and transportation costs, and additional paid leave, which together will outweigh the costs and inconvenience of working in rural areas [222].

Personal and professional support should include improving the quality of living conditions for health workers and their families, which implies investment in infrastructure and services, as these factors directly influence the decision to choose a workplace [304]. It is also necessary to create comfortable and safe working conditions, including the provision of necessary equipment and supplies, supportive supervision and mentoring, so that these jobs become professionally attractive [274]. There is a need to introduce educational interventions to increase interaction between health workers in better-off and less well-off areas, including the use of telemedicine technologies. The development and funding of professional development programs, as well as the creation of higher-skill jobs to enable upward career movement without necessarily moving from their place of residence, can also help increase the number of rural health workers [258, 291]. To reduce the feeling of professional isolation, it is possible to create professional networks, associations of rural health workers, creation of specialized journals of rural health care. Measures of public recognition, such as "rural medicine days", specialized awards and titles both nationally and internationally, can also help to raise the prestige of work in rural medicine [244, 250, 296, 323, 355, 358].

The research results demonstrate that the choice of measures to increase the share of health workers employed in rural areas, as well as to maintain their number, requires a comprehensive study and understanding of labor resources. In addition to a detailed analysis of the labor market and situation, it is necessary to analyze the complex factors that determine the decision of health workers to move from rural to urban areas and vice versa [352]. Negative factors include low wages, limited resources and equipment in the workplace, worse living conditions for the worker and his/her family, and limited career opportunities [354].

It should be noted that Norway has the highest distribution density of doctors and other health care workers in the whole of Europe. However, securing a sufficient number of highly qualified physicians in the northern part of the country has long remained a challenge. In response to the peak of the medical workforce crisis in 1997, a new initiative for postgraduate training and specialization of physicians was launched, implying that for interns who agreed to take up vacant positions in the required field, all costs of professional specialization would be covered by the state. In addition, the local medical association organizes biannual courses and professional training programs, which makes it possible to obtain full specialization without leaving the field. The main results of these initiatives have been that between 1999 and 2006, 267 specialists were employed in this area of Norway, twice as many as expected.

In some countries, special attention should be paid to the availability of pharmacies and essential medicines in rural areas and for the poor [281, 302, 321, 329]. In developing countries, only 42% of public sector health organizations and 64% of private sector health organizations have essential medicines [298]. Median drug prices in developing countries are on average 2.7 times higher in the public health sector and 6.3 times higher in the private sector than international prices [298]298]. Poor people in rural areas face the dual constraints of both inadequate availability of medicines and inability to purchase them. An important aspect of building resources for a functioning health system is attention to the provision of physical infrastructure, key equipment and technology in remote and rural areas.

Low population density, long distances faced by both health care workers and people seeking medical services, as well as the increasing costs associated with the scale of the structural units of the health care system in sparsely populated areas are the main difficulties on the way of providing rural population with medical care not only in Russia, but also abroad [308]. Governments of different countries use a wide range of approaches aimed at ensuring the availability of medical care in rural areas. These include increasing the matching of allocated resources with available needs; municipal reforms; ensuring cooperation between oblasts and municipalities; agreements on cross-provision of medical care between neighboring municipalities; defining and ensuring standardized staffing of the structural units of the health care system throughout the country; creating free or low-cost telephone help lines; ensuring a more even distribution of primary care centers; and ensuring a more even distribution of medical care in rural areas.232, 236, 289, 305].

Additional measures may include the use of mobile health units, providing home-based treatment for the elderly, paying for (or providing) transportation for those seeking medical care, and the use of single-window terminals. [318, 340]. One-stop-shop terminals are information portals that provide access to various programs and services from one centralized point [301, 303]. They reduce costs and increase accessibility of certain types of assistance for people in rural areas. Some countries, mainly in Western Europe, are actively investing in the use of Internet resources, including both for diagnostic purposes and for communicating the results of specialized examinations to the patient [249]. However, a significant proportion of rural residents in many countries do not have access to the Internet, or are not willing to pay for it, and are not computer literate, especially the elderly [249].

In Germany, as part of a rural health care efficiency program to save GP time, nurses use a tablet to send real-time data on patients' health status and, if necessary, organize a videoconference. The nurse performs the activities under the supervision of the general practitioner, is trained in advance in the procedures that can be performed under this program, and is trained in the use of telecommunication and computer equipment.

Currently, there is an urgent need to conduct systematic research to find the most effective methods to improve and control the quality of health care delivery in rural areas. Such studies should take into account the heterogeneity of individual rural areas, which does not allow for a one-size-fits-all approach. In addition, studies of this kind should reflect in detail the state of the health care system, including actions to prevent diseases and promote public health. Government action is needed to improve workplace safety, drinking water quality, maternal health, and access to family planning services [352].

Non-communicable diseases are the leading cause of death in the European Region [278]. Cardiovascular diseases remain the leading cause of death, followed by cancer. Research findings indicate that the availability of noncommunicable disease prevention measures (including screening methods) in rural areas is insufficient. Remoteness from screening sites and transportation problems, combined with lack of symptoms and low awareness of diseases, contribute significantly to low screening rates in rural areas.

Due attention needs to be paid to matching the model of care used with the demographic characteristics and changes in rural areas. The ageing population and the migration of young people to urban areas require a shift in emphasis in many countries towards health care for older persons and persons with disabilities [249]. Rural agricultural areas with a high proportion of seasonal work may have a high proportion of migrants used as labor, who may face financial, administrative, and cultural challenges in accessing health care [249].

An interesting innovative aspect that can contribute to the active development of rural health care is the innovative concept of "social agriculture". This concept is gaining popularity, particularly in European countries. Social agriculture implies the use of agricultural resources for treatment, rehabilitation, education and social inclusion. The concept is of great importance for the treatment of mental disorders, substance dependency, rehabilitation, long-term treatment and care and partial care housing (including the elderly), as well as for education in the field of medicine and healthy lifestyles (e.g. regarding nutrition). In the Netherlands, social farming is now becoming more professionalized and indicators, certificates and training programs for farmers are being developed. These kinds of programs aimed at improving the mental and physical health of the population in the Netherlands are partly financed from the national health system budget [249]. The social agriculture program creates new jobs in rural areas and serves as an additional way to increase rural incomes [255]. In some countries, social farming is used to facilitate the labor market integration of people with disabilities related to both physical and mental impairments, the long-term unemployed or early dropouts from education, and other populations subject to social exclusion [255].

1.6. Summary

Regardless of the region or level of economic development of a particular country, the most important goal of a health care system is to meet the needs of the entire population. These needs include the need for access to the full range of quality health care, delivered in a timely manner by experienced and professional health workers, maximizing outcomes at the lowest possible cost. This need is even greater for low-income and vulnerable populations, especially those living in remote and rural areas in developing countries. Insufficient access to health care in rural areas has a significant negative impact on the level of health of the rural population. The rural population in the Russian Federation is heterogeneous, distributed over a large area and has different demographic characteristics. In view of the above, it is necessary to implement specific improvements according to the needs of each particular rural population. Health care reform is necessary to improve the provision of health care in rural areas, along with the creation of medical infrastructure, attention should be paid to the training and professional development of doctors and other medical personnel working in rural areas. Building and maintaining a highly educated and professional rural health care workforce is only possible with a good understanding of the education, practice and quality of life needs of rural health care workers. Only by providing the rural health care system with a well-trained and highly professional workforce, along with the necessary modern technologies, will it be possible to achieve equal health status between urban and rural residents.

CHAPTER 2. MATERIAL, METHODS AND RESEARCH PROGRAM

This work was carried out using the methods and methodology of complex socio-hygienic, epidemiological and economic research, system analysis and organizational and functional modeling. The research program was developed on the basis of methodological approaches to study the issues of organization and quality of medical care for rural population, developed by the State Program of the Russian Federation "Health Care Development until 2020" and orders of the Ministry of Health of the Russian Federation.

The methodology of complex study of the level and structure of neurological morbidity and provision of specialized care to this category of patients was developed on the basis of the set goal and objectives.

The program of the conducted research included the definition of the following parameters – object of research, collection of initial information, statistical processing and conceptual analysis of the obtained data.

The subject of the study is the activities of outpatient, inpatient, outreach and telemedicine neurological patient care.

The object of the study is medical organizations of inpatient and outpatient-polyclinic type providing neurological care to patients.

Units of observation – patients with neurological pathology (CVD, epilepsy) requiring outpatient, inpatient, traveling and telemedical treatment.

The main set of methods used during the study were:

- ✓ Study and generalization of experience
- ✓ Epidemiological method
- ✓ Document analysis method
- ✓ Expert judgment method
- ✓ Comparative analysis
- ✓ Statistical analysis
- ✓ System analysis
- ✓ Questionnaire

The program of the study is presented in Table 1.

Characterization of the research base

The base of the study was the districts of the Tyumen Oblast of the Russian Federation without AD (hereinafter, when referring to the Tyumen Oblast, it will be assumed that this is a territorial district that does not include autonomous okrugs). This Oblast is a part of the Ural Federal District. The diversity of the Oblast's natural conditions is due to its large size and geographical location. Thus, such natural zones as arctic desert, tundra, forest tundra, taiga, mixed forests and forest-steppe successively replace each other.

The administrative structure of the Tyumen Oblast is complex: within the region there are three districts – the south of the Tyumen Oblast, the Khanty-Mansiysk Autonomous Okrug – Yugra and the Yamalo-Nenets Autonomous Okrug. The administrative center is the city of Tyumen and 22 municipalities [158].

The Tyumen Region is part of the Urals Federal District (UFD) and is located within the West Siberian Plain. The region is the most populated part of the Oblast with a well-developed social infrastructure. The territory is 160.1 thousand km^2. The territory includes 5 cities, 22 districts, 5 urban-type settlements, 936 rural settlements. Two cities are classified as "small" with a population of less than 50 thousand people. Two cities have from 50 to 150 thousand inhabitants and one city (the regional center) is included in the group of large cities with more than 600 thousand inhabitants. Among rural settlements 93% of the total number of villages and hamlets with a population of up to 1000 people [104].

Table 1 – Research program and methods

Objectives of the main stages of the study implementation (2009-2022)			
Phase I	**Phase II**	**Phase III**	**Phase IV**
The analysis of scientific literature, normative legal documents was carried out, the program and methods of research were developed. Demographics as well as the prevalence of neurologic pathology were studied. A forecast of demographic indicators and morbidity of cerebrovascular disease up to 2030 was made on the basis of available actual data without taking into account possible socio-economic changes and the dynamics of migration processes.	The state of organization of specialized neurological medical care for stroke patients was studied. The effectiveness of vascular centers and schools for stroke patients and their relatives was investigated.	The analysis of the activity of visiting medical crews of regional clinical hospitals and telemedicine technologies in providing consultative, organizational and methodological neurological assistance to rural health care in remote and hard-to-reach areas of the Tyumen Oblast has been carried out. Patients' satisfaction with the quality of services provided was investigated.	Analysis of the system of specialized neurological medical care for rural population with epilepsy. Evaluating the effectiveness of epilepsy centers and schools for patients with epilepsy and their relatives. Evaluation of the effectiveness of the antiepileptology service according to the register data.
Objects of study, sources of information, units of observation, scope of study			
Statistical materials of the Tyumen Oblast Health Department for 2009-2022. - 28.	Medical records of inpatients of the regional vascular center in the Regional Clinical Hospital No. 2 (Tyumen) and primary vascular departments at the regional vascular center in Tyumen. (Tyumen) and primary vascular departments on the bases of the Regional Hospital No. 3 (Tobolsk). (Tobolsk), Regional Hospital No. 4 (Ishim) and Regional Hospital No. 23 (Yalutorovsk) - 23689 patients. Cards for assessing the quality of medical care for a patient with STEMI - 23689 cards. Patients with STEMI and their relatives who visited schools for stroke patients - 8254 people. A questionnaire survey was conducted to determine satisfaction with the educational activities conducted - 2200 people and 100 people of the comparison group.	The number of field crews is 50. Consulted patients - 14188 people. To determine the satisfaction of the population with the quality of work of visiting crews, a questionnaire survey was conducted - 832 people.	Patients of the regional epileptology center (Regional Treatment and Rehabilitation Center) and interterritorial epileptology offices (Regional Hospital No. 3, Regional Hospital No. 4, Regional Hospital No. 23) -2163 adults and 826 children. Patients and their relatives who visited schools for epilepsy patients - 1304. To determine the satisfaction of the population with the quality of the conducted schools, a questionnaire survey was conducted - 1412 people and 70 patients of the comparison group (not trained).
Research Methods			
Neurological examination. Literary and analytical. Statistical analysis.	Statistical analysis.	Statistical analysis.	Statistical analysis.

This territorial arrangement creates certain difficulties related to the routing of patients requiring both urgent and planned medical interventions. The lack of a clear understanding and algorithm for routing patients leads to their "chaotic" movement through different stages of medical care, which significantly worsens not only its availability, but also its quality.

The indicators of 25 territories in the south of the Tyumen Oblast were evaluated and divided into 3 groups in order to assess epidemiologic indicators of CVD in urban and rural areas: territories with only urban population (Tyumen, Ishim, Tobolsk); territories with only rural population (Abatsky, Armizonsky, Aromashevsky, Berdyuzhsky, Vagaysky, Vikulovsky, Golyshmovsky). Tobolsk); territories with only rural population (Abatsky, Armizonsky, Aromashevsky, Berdyuzhsky, Vagaysky, Vikulovsky, Golyshmanovsky, Isetsky, Ishimsky, Kazansky, N-Tavdinsky, Omutinsky, Sladkovsky, Sorokinsky, Tobolsky, Tyumen, Uvatsky, Uporovsky, Yurginsky, Yarkovsky districts); territories with both urban and rural populations (Zavodoukovsky and Yalutorovsky districts). and Yalutorovsky districts) (Figure 1) [106, 115].

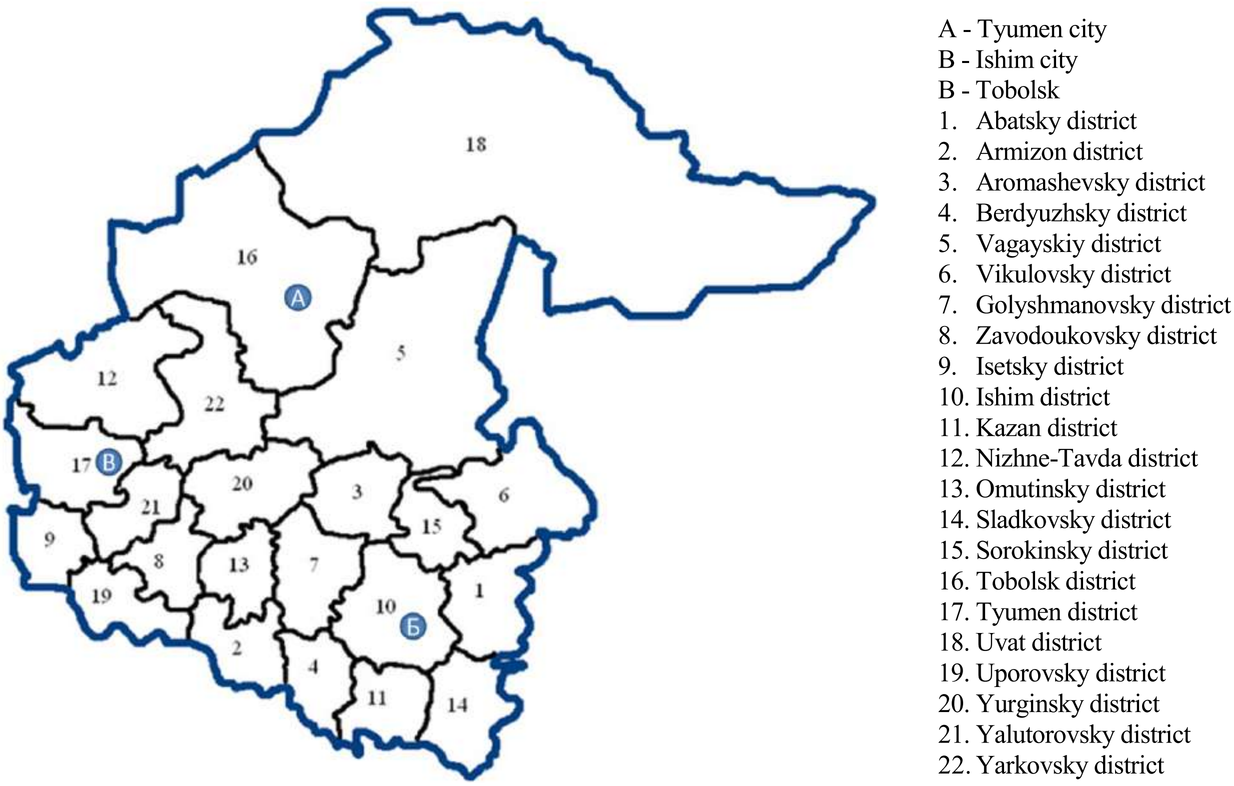


Figure 1 – Districts of the south of the Tyumen Oblast [106]

In 2012, 205 neurologists provided care in the Tyumen Oblast (without autonomous okrugs), of whom 60% worked in outpatient services and 40% in inpatient clinics in hospitals. The number of neurologists per 10,000 population was 1.5 (RF – 1.5; UFO – 1.4) [100].

By 2022, the number of neurologists increased to 246, of which 67% worked in the outpatient service and 33% in inpatient care. The staffing level of neurologists per 10,000 population in the Tyumen Oblast was 1.53 (RF – 1.36; UFO – 1.29).

As of 01.01.2023, medical assistance to the population of the Tyumen Oblast is provided in 50 medical organizations of the public health care system, including 86 branches of regional organizations:

- ✓ 48 institutions of regional subordination;
- ✓ 2 federal agencies
- ✓ 86 branches of regional organizations
    - 10 district hospitals;
    - 15 neighborhood hospitals;
    - 48 medical outpatient clinics;
    - 13 branches of regional institutions;
- ✓ Tyumen Cardiology Center, a branch of the Tomsk Research Medical Center of the Russian Academy of Sciences.

A total of 653 paramedic stations are functioning in the Tyumen Oblast.

In order to solve the set goal and tasks, we used solid and sampling methods of research. At each stage, depending on the set objectives, both objects and scope of the study were changed, clarified and specified. The number, birth rate and mortality rate of the population, as well as primary and secondary morbidity, morbidity and mortality from the studied neurological diseases were studied by the continuous method. Population satisfaction with the quality of services was assessed by a sample method.

The study conducted consisted of several stages:

Stage I – analysis of domestic and foreign scientific literature devoted to the problems and prospects of medical care, including neurological care, to the population living in rural areas. Information search was carried out in scientific bases Medline, Medscape, Cochrane Library, Elibrary both in journals and conference materials, as well as in dissertations for the title of candidate or doctor of medical sciences and normative legal documents. The following key words were used for literature search: rural area, health care organization, neurological care, regional vascular center, primary vascular department, acute cerebrovascular disorder, cerebrovascular disease, mortality, morbidity, mobile forms of medical care, mobile teams, telemedicine, telemedicine technologies, antiepileptological center, educational programs.

The development of the program and methods of research, as well as the assessment of the epidemiological situation, including neurological pathology, in the Tyumen region for 2009-2022 and the forecast up to 2030 were carried out.

For the epidemiological assessment of health indicators of the population of the Tyumen Oblast for 2009-2022, the data of annual statistical reports and materials of the territorial body of the Federal State Statistics Service in the Tyumen Oblast and the Federal State Institution "Main Bureau of Medical and Social Expertise in the Tyumen Oblast" were used. Epidemiological indicators were assessed in order to evaluate the health indicators of the population of the Tyumen Oblast and to select priorities for preventive programs.

The morbidity was analyzed by diagnoses in accordance with the International Classification of Diseases and Health Related Problems, 10th revision (ICD-10).

Forecast of demographic indicators

Demographic forecast – scientifically substantiated information on future trends in population size, reproduction parameters and population structures, including in terms of population size, age-sex and family structure, fertility, mortality, migration, etc. The demographic forecast is a scientific-based information on future trends in population size, reproduction parameters and structures.

Currently, population projections are most commonly used in the following, often interrelated cases:

– when determining the needs in food, energy, housing, social, medical, educational, transportation and other services (forecast of the population and individual age and sex groups);
– in the development of social, pension and health insurance programs (forecast of age-sex and family structures of the population, including the ratio of the working-age and nonworking-age population);
– when determining the rate of economic growth (forecast of the population (employed), its educational, age-sex and family structure).

The following forecasting methods are most commonly used:

Extrapolation methods, moving average method, exponential smoothing method, least squares method, moving age method (cohort method), expert judgment method. The last three methods are most often used in practice. For the calculations of the forecast of demographic processes in the Tyumen Oblast we used the method of moving ages, or the method of components, which makes it possible to obtain a forecast of the total population and its age-sex structure. It should be noted that any forecasting method has two "hard" rules:

1. The minimum number of periods of retrospective data used is 3 study periods. That is, if it is necessary to forecast the mortality of the population for the next few years, the calculations are carried out using mortality indicators for the last 3 years.

2. The longer the forecast period, the higher the forecast error and lower the reliability of the forecast data.

In practice, the calculation of forecast indicators uses comparison with known benchmarks (benchmarking). Moreover, retrospective data for a certain time period can be taken as a benchmark in demographic forecasting.

For operational assessment of the situation, for example, on achievement of the target indicator, "rough" forecasting is used with equating the available statistical data to a certain time period without taking into account the calculation error.

However, it should be noted that when forecasting demographic data, several types of techniques are usually used simultaneously. The most striking example is the forecasting of the population for a year.

Population size (**H**) is directly related to two factors that characterize population movement:

1. Natural increase/decline.
2. Migration (mechanical) increase/decline.

and is calculated by the formula:

$$Ht = \mathbf{Ht} + Kep + Kmp,$$

where

Np – population for the projected year;

Ht – population of the previous year;

Kep is the coefficient of natural increase;

Kmp – migration growth rate.

In turn, the ratios are calculated as follows:

$$Kep = R - S,$$

where

R is the number of births per year;

S is the number of deaths per year.

$$\mathbf{Kmp} = P - V,$$

where

P is the number of arrivals per year;

V – number of departures for the year.

Thus, the projected population is the calculated population and the numbers of births, deaths, arrivals and departures are the projected population.

In order to optimize the labor costs of calculations, various software complexes are currently used. The Tyumen Oblast health care system uses S.M.A.R.T. 2008 (system of instant analysis of relational tables) to calculate forecast values.

Stage II – study of the state of organization of specialized neurological medical care for stroke patients; evaluation of the effectiveness of vascular centers and schools for stroke patients and their relatives [110, 156].

The research materials used for this stage of the work were:

– Patients with STEMI are residents of the Tyumen Oblast, 23689 people in total.

– Annual reports of the regional vascular center in the Regional Clinical Hospital No. 2 (Tyumen) and primary vascular departments in the Regional Clinical Hospital No. 3. (Tyumen) and primary vascular departments on the bases of the Regional Hospital No. 3 (Tobolsk) and the Regional Hospital No. 4 (Ishim). (Tobolsk), GBUZ TO "Regional Hospital No. 4" (Ishim) and GBUZ TO "Regional Hospital No. 23" (Yalutorovsk) [110].

– Cards for assessing the quality of medical care for patients with STEMI – 23689 cards. The following indicators were analyzed: the number of hospitalized patients with STEMI; the frequency of hospitalization of patients with STEMI in the first 24 hours; the percentage of patients with ischemic stroke (IS) hospitalized in the first 3 hours; the percentage of patients with STEMI hospitalized bypassing the emergency room; the percentage of patients who underwent neuroimaging study, including within the first 40 min from the moment of admission; the frequency of systemic thrombolytic therapy (STT) in patients with STEMI; the frequency of systemic thrombolytic therapy (STT) in patients with STEMI. including within the first 40 min of admission; frequency of systemic thrombolytic therapy (SLT) in patients with MI; percentage of patients with clinical improvement and complications after SLT; percentage of patients independent in activities of daily living by the end of hospitalization; mortality from STEMI [110].

– Annual reports of schools for patients with STEMI and their relatives -. 8,254 people.

– To determine the satisfaction with the educational activities conducted, a questionnaire was conducted: 2200 people and 100 people of the comparison group (non-trainees). We designed the questionnaire taking into account that its questions and answer options were understandable for different categories of respondents, and that they were informative for testing the working hypothesis. The questionnaire contained open-ended (no answer options are provided, respondents answer the questions themselves), closed-ended (respondents are offered ready-made answer options from which they choose) and alternative questions (there is some alternative choice from several options in the question (most often yes/no) [112]. The questions in the questionnaire were related to the age and social status of the patients, as well as their opinion on the amount, accessibility of the material provided, acquired practical skills and knowledge about risk factors, symptoms of STEMI and actions to be taken in case of its occurrence. In addition, the respondents were asked questions about the quality and accessibility of the developed handouts and their opinion on the need for such educational events in the future.

Stage III – analysis of the activities of visiting medical teams of regional clinical hospitals and telemedicine technologies to provide consultative, organizational and methodological neurological assistance to rural health care in remote and hard-to-reach areas of the Tyumen Oblast.

Mobile multidisciplinary crews provide residents of rural areas of the Tyumen Oblast with affordable medical care at the expense of regional medical organizations. The specialists of the visiting crews also organize educational events for doctors of rural municipalities.

The research materials used for this stage of the work were:

– reports of field teams – 50.
– counseled patients – 14188 people.
– 832 people were surveyed to determine the satisfaction of the population with the quality of work of visiting crews. The questionnaire, specially developed by us for this study, contained open, closed and alternative questions. The questionnaire

questions concerned the age and social status of the respondents, their purpose of visiting the specialists of the visiting crew, the number of consultations with various specialists during one visit, the number of examinations conducted, as well as the opinion about the organization of the work of the visiting crew specialists, the availability of plans for repeated visits, the previous experience of consultation with these specialists and the negative moments that patients encountered during the appointment.

Stage IV – analysis of the system of providing specialized neurological medical care to the rural population of the Tyumen Oblast with epilepsy; evaluation of the effectiveness of the epileptology center, interterritorial offices and schools for patients with epilepsy and their relatives.

The research materials used for this stage of the work were:

– Annual reports of the regional epileptology center (Regional Treatment and Rehabilitation Center) and inter-territorial epileptology offices (Regional Hospital No. 3, Regional Hospital No. 4, Regional Hospital No. 23).
– Reports of schools held – 1304.
– To determine the satisfaction of the population with the quality of the conducted schools, a questionnaire survey was conducted – 1412 people and 70 patients of the comparison group (not trained). The questionnaire contained open, closed and alternative questions. The questionnaire was conducted anonymously in order to obtain reliable answers. The questionnaire also included questions about the age and social status of the patients, as well as their knowledge of the factors that provoke an epileptic seizure, the manifestations of epilepsy, and the ability to help a person who has had a sudden epileptic seizure. The respondents' opinion about the handouts and satisfaction with the knowledge gained was also taken into account.
– Epilepsy registry data – individual charts of 2,163 adults and 826 children 2163 adults and 826 children.

The required number of observations was determined using the formula proposed by N. A. Plokhinsky:

$$n = \frac{t^2}{k^2} \, (1),$$

where

n is the number of the sample;

t – probability/confidence criterion;

k is the coefficient reflecting the ratio of the maximum permissible error to the standard deviation of the general population.

It is not necessary to calculate the values of the maximum permissible error and standard deviation, but to accept k=0.3-0.5 for ordinary trials, k=0.1-0.3 for medium responsibility trials, and k=0.1 for especially responsible trials.

Depending on the accuracy of the results required in the study, an appropriate likelihood criterion (t) is selected:

– most biological studies – t=1.9; p=0.9;
– studies testing biological hypotheses – t=2.6; p=0.9;
– particularly accurate studies – t=3.3; p=0.9.

Based on the above data with k=0.2 and t=1.9, the sample size should be at least 150 observations.

According to the recommendations of K. A. Otdelnova, for medium precision studies, when k=0.2 and t=3, the required number of observations is 225, whereas for medical and social studies (k=0.2 and t=3) the sample size should be 400 observations.

Accordingly, the sample of 2163 and 826 taken to assess the quality of the antiepileptologic service provided to adults and children with epilepsy in the Tyumen Oblast is representative and sufficient to obtain meaningful results of the analysis.

The sample population of patients and their relatives who had attended a series of lectures on basic aspects of ONMC and epilepsy (2,200 and 1,412 people), as well as patients of visiting crews (832 people) is also sufficient.

All sample populations were formed by simple random sampling from the total number of the respective population.

At the final stage of the work generalization of the obtained research results, formulation of conclusions and practical recommendations were carried out.

Statistical analysis of the study results was performed using the analytical package SPSS-version 18.0 (SPSS Inc., Illinois, USA). The general principles of statistical data analysis were based on the verification of the character of parameter distribution by the one-sample Kolmogorov-Smirnov criterion, which allowed us to solve the question of statistical criterion selection.

Descriptive statistics for one parameter in case of nonparametric distribution of data are presented as arithmetic mean ± standard deviation or as a percentage of the analyzed indicator. Parametric criteria were used to compare samples when the variance of the studied values was insignificant and nonparametric tests when the distribution deviated from normal. Parametric analysis was performed using Student's t-test for unrelated populations, and Mann-Whitney U-test was used among non-parametric criteria. Differences between arithmetic averages were considered statistically significant when the Fisher-Steudent difference criterion was $p<0.01$.

Forecasting was carried out by means of time series analysis. The selection of models that adequately reflect the situation of general and primary morbidity on the basis of which reliable forecasts can be made was carried out using the autoregressive integrated moving average (ARIMA) model. Among the models built, the optimal model with the best forecast accuracy was selected according to a number of standard indicators: R-square – coefficient of determination (the value approaching 1 is considered the best), mean absolute percentage forecast error MAPE (Mean Absolute Percentage Error), (<20% – good forecast accuracy, 20%-50% – satisfactory forecast accuracy, >50% – low forecast accuracy), minimum value of Bayesian information criterion – BIC (Bayesian information criterion).

Summary

1. To conduct the planned research, a program for its implementation has been developed and the main stages have been allocated.

2. The study covered the period 2009-2022, during which outpatient, inpatient and outpatient neurological care for the population of the Tyumen Oblast was analyzed.
3. A forecast of demographic indicators, including the incidence of CVD up to 2030 was made.
4. A questionnaire survey was conducted among four groups of patients (students of schools for patients with CNMI and epilepsy and their relatives, patients of visiting crews, patients who used telemedicine consultations and their relatives) to assess satisfaction with the quality of services provided.
5. Such research methods as study and generalization of experience, epidemiological method, method of document analysis, method of expert evaluations, comparative analysis, statistical analysis, system analysis, questionnaire were used.

Thus, the developed research methodology was of a comprehensive nature, which resulted in the possibility to conduct a comprehensive analysis and in-depth study of the problem, to assess the actual state of the organization of outpatient, inpatient, mobile and telemedicine forms of medical care in the Tyumen Oblast and to solve the tasks set in the study.

CHAPTER 3. EPIDEMIOLOGICAL CHARACTERISTICS HEALTH OF THE POPULATION OF THE TYUMEN REGION

The most informative and objective indicators of public health are such medical and demographic criteria as the number, birth rate, mortality, age-sex composition of the population, which form the main health indicators – morbidity, disability, mortality, etc., which necessitates their dynamic observation and systematic analysis for the timely detection of changes in the demographic situation in the country and the region.

Table 2 shows the primary incidence of diseases of the nervous system in the Tyumen Oblast and the Russian Federation, in which it can be seen that the indicators for the rural population of the Oblast are higher than for the urban population.

Having studied the morbidity rate for diseases of the nervous system in TO, it was revealed that epilepsy makes the greatest contribution to this group of diseases. In addition, the treatment of CVD, which belongs to the class of diseases of the circulatory system and is one of the most common diseases both in Russia and abroad, with high mortality and disability rates, is carried out by neurologists; therefore, the main emphasis in improving the system of neurological care was aimed at patients suffering from these diseases (see Tables 2, 3, 4, 5).

The average annual incidence rate for systemic atrophies affecting mainly the CNS (G10-G12) in the period from 2009 to 2022 was 131.4 ± 47.9, with the highest incidence rates occurring in 2009-2012. Overall, there was a decrease in incidence over the period, with an average absolute loss of 3.2% between 2009 and 2022. In the period before the pandemic of new coronavirus infection (2009-2019), the mean annual incidence rate was 138.3 ± 52.4 and the mean absolute loss was 4.5%, in the pandemic period (2020-2022), the incidence rate was lower compared to the pre-pandemic rate of 106.3 ± 6.1 but not statistically significant and there was a mean absolute increase of 6%.

Table 2 – Primary morbidity of diseases of the nervous system in the population in the Tyumen Oblast in 2009-2022 (per 100,000 population)

Year	Tyumen Region			RF		
	Urban population	Rural population	Total	Urban population	Rural population	Total
2009	6,0	12,7	8,4	10,8	10,7	10,8
2010	6,6	9,8	7,9	12,8	13,2	12,9
2011	9,2	13,0	10,7	13,0	14,1	13,3
2012	8,8	20,7	13,4	12,7	13,8	13,0
2013	6,9	20,4	11,9	15,1	18,0	15,9
2014	8,1	19,7	12,2	24,9	32,5	26,9
2015	35,0	41,4	37,2	37,2	51,8	41,0
2016	56,8	65,9	59,9	52,0	72,3	57,2
2017	88,5	98,0	91,7	63,6	87,8	69,8
2018	94,3	141,7	110,0	69,7	90,5	75,0
2019	104,9	162,9	123,9	63,8	83,8	68,9
2020	104,6	170,8	126,1	n.d.	n.d.	83,5
2021	69,7	122,9	86,8	77,9	103,9	84,4
2022	85,4	189,7	119,1*	n.d.	n.d.	73,5
Average annual level	85,4	170,8	119,1	24,9	13,8	26,9
95% CI	69,7-104,6	122,9-189,7	86,8-126,1	12,8-63,6	83,8-103,9	13,0-68,9
Average absolute growth/loss	-9,6	9,5	-3,5	4,8	6,7	5,3
Average annual growth/decline rate	-9,6	5,4	-2,8	19,4	22,9	20,4

For the urban population, the mean annual incidence rate from 2009 to 2022 was 105.5 ± 50.9 and was higher before the pandemic compared to the rate during the pandemic (113.3 ± 55.3 and 77.0 ± 2.7, respectively). For the rural population, the rate was 25.9 ± 4.1 between 2009 and 2022, 25.0 ± 3.8 before the pandemic and 29.3 ± 3.5

during the pandemic. There was no difference between the average annual incidence rate before and after the pandemic for systemic atrophies affecting mainly the CNS (G10-G12) in rural and urban populations. The dynamics of morbidity rates among urban and rural population in the period before the pandemic differed, there was a decrease in pre-pandemic morbidity among urban population and an increase among rural population (average annual rate of increase/decline -4.8% and 3.8%, respectively). During the pandemic, there was an increase in morbidity in both populations, but it was more pronounced in the rural population (average annual growth rate of 3.8% and 12.7%, respectively) (Table 3).

The average annual incidence rate for extrapyramidal and other motor disorders (G20, G21, G23-G25) in the period from 2009 to 2022 was 2055.6 ± 238.4 and there was an increase in the incidence rate (average absolute increase is 65.7%, average annual growth rate is 3.4%). In the period 2009-2019, the incidence rate averaged 1987.0 ± 216.7, which is significantly lower than in the period 2020-2022. – 2307,3 ± 117,6 (p=0,1). The mean absolute increase was also higher during the pandemic period 116.5% versus 63.5% before the pandemic (Table 4).

For the urban population, the average annual incidence rate from 2009 to 2022 was. 1564.9 ± 276.9 with a mean absolute increase of 57.0%. During the pandemic, the incidence rate for the urban population was significantly higher than before the pandemic (1828.3 ± 21.1 and 1493.1 ± 270.3, p=0.0) and so was the mean absolute increase of 71.2% before and 17.5% during the pandemic. For the rural population, this rate from 2009 to 2022 was 469.3 ± 65.4 with a less pronounced mean absolute increase of 8.7%, mean annual incidence rate of 466.6 ± 58.4 and 479.0 ± 102.8 between 2009-2019 and 2020-2022, respectively, with no significant difference. The incidence rate decreased during the period before the pandemic (mean annual rate of decline 1.7%), and increased during the pandemic (mean annual rate of increase 22.5%).

Table 3 – Structure of systemic atrophies affecting mainly the central nervous system of the adult population in the Tyumen Oblast in 2009-2022 (absolute figures)

Year	Systemic atrophies affecting mainly the central nervous system central nervous system (G10-G12)		
	Urban population	Rural population	Total
2009	137	18	155
2010	194	23	217
2011	199	22	221
2012	190	20	210
2013	76	26	102
2014	70	30	100
2015	73	28	101
2016	75	29	104
2017	74	26	100
2018	74	27	101
2019	84	26	110
2020	75	26	101
2021	76	29	105
2022	80	33	113
Mean annual level, m ± SD	105,5 ± 50,9	25,9 ± 4,1	131,4 ± 47,9
95% confidence interval	76,1-134,9	23,6-28,3	103,7-159,1
Average absolute growth/decline, %	-4,4	1,2	-3,2
Average annual growth/decline rate, %	-4,1	4,8	-2,4

For multiple sclerosis, the mean annual incidence rate between 2009 and 2022 was 623.8 ± 132.4 (95% CI 547.3-700.2), before the pandemic was 577.6 ± 107.4 (95% CI 505.4-649.7), and after (2020-2022) was 793.3 ± 36.9 (95% CI 701.6-885.0). For the urban population, the mean annual incidence was 505.2 ± 121.0 (95% CI 435.3-575.1): 463.4 ± 99.8 (95% CI 396.3-530.4) and 658.7 ± 20.9 (95% CI 606.5-710.8), for rural 118.6 ± 15.9 (95% CI 109.4-127.8): 114.2 ± 12.1 (95% CI 106.0-122.3) and 134.7 ± 20.3 (95% CI 84.2-185.1) between 2009-2019 and 2020-2022, respectively.

Table 4 – Structure of extrapyramidal and other motor disorders of the adult population in the Tyumen Oblast for 2009-2022 (absolute indicators)

Year	Extrapyramidal and other motor disorders (G20, G21, G23-G25)		
	Urban population	Rural population	Total
2009	1098	481	1579
2010	1188	470	1958
2011	1275	521	1796
2012	1284	512	1796
2013	1375	505	1880
2014	1433	483	1916
2015	1606	507	2113
2016	1744	513	2257
2017	1833	377	2210
2018	1778	360	2138
2019	1810	404	2214
2020	1804	396	2200
2021	1842	447	2289
2022	1839	594	2433
Mean annual level, m ± SD	1564,9 ± 276,9	469,3 ± 65,4	2055,6 ± 238,4
95% confidence interval	1405,1-1724,8	431,5-507,0	1917,9-2193,3
Average absolute growth/decline, %	57,0	8,7	65,7
Average annual growth/decline rate, %	4,1	1,6	3,4

The average absolute increase/decline in multiple sclerosis from 2009 through 2022 was. 28.5%: from 2009-2019 was 29.5-26.3% and 3.2% per 10,000 population, and from 2020-2022 was 36.5-20.0% and 16.5% per 10,000 population for total population, urban and rural, respectively. The average annual rate of increase/decline was 4.6-4.9% and 3.7% for urban and rural residents from 2009 to 2022. From 2009 through 2019, the rates were 5.1%, 5.6%, and 2.8% per 10,000 population, and from 2020 through 2022. – 4.7%, 3.1% and 12.4% per 10,000 population for total population, urban and rural residents, respectively (Table 5).

Table 5 – Structure of adult population with multiple sclerosis in the Tyumen Oblast for 2009-2022 (absolute indicators)

Year	Multiple sclerosis (G35)		
	Urban population	Rural population	Total
2009	363	99	462
2010	361	107	468
2011	384	106	490
2012	405	111	516
2013	402	102	504
2014	384	134	518
2015	477	104	581
2016	532	115	647
2017	576	121	697
2018	587	126	713
2019	626	131	757
2020	635	125	760
2021	666	121	787
2022	675	158	833
Mean annual level, m ± SD	505,2 ± 121,0	118,6 ± 15,9	623,8 ± 132,4
95% confidence interval	435,3-575,1	109,4-127,8	547,3-700,2
Average absolute growth/decline, %	24,0	4,5	28,5
Average annual growth/decline rate, %	4,9	3,7	4,6

Between 2009 and 2022. 2951.9 ± 517.7 (95% CI 2653.0-3250.8): 2282.4 ± 416.3 (95% CI 2041.9-2522.7) urban and 669.6 ± 104.5 (95% CI 609.3-729.9) rural population. Between 2009 and 2019. For epilepsy, the mean annual incidence rate was 2773.4 ± 424.4 (95% CI 2488.3-3058.5), and 3606.7 ± 152.3 (95% CI 3228.3-3985.1) from 2020 to 2022, 2136.8 ± 339.6 (95% CI 1908.7-2364.9) and 2816.0 ± 78.5 (95% CI 2620.9-3011.1) for urban population, and 636.6 ± 85.9 (95% CI 578.8-694.3) and 790.7 ± 77.2 (95% CI 598.9-982.5) for rural population, respectively. The mean absolute increase/decline from 2009 to 2022 was 110.0% (85.4% for urban and 24.8% for rural populations). Before the pandemic of new coronavirus infection was 106.9%, 86.8% and 20.1% per 10,000 population total, for urban and rural population, and increased during the pandemic, mainly due to rural population, and was – 150.0%, 78.5% and 71.5% per

10,000 population, respectively. The average annual rate of increase/decline between 2009 and 2022 was 3.7% (3.8% for urban population and 3.5% for rural population). From 2009-2019, it was 3.8%, 4.1% and 3.1% per 10,000 population, and from 2020-2022, it increased slightly due to a decrease among urban population but a sharp increase in rural population to 4.2%, 2.8% and 9.3% per 10,000 population total, for urban and rural population, respectively (Table 5).

It is important to note that among all nosologic forms of diseases of the nervous system, epilepsy and status epilepticus (G40-G41) were most common in patients among both urban and rural populations (with prevalence being higher among rural populations since 2012), as well as extrapyramidal and other movement disorders (G20, G21, G23-G25), with prevalence being higher among rural populations since 2011 (see Tables 6, 7, 8, 9).

Table 6 – Epilepsy structure of the adult population in the Tyumen Oblast in 2009-2022 (absolute figures)

Year	Epilepsy (G40-G41)		
	Urban population	Rural population	Total
2009	1783	559	2342
2010	1725	519	2244
2011	1810	554	2364
2012	1906	583	2489
2013	1952	580	2532
2014	2057	600	2657
2015	2168	679	2847
2016	2346	708	3054
2017	2525	719	3244
2018	2582	741	3323
2019	2651	760	3411
2020	2736	736	3472
2021	2819	757	3576
2022	2893	879	3772
Mean annual level, m ± SD	2282,4 ± 416,3	669,6 ± 104,5	2951,9 ± 517,7
95% confidence interval	2041,9-2522,7	609,3-729,9	2653,0-3250,8
Average absolute growth/decline, %	85,4	24,6	110,0

Average annual growth/decline rate, %	3,8	3,5	3,7

The mean annual incidence rate for systemic atrophies affecting predominantly the CNS (G10-G12) was 12.6 ± 5.1 (95% CI 9.2-16.0) before the new coronavirus infection pandemic (2009-2019) and 9.1 ± 0.5 (95% CI 7.8-10.3) during the pandemic period (2020-2022), i.e. there was a decrease. The mean annual incidence rate for urban population decreased from 15.9 ± 8.4 (95% CI 10.3-21.6) to 9.4 ± 0.6 (95% CI 7.9-10.8), conversely, for rural population increased from 6.5 ± 0.9 (95% CI 5.9-7.0) to 8.5 ± 2.6 (95% CI 1.9-14.9) between 2009-2019 and 2020-2022.

The average absolute increase/decline between 2009 and 2019 was -0.5% per 10,000 population and between 2020 and 2022 was -0.5% per 10,000 population. – 0.5% per 10,000 population; for the urban population it increased from -0.8% to -0.5% per 10,000 population, as well as for the rural population from 0.1% to 2.4% per 10,000 population, respectively. The average annual growth/decline rate increased significantly from -4.2% to 5.6% per 10,000 population between 2009-2019 and 2020-2022; for urban population decreased from -5.1% to -4.9% per 10,000 population; and for rural population increased significantly from 1.8% to 31.8% per 10,000 population between 2009-2019 and 2020-2022, respectively (Table 7).

The mean annual incidence rate for extrapyramidal and other movement disorders (G20, G21, G23-G25), between 2009-2019 was 176.6 ± 16.7 (95% CI 165.4-187.8) and increased to 196.6 ± 9.7 (95% CI 172.7-220.6) thereafter, between 2020-2022. For the urban population, these rates were 206.9 ± 32.9 (95% CI 194.7-229.0) and 226.4 ± 14.3 (95% CI 191.1-261.8), and for the rural population, 121.7 ± 18.8 (95% CI 109.0-134.3) and 137.9 ± 54.3 (95% CI 3.0-272.7) between 2009-2019 and 2020-2022. The mean absolute increase/decrease from 2009-2019 was 4.3% per 10,000 population and increased to 9.6% per 10,000 population from 2020-2022 due to the rural population rates; for urban population, the mean absolute increase/decrease in the incidence of extrapyramidal disorders decreased from 8.9% to -11.1% per 10,000 population, and for rural population, increased from -3.8% to 49.9% per 10,000 population from 2009-2019 and 2019-2022, respectively. The average annual growth/decline rate was 2.6% and 4.9%

per 10,000 population, for urban population it decreased significantly from 4.9% to -4.9% per 10,000 population, for rural population it increased from -3.8% to 41.4% per 10,000 population for the period 2009-2019 and 2020-2022, respectively (Table 8).

Table 7 – Total morbidity of systemic atrophies affecting mainly the central nervous system of the adult population in the Tyumen Oblast (without AD) for 2009-2022 (per 100 thousand population)

Year	Systemic atrophies affecting mainly the central nervous system central nervous system (G10-G12)		
	Urban population	Rural population	Total
2009	18,6	5,5	14,5
2010	26,5	7	20,4
2011	30,9	5,2	20,6
2012	27,8	5,0	19,4
2013	10,9	6,5	9,3
2014	9,9	7,5	9,0
2015	10,2	7,0	9,1
2016	10,3	7,3	9,2
2017	9,9	6,6	8,8
2018	9,8	6,9	8,8
2019	10,9	6,6	9,5
2020	9,7	6,6	8,6
2021	9,8	7,4	8,9
2022	8,7	11,4	9,6
Mean annual level, m ± SD	14,6 ± 7,9	6,9 ± 1,5	11,9 ± 4,7
95% confidence interval	10,0-19,1	6,0-7,8	9,1-14,6
Average absolute growth/decline, %	-0,8	0,5	-0,4
Average annual growth/decline rate, %	-5,63	5,8	-3,1

Table 8 – Total morbidity of extrapyramidal and other motor disorders in the adult population in the Tyumen Oblast (without AD) for 2009-2022 (per 100,000 population)

Year	Extrapyramidal and other motor disorders (G20, G21, G23-G25)		
	Urban population	Rural population	Total
2009	147,2	150,1	148,1
2010	160,8	145,8	156,2
2011	197,8	121,9	167,6
2012	187,9	128,2	165,9
2013	197,4	126,6	171,6
2014	202,2	120,9	172,9
2015	224,2	127,0	189,4
2016	239,1	128,9	200,2
2017	246,6	95,2	194,0
2018	235,5	91,3	186,0
2019	236,9	102,2	190,9
2020	232,4	100,1	187,7
2021	236,8	113,4	195,3
2022	210,2	200,1	206,9
Mean annual level, m ± SD	211,1 ± 30,6	125,1 ± 27,8	180,9 ± 17,4
95% confidence interval	193,4-228,7	109,1-141,2	170,9-190,9
Average absolute growth/decline, %	4,8	3,8	4,5
Average annual growth/decline rate, %	2,8	2,2	2,6

For multiple sclerosis, the mean annual pre-pandemic incidence rate was 51.9 ± 8.1 (95% CI 46.5-57.4) and there was an increase to 67.6 ± 3.0 (95% CI 60.1-75.1) during the pandemic period (2020-2022) for both urban and rural populations. For the urban population, the mean annual incidence rates were 64.0 ± 12.1 (95% CI 55.9-72.1) and 80.9 ± 5.1 (95% CI 68.3-93.7), and for the rural population, 30.0 ± 3.6 (95% CI 27.6-32.4) and 41.2 ± 17.4 (95% CI 1.9-84.4) between 2009-2019 and 2020-2022, respectively. The mean absolute increase/decline in multiple sclerosis increased from 2.2% per 10,000 population between 2009-2019 to 2.9% per 10,000 population between 2020-2022, at the expense of the rural population, where these rates were 0.0% and 14.8% per 10,000 population, respectively, whereas the urban population showed a decrease in these rates from 3.4% to -3.2% per 10,000 population, respectively. The average annual growth/decline rate increased slightly from 2009 to 2019 to 2020-2022 from 4.2% to 4.5% per 10,000 population, also due to a sharp increase in this indicator among the rural population from 0.1% to 39.2% per 10,000 population and a decrease among the urban population from 5.5% to -3.9% per 10,000 population, respectively (Table 9).

Table 9 – Total incidence of multiple sclerosis in adult population in the Tyumen Oblast (without AR) for 2009-2022 (per 100 thousand population)

Year	Multiple sclerosis (G35)		
	Urban population	Rural population	Total
2009	47,9	32,9	43,3
2010	48,3	34,7	44,1
2011	59,6	24,8	45,7
2012	59,3	27,8	47,7
2013	57,7	25,6	46
2014	54,2	33,5	46,7
2015	66,6	26,1	52,1
2016	72,9	28,9	57,4
2017	77,5	30,6	61,2
2018	77,7	31,9	62,0
2019	81,9	33,2	65,3
2020	81,8	31,6	64,9
2021	85,6	30,7	67,2
2022	75,5	61,2	70,8
Mean annual level, m ± SD	67,6 ± 12,9	32,4 ± 8,9	55,3 ± 9,8
95% confidence interval	60,1-75,1	27,3-37,5	49,7-60,9
Average absolute growth/decline, %	2,1	2,2	2,1
Average annual rate of growth/decline, %	3,6	4,9	3,9

For epilepsy, the mean annual incidence rate was 249.7 ± 30.5 (95% CI 229.2-270.2) from 2009 to 2019, increasing to 307.4 ± 12.4 (95% CI 276.6-338.2) from 2020-2022, both for the urban population from 295.4 ± 40.1 (95% CI 268.4-322.3) to

342.7 ± 25.9 (95% CI 278.4-407.0), and rural from 166.7 ± 20.9 (95% CI 152.6-180.8) to 237.9 ± 84.8 (95% CI 27.4-448.6), respectively.

The average absolute increase/decline in the period before the pandemic of new coronavirus infection was 7.5% per 10,000 population and increased to 12.3% per 10,000 population during the pandemic at the expense of the rural population, where the rate increased from 0.5% to 74.9% per 10,000 population, while the urban population showed a decrease from 11.3% to -19.5% per 10 thousand population.

The average annual growth/decline rate for the period 2009-2019 was 2.9% per 10,000 population, and from 2020-2022 it increased to 4.1% per 10,000 population, for urban population the average annual growth/decline rate decreased from 4.0% to -5.7% per 10,000 population, and for rural population it increased from 0.3% to 34.4% per 10,000 population, respectively (Table 10).

Table 10 – Total morbidity of epilepsy among adults in the Tyumen Oblast (without AD) for 2009-2022 (per 100,000 population)

Year	Epilepsy (G40-G41)		
	Urban population	Rural population	Total
2009	234,4	186,4	219,7
2010	231,5	166,5	211,4
2011	280,8	129,7	220,6
2012	278,9	145,9	229,9
2013	280,3	145,4	231,1
2014	290,3	150,1	239,7
2015	302,7	170,1	255,2
2016	321,6	177,9	270,9
2017	339,7	181,6	284,8
2018	341,9	187,9	289,1
2019	346,9	192,3	294,2
2020	352,4	186,0	296,2
2021	362,4	192,1	305,1
2022	313,4	335,8	320,7
Mean annual level, m ± SD	305,5 ± 41,8	181,9 ± 48,6	262,1 ± 36,6
95% confidence interval	281,4-329,6	153,9-210,1	240,9-283,2
Average absolute growth/decline, %	6,1	11,5	7,8
Average annual rate of growth/decline, %	2,3	4,6	2,9

Thus, the obtained data indicate an increase in the incidence of diseases of the nervous system among the adult population in the Tyumen Oblast, including those living in rural areas.

3.1. Epidemiological characteristics of cerebrovascular diseases and diseases of the circulatory system

In general, the overall morbidity in the class of nervous diseases among the adult population in TO was higher compared to the RF indicators, especially in urban areas.

In most rural areas, the total morbidity in the class of nervous diseases was lower than in the Russian Federation, only in some areas exceeding the figures for Russia (Table 11).

Table 11 – Total morbidity of adults (18 years and older) by class of nervous system diseases in the Tyumen Oblast (without AD) for 2009-2022 (per 1000 population of corresponding age)

Territories	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
By Russia	47,9	48,2	48,7	48,9	49,8	50,0	49,6	49,2	48,9	48,8	48,9	42,5	43,7	44,7
By UFO	38,8	37,2	37,3	37,8	38,4	39,8	41,9	43,4	46,1	46,0	46,7	39,9	40,8	40,8
On maintenance	68,8	58,6	59,9	61,1	62,1	60,6	63,9	65,1	66,4	66,4	65,8	53,6	55,4	54,5
Tyumen	97,1	83,3	84,6	83,4	86,7	82,3	86,2	86,9	86,9	87,8	88,9	68,4	69,7	68,4
Ishim	46,2	39,8	39,1	41,4	39,4	40,9	44,5	48,5	49,5	52,1	52,3	51,7	53,3	54,8
Ishim district	72,7	66,6	70,6	71,2	69,9	71,8	73,6	67,2	69,4	65,9	64,7	63,5	61,9	59,9
Tobolsk	33,7	13,1	8,9	11,7	11,1	10,4	11,2	13,3	17,7	24,3	29,2	20,8	23,2	23,3
Abatsky district	15,8	15,2	12,5	15,8	11,8	9,0	11,3	18,4	28,6	16,4	20,7	17,9	18,9	18,6
Armizonsky	14,7	11,1	11,8	14,2	16,9	15,4	15,3	15,3	16,4	15,4	18,6	19,1	20,3	21,9
Aromashevsky	91,9	62,9	57,6	69,9	73,4	77,0	77,8	77,3	75,8	76,3	86,6	42,2	43,8	44,6
Berdyuzhsky	52,6	46,5	34,5	35,5	37,8	37,7	38,3	38,6	39,2	43,6	44,1	44,3	45,7	43,9
Vagayskiy	26,0	29,8	28,9	28,8	27,6	25,7	26,3	33,5	31,5	31,3	37,2	24,9	22,8	25,9
Vikulovsky	75,1	71,6	39,6	59,2	66,5	63,4	68,9	69,9	76,7	77,3	77,2	52,4	48,8	99,8
Golyshmanovsky district	54,9	34,3	28,5	30,2	27,5	27,8	29,5	30,2	31,3	30,7	31,6	31,2	31,8	32,4
Zavodoukovsky	10,3	8,8	8,1	8,3	8,9	9,1	8,9	8,9	9,0	9,5	9,6	6,7	11,9	12,0
Isetsky	18,6	16,5	19,6	21,5	20,9	20,3	23,5	20,3	20,2	18,3	16,1	9,6	9,9	9,4
Ishimsky	30,1	32,4	32,1	32,2	31,6	30,4	32,8	31,4	26,0	23,2	24,5	24,9	30,7	31,7

Table 11 continued

Territories	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Kazansky	23,6	20,5	14,5	12,7	15,3	20,7	28,8	23,8	24,5	25,7	28,1	24,3	22,4	20,2
Nizhne-Tavdinsky r	12,8	10,0	8,5	6,0	8,6	9,3	10,9	7,2	6,9	6,4	7,3	7,6	6,6	7,6
Omutinsky	39,6	46,1	45,9	45,9	51,7	55,9	46,3	67,4	71,7	72,5	73,6	67,7	69,3	65,6
Sladkovsky	68,0	54,9	56,3	56,4	43,6	45,2	46,1	55,3	60,2	60,7	39	39,4	45,1	40,2
Sorokinsky	43,4	49,9	52,1	54,3	55,5	50,9	51,3	50,8	52,6	52,2	52,7	54,5	60,9	51,3
Tyumen	24,8	19,3	21,2	25,4	21,9	22,1	21,9	22,2	22,5	20,8	18,2	17,2	15,2	16
Tobolsk	21,8	15,5	14,6	14,5	15,7	16,1	16,4	12,3	11,7	12,7	15,1	15,4	15,9	16,2
Uvatsky	9,3	7,6	7,2	7,8	7,7	7,7	7,9	8,5	9,5	10,9	11,5	11,3	16,7	24,4
Uporovsky	28,6	28,9	29,3	30,2	29,9	30,5	31,1	26,4	26,3	8,2	7,6	7,4	7,4	9,2
Yurginsky	34,1	39,2	38,9	41,3	38,3	39,4	28,2	29,2	29,5	28,9	28,8	26,9	28,6	33,4
Yalutorovsky	97,1	83,3	84,6	83,4	86,7	82,3	86,2	86,9	86,9	87,8	88,9	68,4	69,7	68,4
Yarkovsky	46,2	39,8	39,1	41,4	39,4	40,9	44,5	48,5	49,5	52,1	52,3	51,7	53,3	54,8

In assessing the primary incidence of CVD, extremely low rates were found in 2009, due to underdiagnosis of the diseases (Table 12).

Table 12 – Primary morbidity of adults (18 years and older) by class of nervous system diseases in the Tyumen Oblast (without AD) for 2009-2022 (per 100 thousand population of the corresponding age)

Territories	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
By Russia	1103	1070	1060	1032	1055	1043	994	974	973	942	960	816	886	834
By UFO	1096	987	938	922	912	915	904	995	952	940	846	960	797	1017
On maintenance	1218	933	962	1028	1049	990	1004	981	908	856	814	751	743	717
Tyumen	1218	933	962	1028	1049	990	1004	981	908	856	814	751	743	717
Ishim	1656	1263	1389	1450	1613	1472	1436	1385	1193	1207	1095	1009	958	902
Ishim town and Ishim district	168	166	145	342	296	310	641	1011	1393	1637	1657	1575	1570	1625
Tobolsk	1056	909	844	805	763	735	708	598	629	588	536	583	513	500
Abatsky district	1040	142	155	204	72	51	120	264	167	146	78	189	160	516
Armizonsky	429	958	430	545	552	172	459	789	312	300	659	194	195	309
Aromashevsky	233	172	51	306	356	278	261	265	223	192	233	239	388	540
Berdyuzhsky	2363	1510	1286	1130	1089	1008	1038	1046	427	167	829	607	591	413
Vagayskiy	869	602	1365	1306	1283	1181	1230	473	457	524	549	558	388	354
Vikulovsky	1704	1130	947	837	700	516	487	325	168	135	516	476	567	1202
Golyshmanovsky	500	531	249	248	157	88	464	648	820	161	168	242	301	74

Table 12 continued

Territories	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Zavodoukovsky	204	243	272	329	223	239	387	372	260	255	243	201	218	268
Isetsky	238	176	181	173	179	193	68	78	64	75	167	112	561	411
Ishimsky	886	728	295	574	445	423	424	362	83	66	60	30	54	37
Kazansky	549	585	565	516	447	554	580	17	58	166	235	117	550	259
Nizhnetavdinsky	621	491	165	226	79	291	347	202	239	318	461	222	221	184
Omutinsky	289	165	117	109	146	160	116	71	98	88	129	79	80	97
Sladkovsky	2536	2733	3105	3104	706	709	840	993	960	534	447	339	538	469
Sorokinsky	2616	1803	1310	1117	723	804	799	873	958	223	193	239	302	304
Tyumen	499	310	176	402	483	487	320	276	286	245	260	323	301	169
Tobolsk	179	188	691	1453	1340	1354	1324	894	797	666	771	240	240	204
Uvatsky	320	168	262	307	362	335	331	143	99	188	267	148	124	214
Uporovsky	453	110	102	126	139	106	85	172	131	221	202	159	665	760
Yurginsky	475	407	410	509	506	544	261	237	260	145	98	78	88	174
Yalutorovsky	193	169	188	297	134	117	172	270	248	255	390	374	345	357
Yarkovsky	1218	933	962	1028	1049	990	1004	981	908	856	814	751	743	717

In 2011, the Tyumen Region joined the Federal Targeted Program to improve the system of organization of medical care for patients with vascular diseases (National Project "Health"), which resulted in the creation of regional vascular centers (RVCs) and primary vascular departments (PVDs) [210].

Primary morbidity rates in TO were generally consistent with and lower in 2012-2014 and from 2017 to 2022 compared to the corresponding rates in Russia (Table 12).

As with the overall morbidity rates, primary morbidity was higher in the urban population than in the rural population.

The highest morbidity rates were registered in Tyumen city and Berdyuzhsky district. In rural areas, the primary morbidity rates were significantly lower compared to both the city and the RF. During the period under evaluation, in the Sorokinsky and Uvatsky districts, the primary morbidity rates for the class of nervous diseases increased significantly and became comparable with those in Russia, which may be associated with the implementation of the national program "Health" and modernization of the neurological care system in the Oblast (Table 13).

Table 13 – Primary incidence of CVD in the adult population of the Tyumen Oblast in 2009-2022 (per 100,000 population)

Neighborhood	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Tyumen	741	662	716	652	743	786	852	886	877	905	907	821	859	949
Ishim and Ishim district	887	367	866	657	856	909	1006	1051	1023	975	944	929	950	1007
Tobolsk	455	468	569	1147	689	733	859	912	892	907	1024	928,9	966,4	1102
Abatsky district	697	582	602	605	716	516	453	553	569	511	757	392	478	521
Armizonsky	594	653	816	632	641	703	502	490	493	430	778	686	593	698
Aromashevsky	695	722	733	649	526	610	824	1048	1043	1022	2554	1314	1326	1577
Berdyuzhsky	261	343	370	348	465	267	500	311	317	926	1400	1209	1099	1280
Vagayskiy	975	755	981	899	1288	1032	412,9	785	784	382	757	680	480	702
Vikulovsky	527	398	573	793	773	836	1001	648	652	707	695	628	729	629
Golyshmanovsky	1877	1447	1594	990	961	1123	1156	809	813	261	364	646	705	387
Zavodoukovsky	411	403	580	432	416	649	602	876	880	936	886	499	363	679
Isetsky	578	585	746	623	545	613	623	601	601	964	1019	707	888	940
Kazansky	1152	1002	1118	869	928	793,	442	676	684	889	1097	971	1234	1657
N-Tavdinsky	788	502	511	436	370	429	540	900	909	758	941	593	1775	993
Omutinsky	497	199	159	272	226	359	592	406	417	576	602	773	762	1093
Sladkovsky	265	384	363	691	406	530	507	559	566	863	432	580	762	755
Sorokinsky	816	609	775	963	695	994	407	584	599	577	604	680	455	1204
Tobolsk	548	924	902	1118	889	606	504	823	840	493	893	790	666	609
Tyumen	759	570	633	816	716	436	497	553	560	572	757	652	480	634
Uvatsky	517	367	409	459	436	623	754	652	653	1045	704	552	646	949
Uporovsky	485	483	316	500	846	780	544	690	691	659	757	444	627	486
Yurginsky	659	393	604	721	977	873	929	740	739	927	819	683	600	580
Yalutorovsky	463	622	511	630	534	553	625	376	383	1184	1355	841	779	894
Yarkovsky	676	701	841	801	824	841	1029	982	980	855	1334	904	846	1073

The mean annual incidence of primary CVD in the population in the Tyumen Oblast between 2009-2019 and 2020-2022. increased from 806.9 ± 89.5 (95% CI 746.8-867.1) to 875.2 ± 63.9 (95% CI 716.4-1034.0), both for urban [from 1451.2 ± 263.6 (95% CI 1274.1-1628.2) to 2205.9 ± 1227.9 (95% CI 877.3-5256.2)] and for rural [from 431.7 ± 72.0 (95% CI 383.3-480.1) and 589.8 ± 293.5 (95% CI 139.3-1318.9)] and mixed [807.0 ± 89.5 (95% CI 746.9-867.1) and 875.3 ± 64.1 (95% CI 716.2-1034.5)] populations.

The average absolute growth/decline rate of primary incidence of CVD of the population in the Tyumen Oblast in the period from 2009-2019 to 2020-2022 also increased from 10.9% to 62.4% per 10,000 population among all analyzed population groups: urban (from -53.8% to 1088.6% per 10,000 population), rural (from -9.1% to 263.2% per 10,000 population) and mixed (from 10.9% to 62.5% per 10,000 population). There was also an increase in the average annual rate of growth/decline of primary incidence of CVD in the population in the Tyumen Oblast in the period from 2009-2019 to 2020-2022 from 1.3% to 7.3% among both urban (from -3.0% to 58.3% per 10,000 population), rural (from -1.6% to 52.0% per 10,000 population) and mixed (from 1.3% to 7.3% per 10,000 population) populations (Table 14).

Table 14 – Primary incidence of CVD in the Tyumen Oblast in 2009-2022 (per 100 thousand population)

Year	Urban population	Rural population	Mixed population
2009	2036,5	596,9	810,0
2010	1874,4	465,2	724,0
2011	1212,5	361,1	716,0
2012	1268,8	378,5	652,0
2013	1292,1	381,4	743,0
2014	1297,7	399,6	786,0
2015	1357,0	368,1	852,0
2016	1316,7	391,7	886,0
2017	1415,9	461,7	884,0
2018	1392,9	438,8	905,0
2019	1498,1	506,0	919,0
2020	1445,4	401,7	821,0
2021	1549,9	439,8	859,0
2022	3622,5	928	946,0
Average annual level	1612,9 ± 623,5	465,6 ± 147,6	821,6 ± 87,4
95% CI	1252,9-1972,9	380,4-550,8	771,2-872,1
Average absolute growth/loss	122,0	25,5	10,5
Average annual growth/decline rate	4,5	3,5	1,2

The total incidence of CVD in the population of the Tyumen Oblast was at an unstable level until 2013, but since joining the Federal Program to improve the system of organization of medical care for patients with vascular diseases the situation has become more stable [210].

In rural areas, an increase in the total incidence of CVD, more than the primary incidence, was revealed. The most pronounced increase was registered in Uvatsky, Armizonsky and N-Tavdinsky districts (p<0.0). Also, a significant increase in the total incidence of CVD was observed in 4 more districts of the Tyumen Oblast: Omutinsky, Kazansky, Aromashevsky and Sladkovsky districts (p<0.0). In the other 5 districts, where an increase in the total incidence of CVD was observed, it was statistically insignificant. In the remaining districts of the Tyumen Oblast there was a decrease in this indicator, which was not statistically significant (Table 15).

Table 15 – Total incidence of CVD among the population in the Tyumen Oblast in 2009-2022 (per 100 thousand population)

Neighborhood	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Tyumen	6009	5402	5347	5153	5176	5356	5444	5577	5521	5985	5756	5498	5348	5494
Ishim and Ishim district	8318	3389	7543	6948	7017	7227	7236	7371	7177	7790	7837	7332	6882	6972
Tobolsk	5488	5592	6719	7409	5316	5475	5814	6234	6099	6412	6992	6917	7254	7579
Abatsky district	4574	3548	3328	2842	2872	2689	2612	2606	2679	2551	2398	1963	1760	2038
Armizonsky	1769	2023	2009	1692	1707	1722	1656	1651	1659	1795	2177	1939	1859	2044
Aromashevsky	2273	834	797	662	854	941	1620	1946	1937	3039	4586	4053	4382	6405
Berdyuzhsky	1259	1424	1499	1519	1642	1521	1807	1648	1678	2802	3550	3753	4590	4111
Vagayskiy	6813	7428	4636	4531	5634	5768	5781	4839	4833	3280	3339	2997	2844	3164
Vikulovsky	1695	1709	1851	2123	1734	1445	1847	1669	1679	1856	1958	1795	1973	1920
Golyshmanovsky	6888	7390	5983	5764	5799	5787	6175	5982	6006	2863	1743	3330	3394	2500
Zavodoukovsky	1517	2906	2800	2313	1978	2049	2023	2277	2287	2621	2842	2358	2523	2606
Isetsky	4669		4794	5022	4982	5013	5009	5155	5156	5796	3056	2809	3166	3384
Kazansky	2732	2464	2217	1988	2034	1921	1827	1680	1701	1998	2497	2338	2855	3268
N-Tavdinsky	2852	1969	2258	2157	2544	2568	2829	3303	3335	3520	3684	2847	4054	4469
Omutinsky	870	1065	839	766	1035	1021	1321	1194	1229	1408	1457	1681	1712	2031
Sladkovsky	1021	944	808	1499	1251	1324	1321	1366	1383	1754	1531	1803	1938	1952
Sorokinsky	2132	1766	1422	1739	1592	1964	1801	1894	1944	2109	2198	2342	2474	3223
Tobolsk	1954	2075	1366	1528	1268	968	930	1267	1293	1096	1731	1425	1261	1162
Tyumen	1779	1157	1294	1743	1620	1312	1377	1456	1476	1556	1521	1419	818	1003
Uvatsky	9735	6751	6868	6847	5660	6313	6230	6576	6588	7361	4635	4668	5324	5525
Uporovsky	592	784	329	892	873	923	1234	1302	1305	1977	2277	2177	2389	2572
Yurginsky	2217	2006	2069	1942	2481	2549	2457	2069	2067	2461	2475	2434	2353	2346
Yalutorovsky	1275	1205	1042	1187	1121	1233	1398	1226	1248	2159	2800	3385	3644	3747
Yarkovsky	2087	1936	2074	2036	2027	2032	2051	1968	1965	1918	2414	2025	1949	2210

It was revealed that the average annual incidence rate of total CVD in the Tyumen Oblast population in the period 2009-2019 (per 1000 population) amounted to 5562.2 ± 307.4 (95% CI 5355.7-5768.7), and in the period 2020-2022 (95% CI 5355.7-5768.7). increased to 5440.5 ± 80.9 (95% CI 5239.6-5641.4) at the expense of the rural population, where the rate was 995.8 ± 149.7 (95% CI 895.3-1096.4) and 1020.1 ± 60.0 (95% CI 870.9-1169.2), respectively. Among the urban population, the mean annual incidence of total CVD in the population in the Tyumen region decreased from 7788.9 ± 383.4 (95% CI 7531.3-8046.5) to 7071.2 ± 617.4 (95% CI 5537.5-8604.8) between 2009-2019 and 2020-2022, as well as in the mixed population from 5594.3 ± 299.9 (95% CI 5392.8-5795.7) to 5440.3 ± 80.8 (95% CI 5239.6-5641.0). The mean absolute increase/decrease in the overall incidence of CVD in the population in the Tyumen Oblast increased from -17.9% to -11.3% per 10,000 population between 2009-2019 and 2020-2022; it decreased from 29.8% to -592.4% per 10,000 population among the urban population, from 32.8% to -40.1% per 10,000 population among the rural population, and increased from -15.8% to -11.5% per 10,000 population among the mixed population. The average annual rate of increase/decline of the total incidence of CVD in the Tyumen Oblast population increased from -0.3% to 0.3% per 10,000 population in the period from 2009-2019 to 2020-2022, among urban population this indicator decreased from 0.4% to -9.1% per 10,000 population, among rural population – from 3.5% to -7.5% per 10,000 population. from 3.5% to -7.8% per 10,000 population, and among the mixed population – increased from -0.3% to 0.3% per 10,000 population between 2009-2019 and 2020-2022, respectively (Table 16).

Mortality from CVD in both urban and rural populations was lower than in the RF [115]. Moreover, the mean annual CVD mortality rate between 2009 and 2019 in the urban population was 162.6 ± 57.6 (95% CI 123.9-201.3), whereas it was significantly lower between 2020 and 2022: 72,4 ± 9,9 (95% CI 47.7-97.1), the same trend was observed in the rural population, where the rate was 145.9 ± 21.8 (95% CI 131.3-160.5) and 93.8 ± 4.4 (95% CI 82.8-104.9) between 2009-2019 and 2020-2022. On average, the mean annual CVD mortality rate in the TO population was 155.5 ± 42.4 (95% CI 127.0-184.1) between 2009-2019 and 79.3 ± 5.9 (95% CI 64.7-93.9) between 2020-2022.

Table 16 – Total incidence of CVD in the population in the Tyumen Oblast 2009-2022 (per 100,000 population)

Year	Urban population	Rural population	Mixed population
2009	7771,5	804,9	5987
2010	7097,2	764,9	5256
2011	8088,2	951,4	5347
2012	7424,1	811,4	5153
2013	7401,7	950,3	5776
2014	7644,5	1004,0	5356
2015	7721,6	1122,0	5444
2016	7901,7	1155,8	5577
2017	8176,7	1109,2	5827
2018	8382,1	1147,7	5985
2019	8069,1	1132,5	5829
2020	7563,1	1034,4	5498
2021	7271,9	1071,7	5348
2022	6378,4	954,2	5475
Mean annual level, m ± SD	7635,1 ± 514,9	1001,0 ± 133,8	5561,3 ± 272,9
95% confidence interval	7337,8-7932,4	923,8-1078,3	5403,7-5718,8
Average absolute growth/decline, %	-107,2	11,5	-39,4
Average annual growth/decline rate, %	-1,5	1,3	-0,7

The average absolute increase/decline among the urban population during the period 2009-2019 was -16.5% per 10,000 population and decreased to – 9.9% per 10,000 population during the pandemic; among the rural population, this indicator was – 5.8% and 2.9% per 10,000 population, respectively. On average, the average absolute increase/decline among the TO residents amounted to -12.3% and – 5.9% per 10 thousand population in the period 2009-1019 and 2020-2022, respectively. Against the background of these indicators, there was a slight increase in the average annual rate of increase/decline among the urban population from -10.6% to -12.9% per 10,000 population in the period 2009-1019 and 2020-2022, respectively. And among the rural population, the average annual rate of increase/decline increased from -4.6% to 3.1% per 10,000 population, respectively. Among the total TO population, the average annual rate of increase/decline decreased from -8.5% per 10,000 population for the period 2009-2019 to -7.1% per 10,000 population for the period 2020-2022. (Table 17).

Table 17 – Mortality from CVD among urban and rural population of the Tyumen Oblast in 2009-2022 (per 100 thousand population)

Year	Mortality from CVD			
	Urban population	Rural population	Average for the region	RF
2009	244,6	154	208,2	262,5
2010	220,9	170,6	200,8	260,6
2011	211,9	149	187,3	232,8
2012	210,4	151	187,6	225,6
2013	185,2	169,5	179,4	216,4
2014	182,6	160	174,6	205,5
2015	128,9	152,6	137,2	198,3
2016	126,4	149,2	134,2	190,8
2017	101,6	126,5	110	180,1
2018	96,3	126,1	106,2	179,5
2019	80,1	96,4	85,4	177,6
2020	81,8	92,8	85,4	190,2
2021	73,4	90	78,8	190,7
2022	62	98,7	73,7	
Mean annual level, m ± SD	143,3 ± 63,6	134,7 ± 29,3	139,2 ± 49,4	208,5 ± 29,2
95% confidence interval	106,6-179,9	117,8-151,7	110,7-167,8	190,8-226,2

Average absolute growth/decline, %	-14,1	-4,3	-10,4	-5,9
Average annual growth/decline rate, %	-10,0	-3,4	-7,7	-2,6

When sex-specific mortality from CVD was assessed, it was found that males were 4-5 times higher than females during the period evaluated [102], which is in agreement with the data of other authors.

The mean annual CVD mortality rate among male TOs was 131.9 ± 30.2 (95% CI 111.6-152.2) between 2009 and 2019. [among urban population – 132.3 ± 41.4 (95% CI 104.5-160.2), among rural population – 133.3 ± 18.2 (95% CI 121.1-145.6], further in the period there was a decrease in the mean annual CVD mortality rate in males to 78.8 ± 4.3 (95% CI 68.3-89.4) from 2009 to 2019. [72.4 ± 9.7 (95% CI 48.4-96.5) among urban populations and 92.1 ± 7.8 (95% CI 72.8-111.3) among rural populations]. Among women, the mean annual CVD mortality rates were 176.3 ± 53.8 (95% CI140.1-212.4), 189.3 ± 70.6 (95% CI141.9-236.7), and 155.8 ± 32.3 (95% CI 134.1-177.5) total, among urban and rural populations, respectively, between 2009 and 2019, and between 2020 and 2022. this rate corresponded to 79.8 ± 8.4 (95% CI 58.9-100.8), 75.5 ± 15.6 (95% CI 36.7-114.3) and 89.3 ± 7.8 (95% CI 70.0-108.6), respectively.

The average absolute increase/decline between 2009 and 2019 among male and female TOs was -8.6% and -15.7% per 10,000 population, respectively, and between 2019 and 2022. – -3,8% и -7,9%.

Among the urban population, the average absolute increase/decline in the period 2009-2019 was equal to -11.4% and -20.2% per 10,000 population among men and women, respectively, and in the period 2020-2022, it was equal to -9.3% and -15.2% per 10,000 population, respectively, i.e. there was a decrease in this indicator among both men and women. -9.3% and -15.2% per 10,000 population, respectively, i.e. there was a decrease in this indicator among both men and women.

Among the rural population, the average absolute increase/decline between 2009 and 2019 was -4.4% and -8.9% per 10,000 population for males and females, respectively, and between 2020 and 2022. – 7.8% and 7.7% per 10,000 population, respectively. The average annual rate of increase/decline for the period 2009-2019 among males was -7.2%, -8.9% and -4.1% per 10,000 total population among urban and rural populations, respectively, and for females -9.6%, -11.1% and -6.7% per 10,000 population, respectively. In the period 2020-2022, there was an increase in this indicator, mainly at the expense of the rural population. Thus, the average annual rate of increase/decline among men amounted to -4.7%, -12.3% and 8.8% per 10,000 population in total, among urban and rural population, respectively, and among women -9.3%, -18.0% and 8.9% per 10,000 population, respectively (Table 18).

Table 18 – Mortality from CVD in the population of the Tyumen Oblast for 2009-2022, depending on sex (per 100 thousand population).

Year	Mortality from CVD					
	Urban population		Rural population		Total men	Total women
	Men	Women	Men	Women		
2009	188	292,9	129	177	163,7	247,2
2010	177,9	257,4	140,9	197,8	162,8	234,2
2011	166,1	250,9	151,7	146,5	160,3	211
2012	172,5	242,8	135,3	165,5	157,9	213,8
2013	148,3	217,2	148,5	188,8	148,4	207
2014	142,8	217,4	143,2	175,6	142,9	202,8
2015	108	147,2	147,2	157,5	122	150,8
2016	103	147,1	130,2	166,7	112,5	153,7
2017	87,4	114,2	126,2	126,9	100,7	118,4
2018	87,6	104	128,9	123,5	101,5	110,4
2019	74	90,7	85,3	88,1	77,8	89,8
2020	80	92,8	84,3	82,2	81,4	89,4
2021	75,7	71,4	92,1	88,1	81,1	76,6
2022	61,5	62,4	99,8	97,6	73,9	73,5
Annual average level, m ± SD	119,5 ± 44,6	164,9 ± 78,8	124,5 ± 23,9	141,6 ± 40,2	120,5 ± 34,9	155,6 ± 62,7
95% confidence interval	93,8-145,2	119,4-210,4	110,7-138,3	118,4-164,8	100,4-140,6	119,4-191,8
Average absolute growth/decline, %	-9,7	-17,7	-2,3	-6,1	-6,9	-13,4

Average annual growth/decline rate, %	-8,2	-11,2	-1,9	-4,5	-5,9	-8,9

3.2 Indicators of disability due to neurological pathology

The study of the structure and dynamics of the indicators of disability due to diseases of the nervous system of the population in the Tyumen Oblast revealed an increase in the share of disabled people (per 10 thousand population) in the period 2009-2022 both in urban and rural areas.

The average annual rate of primary disability among the urban population of TO in the period 2009-2019 was 1.9 ± 0.3 (95% CI 1.8-2.2) per 10,000 population, among working-age persons – 1.5 ± 0.3 (95% CI 1.3-1.7), and 1.9 ± 0.5 (95% CI 1.6-2.3) and 1.6 ± 0.3 (95% CI 1.4-1.8) in the rural population total and among working-age individuals, respectively. In the period 2020-2022, the mean annual primary disability rate in the urban population of TO was 2.2 ± 0.4 (95% CI 1.2-3.3) and 3.1 ± 0.6 (95% CI 1.7-4.5) total and among working-age persons per 10,000 population, respectively, and in the rural population was 1.9 ± 0.2 (95% CI 1.4-2.4) and 1.5 ± 0.4 (95% CI 0.5-2.5), respectively. The average absolute increase/decrease in primary disability among the urban population of TO in the period 2009-2019 was 0.1% per 10,000 population, and in the period 2020-2022 – 0.3% per 10,000 population, and among working age individuals – 0.1% and 0.4%, per 10,000 population, respectively. Among the rural population of TO, this indicator in the period 2009-2019 was 0.1% and 0.1% per 10 thousand population, respectively, and among working-age persons – 0.0% and -0.2% per 10 thousand population, respectively. The average annual rate of growth/decline in the period 2009-2019 among urban and rural population was equal to 3.9% and 3.6% per 10 thousand population, and among working-age persons – 4.7% and 2.9% per 10 thousand population, respectively.

In the period 2020-2022, this indicator among the urban and rural population increased significantly to 13.9 and 5.1 per 10,000 population, respectively, and among working-age persons – to 12.9 and – 8.2 (per 10,000 population), respectively (Table 19).

With regard to re-disability, it remained at about the same level over the period assessed.

Table 19 – Dynamics of primary disability of the adult population in the Tyumen Oblast in 2009-2022 by diseases of the nervous system (per 10 thousand population)

Year	Recognized as disabled			
	Urban population		Rural population	
	Total	Persons of working age	Total	Persons of working age
2009	1,5	1,2	1,4	1,2
2010	1,5	1	1,5	1,2
2011	2,3	1,6	1,7	1,7
2012	2,1	1,5	2,2	1,8
2013	2	1,5	2,1	1,9
2014	2,1	1,7	3	2,2
2015	2,1	1,7	2,4	1,8
2016	2,1	1,6	1,9	1,7
2017	1,7	1,2	1,6	1,3
2018	2,1	1,7	1,7	1,6
2019	2,2	1,9	2	1,6
2020	2,1	2,9	1,9	1,9
2021	1,9	2,6	1,7	1,1
2022	2,7	3,7	2,1	1,6
Mean annual level, m ± SD	2,0 ± 0,3	1,8 ± 0,7	1,9 ± 0,4	1,6 ± 0,3
95% confidence interval	1,9-2,2	1,4-2,3	1,7-2,2	1,4-1,8
Average absolute growth/decline, %	0,1	0,2	0,1	0,0

Average annual growth/decline rate, %	4,6	9,1	3,2	2,2

Analysis of indicators in the pre – and covid period (2020-2022) revealed that the mean annual rate of recurrent disability among the urban population in the period 2009-2019 was 5.9 ± 1.4 (95% CI 5.0-6.9) and 5.6 ± 1.7 (95% CI 4.4-6.7) per 10,000 population total and among the working age population. was 5.9 ± 1.4 (95% CI 5.0-6.9) and 5.6 ± 1.7 (95% CI 4.4-6.7) per 10,000 total and working-age population, respectively, and 6.6 ± 1.6 (95% CI 5.6-7.7) and 6.9 ± 2.0 (95% CI 5.6-8.3), respectively, in the rural population. During the pandemic period of new coronavirus infection (2020-2022), there was no significant trend and the mean annual re-disability rate in the urban population was 5.7 ± 1.5 (95% CI 1.9-9.5) and 7.9 ± 2.1 (95% CI 2.6-13.2) per 10,000 total and working-age population, respectively, and 6.9 ± 2.3 (95% CI 1.3-12.6) and 7.4 ± 3.1 (95% CI 0.2-15.0), respectively, in the rural population. The mean absolute increase/decrease in recurrent disability between 2009 and 2019 among urban and rural populations was -0.4% and -0.4% per 10,000 population, and -0.5% and -0.6% per 10,000 population among working-age individuals, respectively. In the period 2020-2022, this indicator amounted to 1.5% and 2.3% per 10,000 population, and among working-age persons – 2.1% and 3.1% per 10,000 population, respectively. The average annual rate of increase/decrease of repeated disability in the period 2009-2019 among the urban population was -6.2% and -8.0% per 10,000 of the total population and among persons of working age, respectively, and among the rural population -7.0% and -8.0% per 10,000 of the population, respectively. In the period 2020-2022, this indicator among the urban population increased significantly to 32.3% and 32.3% per 10,000 of the total population and among persons of working age, respectively, and among the rural population to 41.4% and 56.6% per 10,000 of the total population and among persons of working age, respectively (Table 20).

The dynamics of primary disability by CVD in the population of the Tyumen Oblast during the evaluated period increased slightly among both urban and rural populations, while no differences between these subgroups of the population were observed.

The mean annual rate of primary disability by CVD among the urban population of TO in the period 2009-2019 was 5.5 ± 0.5 (95% CI 5.2-5.8) and 2.2 ± 0.4 (95% CI 1.9-2.5) per 10,000 total and working age population, respectively, and among the rural population was 6.5 ± 1.4 (95% CI 5.5-7.4) and 2.9 ± 0.5 (95% CI 2.6-3.3) per 10,000 population, respectively. During the pandemic, this rate was 5.2 ± 0.7 (95% CI 3.4-6.9) and 7.1 ± 1.1 (95% CI 4.4-9.9) per 10,000 total and working-age population in the urban population, and 5.1 ± 0.7 (95% CI 3.3-6.8) and 2.5 ± 0.7 (95% CI 0.7-4.3) per 10,000 population in the rural population, respectively. The mean absolute increase/decline among the urban population was -0.0% and -0.0% per 10,000 total and working age population between 2009 and 2019, and increased to 0.7% and 1.1% per 10,000 population between 2020 and 2022, respectively.

Table 20 – Dynamics of repeated disability of the population in the Tyumen Oblast in 2009-2022 by diseases of the nervous system (over 18 years of age) per 10 thousand people

Year	Recognized as disabled			
	Urban population		Rural population	
	Total	Persons of working age. ages	Total	Persons of working age
2009	7,8	8,3	8,3	9,7
2010	8,3	8,3	9	10,3
2011	7,6	7,4	8,5	9,1
2012	6,4	5,9	6,3	6,8
2013	5,2	4,9	6,3	6,3
2014	5,5	4,9	7,2	7,1
2015	5,7	5	6,9	7,3
2016	5	4,5	6	5,8
2017	4,8	4,1	5,6	5,5
2018	4,9	4,2	4,9	4,7
2019	4,1	3,6	4	4,2
2020	4	5,6	4,5	4,2

2021	6	8,3	7,4	7,7
2022	7	9,8	9	10,3
Mean annual level, m ± SD	5,9 ± 1,4	6,1 ± 1,9	6,7 ± 1,6	7,1 ± 2,1
95% confidence interval	5,1-6,7	4,9-7,2	5,8-7,7	5,8-8,3
Average absolute growth/decline, %	-0,1	0,1	0,1	0,1
Average annual growth/decline rate, %	-0,8	1,3	0,6	0,5

Among people living in rural areas, the average absolute growth/decline rate for the period 2009-2019 was 0.0% and 0.0% per 10,000 population in total and among working-age people, and for the period 2020-2022 – -0.4% and -0.7% per 10,000 population, respectively. The average annual rate of increase/decline for the period 2009-2019 among the urban population was -0.2% and -1.8% per 10,000 population total and among working-age persons, and among the rural population was 0.6% and 0.4% per 10,000 population, respectively. In the period 2020-2022, this indicator increased significantly among the urban population and decreased among the rural population, resulting in 14.5% and 16.7% per 10,000 population in total and among persons of working age among the urban population and -7.2% and -22.2% per 10,000 population, respectively, among persons living in rural areas (Table 21).

Table 21 – Dynamics of primary disability of the Tyumen Oblast population in 2009-2022 by CVD (over 18 years old) per 10 thousand population

Year	Recognized as disabled			
	Urban population		Rural population	
	Total	Persons of working age	Total	Persons of working age
2009	5,3	2,4	4,8	2,5
2010	5,4	2,5	5,7	2,7
2011	6,3	2,8	5,9	2,7
2012	6,2	2,8	6,7	3,3
2013	5,4	2,2	8,1	3,8
2014	5,7	2,2	8,1	3,9
2015	5,4	2,2	8,5	3

2016	5,5	1,9	6,7	2,9
2017	4,7	1,8	6,6	3
2018	5	1,7	4,7	2,3
2019	5,2	2	5,1	2,6
2020	4,5	6,1	5,8	3,3
2021	5,1	7	4,4	2,1
2022	5,9	8,3	5	2
Mean annual level, m ± SD	5,4 ± 0,5	3,3 ± 2,2	6,2 ± 1,4	2,9 ± 0,6
95% confidence interval	5,1-5,7	2,0-4,5	5,4-6,9	2,5-3,2
Average absolute growth/decline, %	0,1	0,5	0,0	-0,0
Average annual growth/decline rate, %	0,8	10,0	0,3	-1,7

The dynamics of re-disability of the TO population by CVD for the period under evaluation was studied. During the whole analyzed period, it was higher in persons living in rural areas than in urban population.

The mean annual rate of recurrent disability in the urban population of TO for CVD in the period 2009-2019 was 10.5 ± 1.7 (95% CI 9.4-11.6) and 5.6 ± 2.2 (95% CI 4.1-7.1) per 10 thousand. of the total and working-age population, respectively, whereas during the period, due to the increase in CVD incidence among the working-age population, this rate increased in this population group and was 8.7 ± 2.1 (95% CI 3.4-14.0) per 10,000 population among the total urban population and 11.7 ± 2.9 (95% CI 4.4-18.9) per 10,000 population among the working-age population (95% CI 4.4-18.9) per 10,000 population.

Among individuals living in rural areas, the mean annual rate of recurrent CVD disability was higher than the urban population between 2009 and 2019, at 12.6 ± 1.4 (95% CI 11.6-13.5) and 7.7 ± 1.4 (95% CI 6.7-8.6) per 10,000. population overall and among the working-age population, and the successful optimization of rural health care delivery between 2019-2022 reduced this rate to 10.7 ± 3.0 (95% CI 3.2-18.2) and 6.0 ± 1.6 (95% CI 2.2-9.9) per 10,000 population, respectively. The mean absolute increase/decrease in re-disability for CVD in the urban population between 2009 and 2019 was -0.4% and -0.5% per 10,000 total and working-age population, respectively, and increased to 2.0% and 2.9% per 10,000 population in the covid period, respectively. Among the rural population, the average absolute rate of increase/decrease in re-disability by CVD was -0.3% and -0.5% per 10,000 population total and among working-age individuals between 2009 and 2019, and increased to 3.0% and 1.6% per 10,000 population, respectively, in the covid period (between 2019 and 2022). The average annual rate of increase/decline in the period 2009-2019 among the urban population was equal to -3.7% and -8.9% per 10,000 population total and among working-age persons, and increased sharply to 27.9% and 29.4% per 10,000 population, respectively, in the period 2020-2022. Among the rural population, the average annual rate of increase/decline was -2.4% and -6.3% per 10,000 population of total and working age population during the period 2009-2019, and subsequently increased to 34.2% and 30.6% per 10,000 population, respectively, during the period 2020-2022 (Table 22).

Table 22 – Dynamics of repeated disability of the Tyumen Oblast population in 2009-2022 by CVD (over 18 years old) per 10 thousand population

Year	Recognized as disabled			
	Urban population		Rural population	
	Total	Persons of working age	Total	Persons of working age
2009	11,4	8,2	12,7	10,3
2010	13,6	10,7	14	9,2
2011	12,3	6,6	14,8	8,8
2012	10,7	5,6	11,4	7,1
2013	9,7	4,8	12,6	7,2
2014	11,4	5,9	13,9	7,9
2015	10,6	5	12,7	8,2
2016	9,6	4,2	13,3	7,6
2017	9,4	3,9	11,4	6,3
2018	8,8	3,6	11,6	6,3
2019	7,8	3,2	10	5,4
2020	6,3	8,6	7,5	4,4
2021	9,6	12	11	6,2
2022	10,3	14,4	13,5	7,5
Mean annual level, m ± SD	10,1 ± 1,8	6,9 ± 3,4	12,2 ± 1,9	7,3 ± 1,6
95% confidence interval	9,1-11,2	4,9-8,9	11,1-13,3	6,4-8,2
Average absolute growth/decline, %	-0,1	0,5	0,1	-0,2

Average annual rate of growth/decline, %	-0,8	4,4	0,5	-2,4

The structure of primary disability for CVD by groups was studied. In general, the most frequent disability groups for CVD were II and III, while group I was noted the least frequently. No significant differences in the structure of the total contingent of disabled people with CVD for both groups II and III, as well as for urban and rural areas for each of the groups in the study period were revealed.

The mean annual rate of primary disability for CVD in the urban population between 2009 and 2019 was. was 122.6 ± 18.1 (95% CI 110.5-134.8), of which 19.9 ± 7.5 (95% CI 14.8-24.9) for disability group I, 48.0 ± 13.2 (95% CI 39.2-56.8) for group II, and 54.7 ± 5.7 (95% CI 50.9-58.6) for group III, in the covid period, this index increased significantly and amounted to 431.0 ± 63.7 (95% CI 272.9-589.1), of which for disability group I – 170.0 ± 18.5 (95% CI 123.9-216.0), for group II – 146.7 ± 25.6 (95% CI 83.1-210.2), for group III – 114.3 ± 20.3 (95% CI 64.0-164.7).

The average absolute growth/decline rate increased significantly from 2009-2019 to 2020-2022 from -0.6 to 63.5 per 10,000 population total, for disability group I from -0.6 to 18.5 per 10,000 population, for disability group II from -1.1 to 25.5 per 10,000 population, and for disability group III from 1.1 to 19.5 per 10,000 population. A similar picture was observed for the average annual rate of increase/decline, which in the period of 2009-2019 for the urban population was -0.5% per 10,000 population, and in the period 2020-2022. – 15.9% per 10,000 population; among persons with disability group I this indicator was equal to -2.7% and 11.5% per 10,000 population. in the period 2009-2019 and 2020-2022, respectively; among persons with group II – -2.4% and 19.4%, and with group III – 2.1% and 18.2% per 10,000 population, respectively.

Among those living in rural areas, the mean annual primary disability rate for CVD between 2009-2019 was 82.5 ± 17.3 (95% CI 70.8-94.1) per 10,000 population (disability group I – 16.1 ± 4.9 (95% CI 12.8-19.4), group II – 26.4 ± 7.3 (95% CI 21.4-31.3, group III – 40.0 ± 10.3 (95% CI 33.1-46.9), thereafter, between 2020-2022, the mean annual rate of primary disability for CVD increased to 171.0 ± 25.2 (95% CI 108.3-233.7) per

10,000 population (group I – 66.7 ± 15.1 (95% CI 29.1-104.3), group II – 42.0 ± 32.4 (95% CI 18.4-122.4), group III – 47.3 ± 9.2 (95% CI 24.4-70.3). The mean absolute increase/decrease in primary disability by CVD from 2009-2019 was -1.2% per 10,000 population and decreased to -15.5% per 10,000 population from 2020-2022 (Group I – from -0.1% to -12.0% per 10,000 population, Group II – from -1.5% to 4.5% per 10,000 population, and Group III – from 0.4% to -8.0% per 10,000 population, respectively). The average annual rate of increase/decline in the rural population also decreased from 2009-2019 to 2020-2022, from -1.7% to -8.2% per 10,000 population, respectively (disability group I – from -0.9% to -15.5% per 10,000 population, Group II – increased from -6.1% to 7.7%, Group III – decreased from 1.2% to -14.9% per 10,000 population, respectively) (Table 23).

Table 23 – Dynamics of primary disability of the population of the Tyumen Oblast in 2009-2022 by CHD by groups (over 18 years old)

Year	Recognized as disabled					
	Urban population			Rural population		
	I	II	III	I	II	III
2009	25	51	48	11	32	33
2010	16	59	60	16	27	38
2011	12	77	67	11	29	35
2012	38	57	55	23	37	41
2013	15	49	54	17	37	54
2014	22	41	53	26	22	64
2015	26	47	50	16	25	39
2016	13	44	49	14	27	35
2017	17	30	57	16	23	37
2018	16	33	50	17	14	27
2019	19	40	59	10	17	37
2020	152	120	98	84	56	58
2021	169	149	108	56	5	42
2022	189	171	137	60	65	42

Mean annual level, m ± SD	52,1 ± 64,7	69,1 ± 44,7	67,5 ± 27,1	26,9 ± 22,8	29,7 ± 15,7	41,6 ± 10,2
95% confidence interval	14,7-89,4	43,3-94,9	51,9-83,1	13,8-40,1	20,6-38,8	35,7-47,5
Average absolute growth/decline, %	12,6	9,2	6,9	3,8	2,5	0,7
Average annual growth/decline rate, %	16,8	9,8	8,4	13,9	5,6	1,9

When assessing the level of primary disability due to epilepsy among the population over 18 years of age, a stable specific weight of PIP for this disease was revealed in both urban and rural areas. From 2011 to 2014, the proportion of PIP per 10,000 in rural areas was higher than in urban areas, but in the following years, the indicators in urban and rural areas were stable and practically the same.

The analysis of the dynamics of primary disability of the population of the Tyumen Oblast for 2009-2022 on epilepsy showed that its average annual level in the period 2009-2019 among the urban population amounted to 0.1 ± 0.0 (95% CI 0.1-0.1) and 0.1 ± 0.1 (95% CI 0.1-0.2) per 10,000 population and among persons of working age, while for the rural population this indicator was slightly higher: 0.2 ± 0.1 (95% CI 0.2-0.3) and 0.3 ± 0.1 (95% CI 0.2-0.3). of the total and working age population, while for the rural population the rate was slightly higher at 0.2 ± 0.1 (95% CI 0.2-0.3) and 0.3 ± 0.1 (95% CI 0.2-0.4) per 10,000 population, respectively. Between 2019 and 2022, the mean annualized annualized primary disability rate for epilepsy in the TO population decreased for both the urban population to 0.1 ± 0.0 (95% CI 0.1-0.1) and 0.1 ± 0.0(95% CI 0.1-0.1) per 10,000 total and working age population, and for the rural population to 0.1 ± 0.1 (95% CI 0.1-0.4) and 0.1 ± 0.1 (95% CI 0.1-0.4), respectively. The mean absolute increase/decline from 2009-2019 to 2020-2022 remained almost constant among both the urban population: 0.0% and 0.0% per 10,000 total population, respectively, and -0.0% and 0.0% per 10,000 working-age population, respectively, and among the rural population: from -0.0% to 0.1% per 10,000 total population and from -0.0% to 0.1% per 10,000 working-age population, respectively. The average annual rate of increase/decline among the urban population from 2009-2019 to 2019-2022 remained unchanged (0.0% per 10,000 population), and among working-age persons increased from -6.7% to 0.0% per 10,000 population. Among persons living in rural areas, this indicator increased from -6.7% to 41.4% per 10,000 population and from -3.9% to 41.4% per 10,000 population among working-age persons, respectively (Table 24).

At the same time, over the entire observation period, the proportion of PIP in rural areas was greater than in urban areas. The mean annual rate of recurrent disability among the urban population of TO for the period 2009-2019 was 0.8 ± 0.5 (95% CI 0.4-1.1) and 0.9 ± 0.6 (95% CI 0.5-1.3) per 1 – thousand population among the total population and working-age persons, respectively, and further, in the period 2020-2022, this rate decreased to 0.3 ± 0.2 (95% CI 0.1-0.7) and 0.4 ± 0.2 (95% CI 0.0-0.8) per 10,000 population, respectively. In the rural population, the mean annual rate of recurrent disability was higher than in the urban population between 2009 and 2019, at 0.2 ± 0.1 (95% CI 0.0-0.3) and 0.3 ± 0.1 (95% CI 0.1-0.4) per 10,000 population among all and working-age individuals, respectively.

Table 24 – Dynamics of primary disability of the population of the Tyumen Oblast for 2009-2022 by epilepsy (over 18 years of age) per 10 thousand population.

Year	Recognized as disabled			
	Urban population		Rural population	
	Total	Persons of working age	Total	Persons of working age
2009	0,1	0,2	0,2	0,3
2010	0,1	0,1	0,2	0,2
2011	0,1	0,1	0,4	0,4
2012	0,1	0,2	0,2	0,3
2013	0,2	0,2	0,3	0,5
2014	0,1	0,1	0,3	0,4
2015	0,1	0,2	0,3	0,3
2016	0,1	0,1	0,2	0,3
2017	0,1	0,1	0,1	0,2
2018	0,1	0,1	0,1	0,2
2019	0,1	0,1	0,1	0,2

2020	0,1	0,1	0,1	0,1
2021	0,1	0,1	0	0
2022	0,1	0,1	0,2	0,2
Mean annual level, m ± SD	0,1 ± 0,0	0,1 ± 0,1	0,2 ± 0,1	0,3 ± 0,1
95% confidence interval	0,1-0,1	0,1-0,2	0,1-0,3	0,2-0,3
Average absolute growth/decline, %	0,0	-0,0	0,0	-0,0
Average annual growth/decline rate, %	0,0	-5,2	0,0	-3,1

The average absolute increase/decline in repeat disability among the urban population of TO increased from -0.1% to 0.2% per 10,000 of the total population and from -0.1% to 0.2% per 10,000 of the working age population from 2009-2019 to 2020-2022, respectively. Among those living in rural areas, the average absolute rate of increase/decrease in repeat disability among the urban TO population increased from -0.2% to 0.0% per 10,000 total population and from -0.2% to 0.0% per 10,000 total population among working-age persons. The average annual rate of increase/decline of repeat disability among the urban population of TO increased from 2009-2019 to 2020-2022 from -16.4% to 100.0% per 10,000 population and from -14.3% to 58.1% per 10,000 population among persons of working age; among the rural population, this indicator increased from -15.3% to 0.0% per 10,000 population and from -13.9% to 0.0% per 10,000 population among persons of working age, respectively (Table 25).

Table 25 – Dynamics of repeated disability of the population of the Tyumen Oblast for 2009-2022 by epilepsy (over 18 years old) per 10 thousand population

Year	Recognized as disabled			
	Urban population		Rural population	
	Total	Persons of working age	Total	Persons of working age
2009	1,2	1,4	2,1	2,7
2010	1,2	1,5	2,1	2,7
2011	1,8	2,1	2,4	3,1
2012	1	1,2	2	2,6

2013	0,8	0,9	1,3	1,6
2014	0,5	0,7	1,2	1,6
2015	0,5	0,6	1,1	1,5
2016	0,5	0,6	1	1,3
2017	0,3	0,4	0,8	1,2
2018	0,3	0,4	0,7	1
2019	0,2	0,3	0,4	0,6
2020	0,1	0,2	0,2	0,3
2021	0,3	0,4	0,1	0,2
2022	0,4	0,5	0,2	0,3
Mean annual level, m ± SD	0,7 ± 0,5	0,8 ± 0,6	1,1 ± 0,8	1,5 ± 0,8
95% confidence interval	0,4-0,9	0,5-1,1	0,7-1,6	0,9-2,0
Average absolute growth/decline, %	-0,1	-0,1	-0,2	-0,2
Average annual growth/decline rate, %	-8,1	-7,6	-16,6	-15,6

Thus, the analysis of the structure and dynamics of the indicators of disability due to diseases of the nervous system of the population in the Tyumen Oblast revealed an increase in the indicators of primary disability of the adult population in the Tyumen Oblast in 2009-2022 due to diseases of the nervous system (per 10 thousand population) in both urban and rural areas.

The data on the structure and dynamics of disability indicators due to diseases of the nervous system in the Tyumen Oblast according to the number of applications to the medical and social expert assessment bureaus for 2009-2022 can be used as an information base for the creation of comprehensive target programs to optimize the neurological service.

3.3. Analysis and forecast of morbidity and mortality in the class of nervous system diseases in the Tyumen Oblast

Despite the projected decrease in CVD mortality, an increase in absolute data should be noted due to the increase in population size (Table 25).

Table 25 – Forecast of mortality from CVD in the Tyumen Oblast per 100 thousand population

Year	Population size	Mortality abs.	Mortality rate
2009*	1 328,9*	2 767	208,2
2010*	1 338,3*	2 688	200,8
2011*	1 352,4*	2 533	187,3
2012*	1 373,3*	2 577	187,6
2013*	1 397,2*	2 507	179,4
2014*	1 419,3*	2 478	174,6
2015*	1 441,9*	1 978	137,2
2016*	1 466,3*	1 968	134,2
2017*	1 488,3*	1 637	110

Table 25 continued

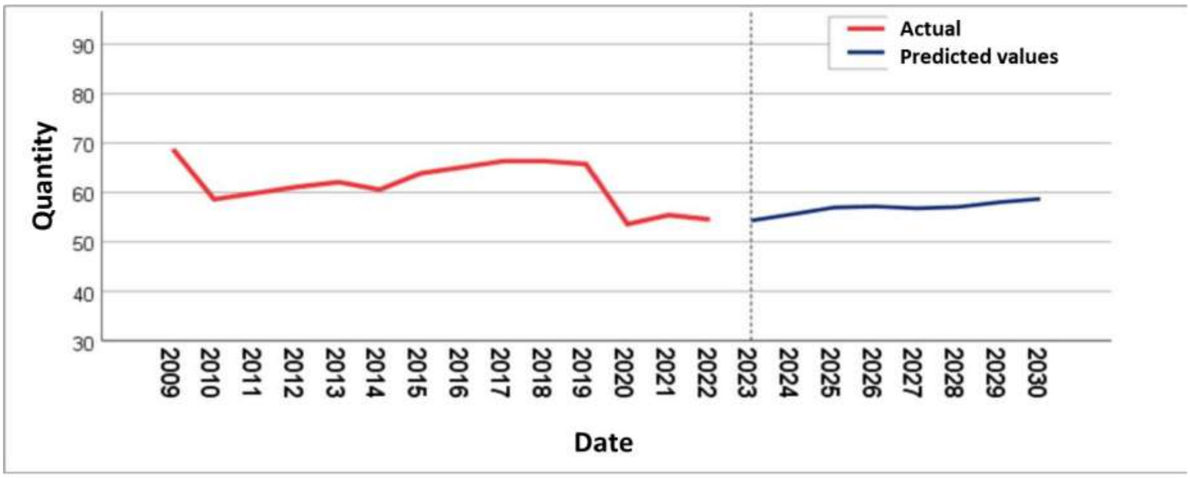
Year	Population size	Mortality abs.	Mortality rate
2018*	1 508,7*	1 602	106,2
2019*	1 528,1*	1 305	85,4
2020	1 540,4*	1 315	85,4
2021	1 547,8*	1 219	78,8
2022	1 605,6**	1 144	71,3
2023	1 613,0***	1 148****	71,2
2024	1 623,5***	1 154****	71,1
2025	1 636,1***	1 161****	71
2026	1 649,9***	1 153****	69,9
2027	1 664,4***	1 162****	69,8
2028	1 680,2***	1 171****	69,7
2029	1 697,0***	1 181****	69,6
2030	1 714,0***	1 191****	69,5

Note: * – actual Rosstat data
** – Rosstat data for 2022 (taking into account the results of the WNP-2020)
*** – forecast values of the indicator "Average annual number of population" (base variant of the forecast) are formed taking into account the data of the Department of Economy of the Tyumen Oblast dated 11.04.2023
**** – forecasted values of the number of deaths from CVD were formed taking into account the forecast of population mortality from all causes in the Tyumen Oblast (without autonomous okrugs) for the period up to 2034, sent to the Department of Health of the Tyumen Oblast on 14.04.2023.

Forecasting models of the general morbidity of adults (18 years and older) by class of nervous system diseases in the Tyumen Oblast (without AD) up to 2030 (per 1000 population)

The forecasting model was built taking into account the data on the registration of cases of general morbidity in the class of nervous system diseases in the Tyumen Oblast since 2009 (Figure 2). The obtained data indicate that the detection of general morbidity in the class of nervous system diseases in the Tyumen Oblast remains at the same level.

In the developed model, the MAPE prediction error was 1.0% BIC value was 1.7 and R-squared was 0.9.



	2023	2024	2025	2026	2027	2028	2029	2030
Projected values	54,3	55,6	56,9	57,2	56,8	57,1	58,0	58,7
95% confidence interval	51,9-56,6	53,1-58,1	54,1-59,9	53,9-60,3	53,6-60,0	53,6-60,5	54,6-61,5	55,1-62,3

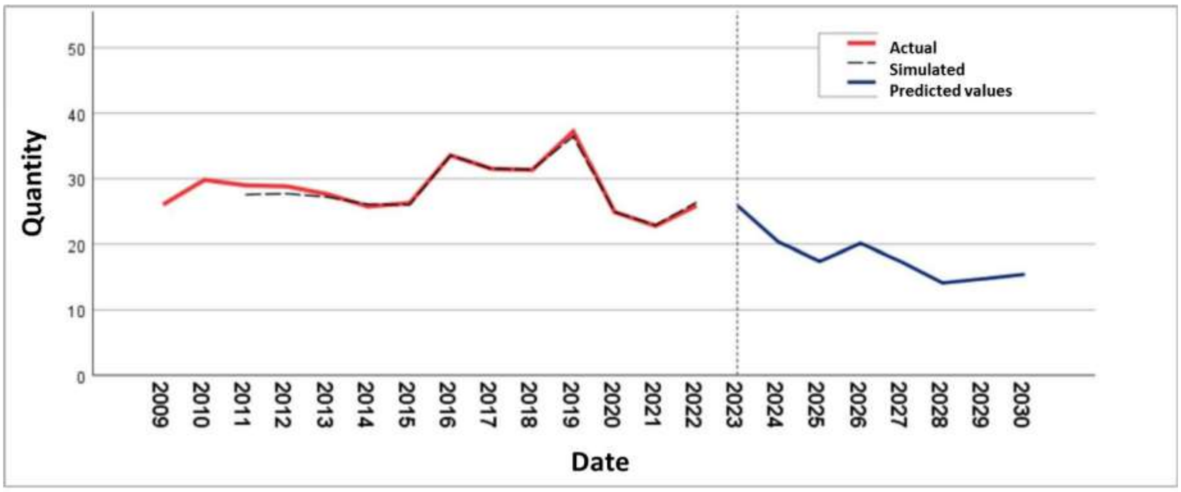
Figure 2 – Forecast of total morbidity by class of nervous system diseases in the Tyumen Oblast adults (18 years and older)

Stability of general morbidity in the class of diseases of the nervous system was predicted in such districts as Tyumen, Armizonsky, Aromashevsky, Zavodoukovsky, Isetsky, Kazansky, N-Tavdinsky, Omutinsky, Sladkovsky, Sorokinsky, Tobolsky, Uporovsky, Yalutorovsky and Yarkovsky districts.

The increase in total morbidity in the class of diseases of the nervous system was predicted in Ishim city and Ishimsky district, Abatsky, Berdyuzhsky, Vagaysky and Yurginsky districts.

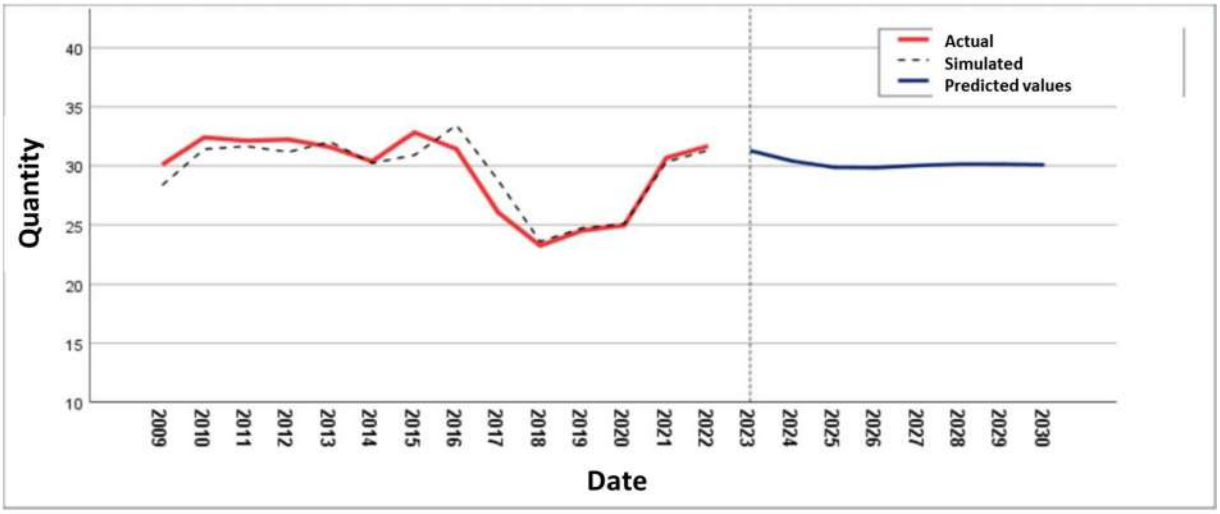
A decrease in the total morbidity rate for nervous system diseases was predicted in Tobolsk, Vikulovsk, Golyshmanovsk, Tyumen and Uvat districts.

Figures 3, 4, 5 show the most striking examples of the models displaying forecasting of decrease (Figure 3), stability (Figure 4), increase (Figure 5) of the general morbidity rate in the class of nervous system diseases in different districts of the Tyumen Oblast.



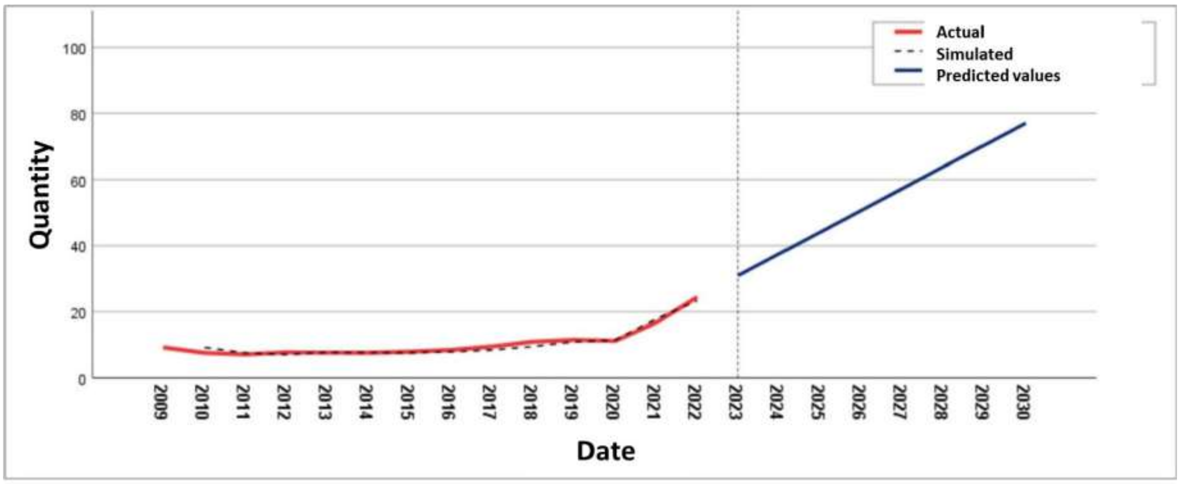
	2023	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Projected values	25,9	20,3	17,4	20,1	17,3	14,1	14,8	15,4
95% confidence interval	24,3-27,5	18,5-22,3	15,3-19,7	17,1-23,4	13,5-21,6	10,2-18,6	10,0-20,3	9,7-22,3

Figure 3 – Forecast of total morbidity by class of diseases of the nervous system of adults in Vikulovsky district (18 years and older)



	2023	2024	2025	2026	2027	2028	2029	2030
Projected values	31,3	30,4	29,9	29,8	30,0	30,1	30,1	30,1
95% confidence interval	26,7-36,2	20,8-41,5	18,8-43,1	18,7-43,2	18,8-43,4	18,8-43,6	18,8-43,6	18,8-43,6

Figure 4 – Forecast of total morbidity by class of diseases of the nervous system of adults in Nizhnyetavdinsky Raion (18 years and older)



	2023	2024	2025	2026	2027	2028	2029	2030
Projected values	30,9	37,6	44,1	50,7	57,3	63,9	70,4	77,0
95% confidence interval	29,0-32,9	34,8-40,3	40,8-47,5	46,8-54,6	52,9-61,6	59,1-68,6	65,3-75,6	71,5-82,5

Figure 5 – Forecast of total morbidity by class of diseases of the nervous system of adults in Yurginsky District (18 years and older)

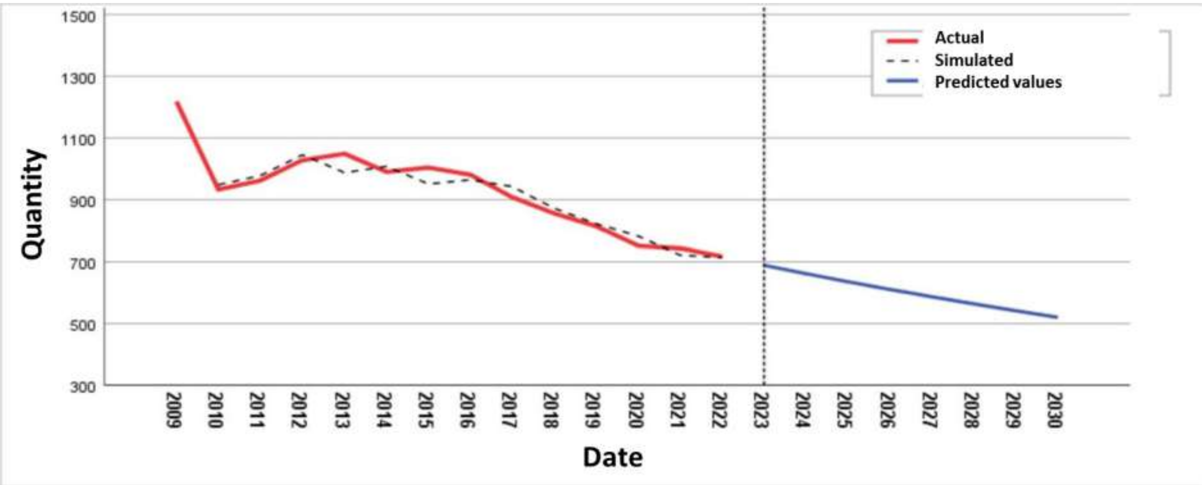
On the basis of the time series model, the values of detection of total morbidity by the class of nervous system diseases in Vikulovsky district were predicted with the average absolute forecast error MAPE 1.5%, BIC – 1.8, R-square – 0.9.

In Nizhnyetavdinsk rayon the values of detection of total morbidity in the class of nervous system diseases were projected with MAPE equal to 3.1%, BIC – 3.2, R-square – 0.9.

In the developed time series model of detection of the total incidence of the class of nervous system diseases in Yurginsky district, MAPE was 6.9%, BIC was 0.1, R-square was 0.9.

Forecasting models of primary morbidity of adults (18 years and older) by class of nervous system diseases in the Tyumen Oblast (without AD) until 2030 (per 1000 population)

The forecasting model was built taking into account the data on registration of cases of primary morbidity in the class of nervous system diseases in the Tyumen Oblast since 2009 (Figure 6).



	2023	2024	2025	2026	2027	2028	2029	2030
Projected values	688,8	661,7	635,7	610,6	586,6	563,5	541,4	520,1
95% confidence interval	636,5-744,4	591,6-738,2	554,0-726,6	520,9-712,4	490,9-696,7	463,5-680,1	438,2-663,1	414,7-645,8

Figure 6 – Forecast of primary morbidity by class of nervous system diseases in the Tyumen Oblast adults (18 years and older)

The obtained data indicate a significant decrease in the detection of primary morbidity in the class of diseases of the nervous system in the Tyumen Oblast.

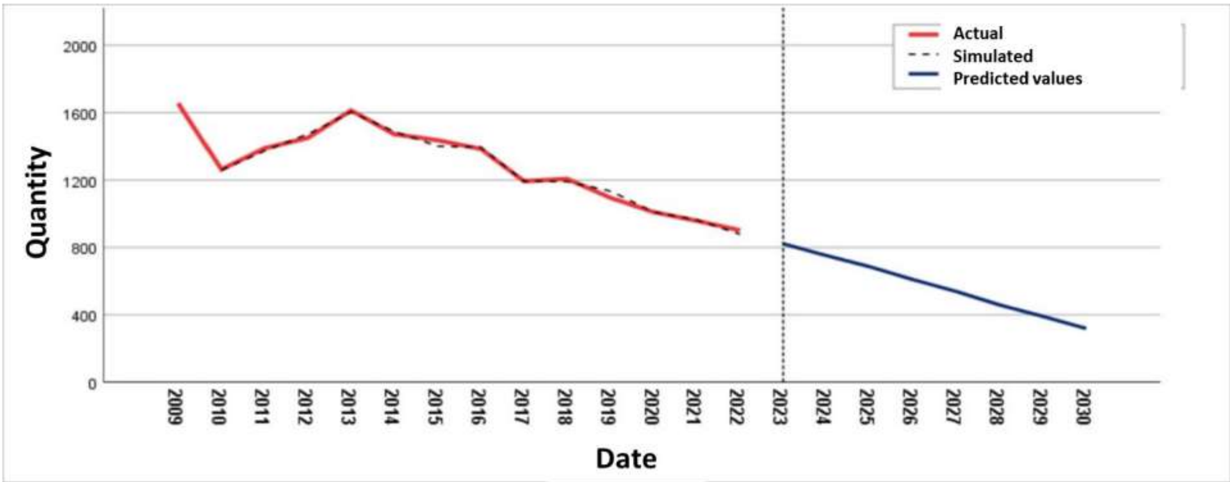
In the developed model, the MAPE prediction error was 2.6%, the Bayes Information Criterion (BIC) value was 7.7, and the R-squared was 0.91.

In some districts an increase in primary morbidity in the class of nervous system diseases was predicted: Vagaysky, Vikulovsky, Golyshmanovsky, Zavodoukovsky, Sorokinsky, Tyumen, Uvatsky, Uporovsky and Yarkovsky districts.

Accordingly, for the majority of districts a decrease in cases of primary morbidity in the class of nervous system diseases was predicted: Tyumen city, Ishim city and Ishimsky district, Tobolsk city, Abatsky, Armizonsky, Isetsky, Kazansky, N-Tavdinsky and Tobolsky districts.

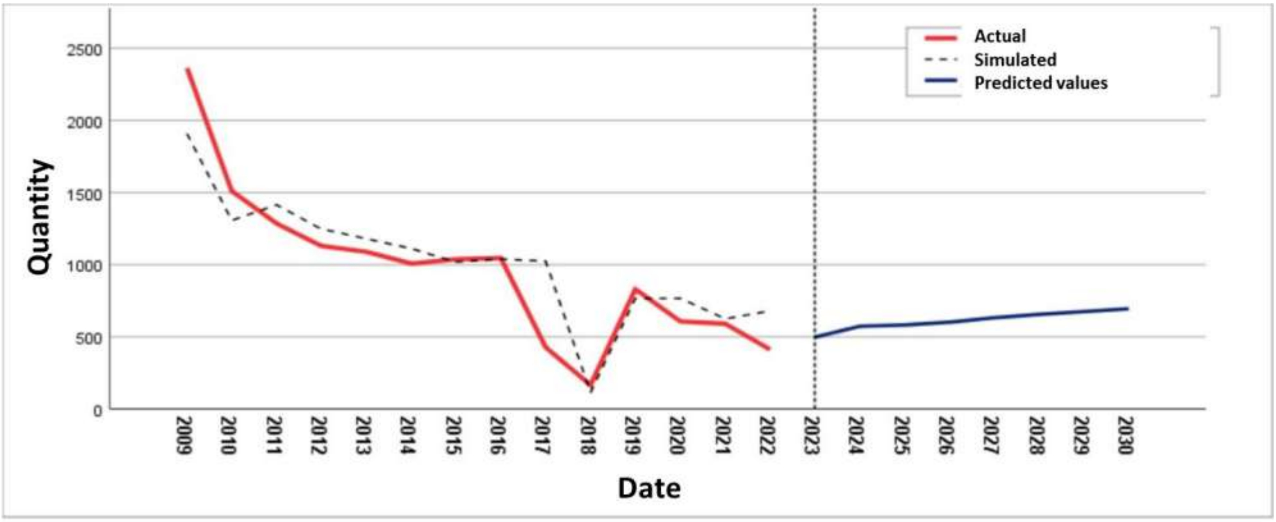
The minimum dynamics in predicting cases of primary morbidity in the class of diseases of the nervous system was noted for such districts as Aromashevsky, Berdyuzhsky, Omutinsky, Sladkovsky, Yurginsky, Yalutorovsky.

Figures 7, 8, 9 show the most striking examples of models displaying forecasting of decrease (Figure 7), increase (Figure 8) and stability (Figure 9), primary morbidity, morbidity in the class of diseases of the nervous system of adults in different districts of the Tyumen region.



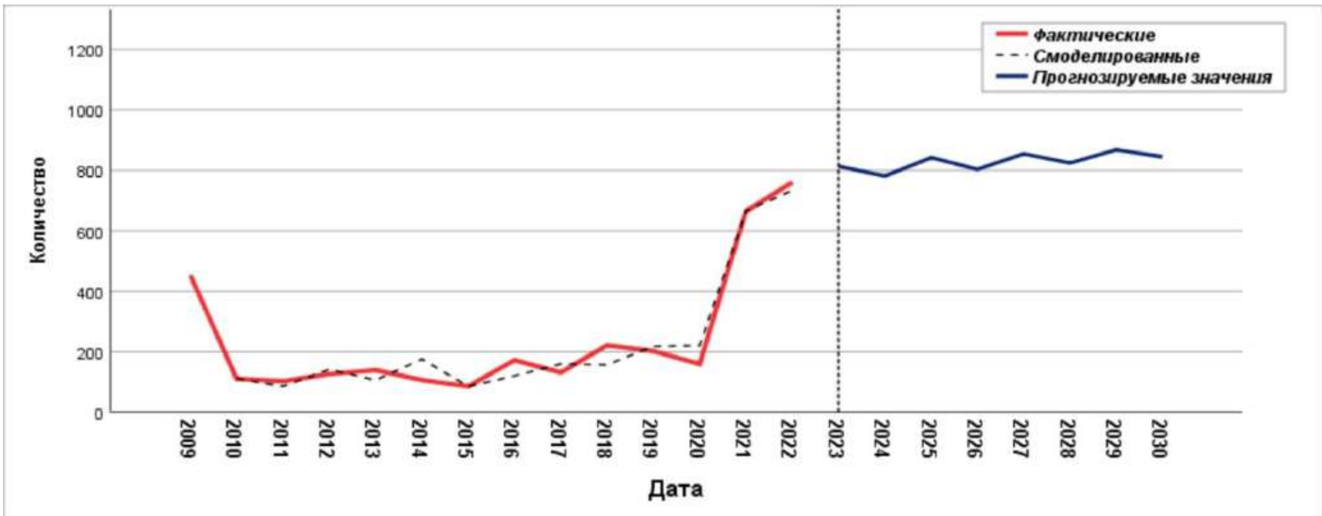
	2023	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Projected values	822,1	751,3	685,1	609,0	538,7	459,2	390,5	319,1
95% confidence interval	752,4-891,7	677,1-825,4	607,6-762,7	519,9-698,2	444,0-633,3	359,9-558,5	284,7-496,4	208,2-429,9

Figure 7 – Forecast of the detection of primary morbidity in the class of diseases of the nervous system among the adult population in Tyumen city



	2023	2024	2025	2026	2027	2028	2029	2030
Projected values	367,9	539,8	557,2	564,6	621,8	652,6	673,4	702,5
95% confidence interval	76,1-826,6	26,4-1536,5	21,2-1667,1	15,8-1784,9	13,3-2011,0	11,9-2143,5	9,9-2243,7	7,6-2355,4

Figure 8 – Forecast of detection of primary morbidity of nervous system diseases among adults in Berdyuzhsky Raion



	2023	2024	2025	2026	2027	2028	2029	2030
Projected values	813,4	781,3	842,1	803,3	854,6	824,5	867,9	844,8
95% confidence interval	701,9-924,9	618,3-944,3	644,2-1040,0	572,8-1033,9	597,9-1111,4	541,9-1106,9	563,6-1172,4	518,5-1171,2

Figure 9 – Forecast of primary morbidity by class of nervous system diseases among adults in Yurginsky Raion

In the developed time series model of detection of primary morbidity in the class of diseases of the nervous system of adults in Tyumen, MAPE was 1.2%, BIC – 8.2, R-square – 0.9.

In a time series model of the detection of primary morbidity in the class of adult nervous system diseases in Berdyuzhsky district, the predictor had a MAPE of 20%, a BIC of 13.3, and an R-squared of 0.9.

In the developed time series model of detection of primary morbidity in the class of nervous system diseases in Yurginsky district MAPE is 19%, BIC was 8.8, R-square was 0.9.

Forecasting models of primary morbidity of adults (18 years and older) for CVD in the Tyumen Oblast (without AD) until 2030. (per 1000 population)

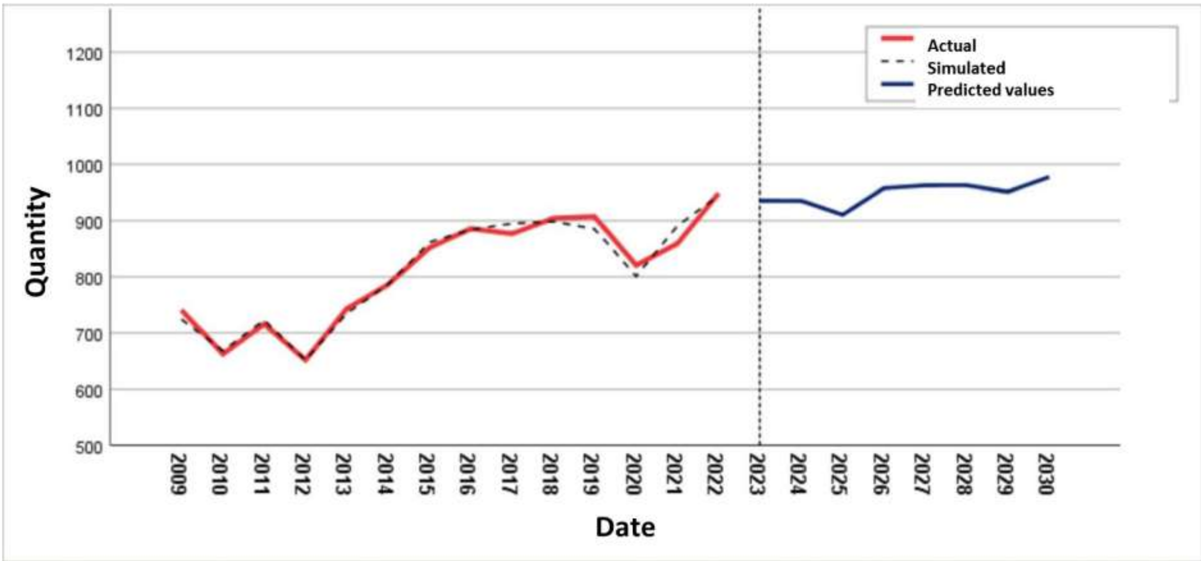
The forecasting model was built taking into account the data on registration of cases of primary incidence of CDI in the Tyumen Oblast since 2009 (Figure 10). The obtained data indicate an increase in the detection of primary incidence of CDI in the Tyumen Oblast.

In the developed model, the MAPE prediction error was 1.3%, BIC was 8.01, and R-squared was 0.9.

Accordingly, for the majority of districts an increase in the primary incidence of CVD was predicted: Tyumen city, Ishim city and Ishimsky district, Armizon, Golyshmanovsky, Omutinsky, Tyumen, Uporovsky, Yalutorovsky and Yarkovsky districts.

In some districts a decrease in primary incidence of CDI was predicted: Abatsky, Berdyuzhsky, Vikulovsky, Zavodoukovsky, Isetsky, Kazansky, N-Tavdinsky and Sladkovsky districts.

Minimal dynamics in predicting cases of primary incidence of CVD was observed for such districts as Tobolsk, Aromashevsky, Vagaysky, Sorokinsky, Tobolsk, Uvatsky and Yurginsky districts.



	2023	2024	2025	2026	2027	2028	2029	2030
Projected values	935,8	935,5	910,7	957,9	962,8	962,8	951,5	977,7
95% confidence interval	877,4-994,2	863,7-1007,4	838,1-983,3	885,3-1030,6	883,1-1042,4	881,3-1044,4	869,2-1033,7	895,5-1060,0

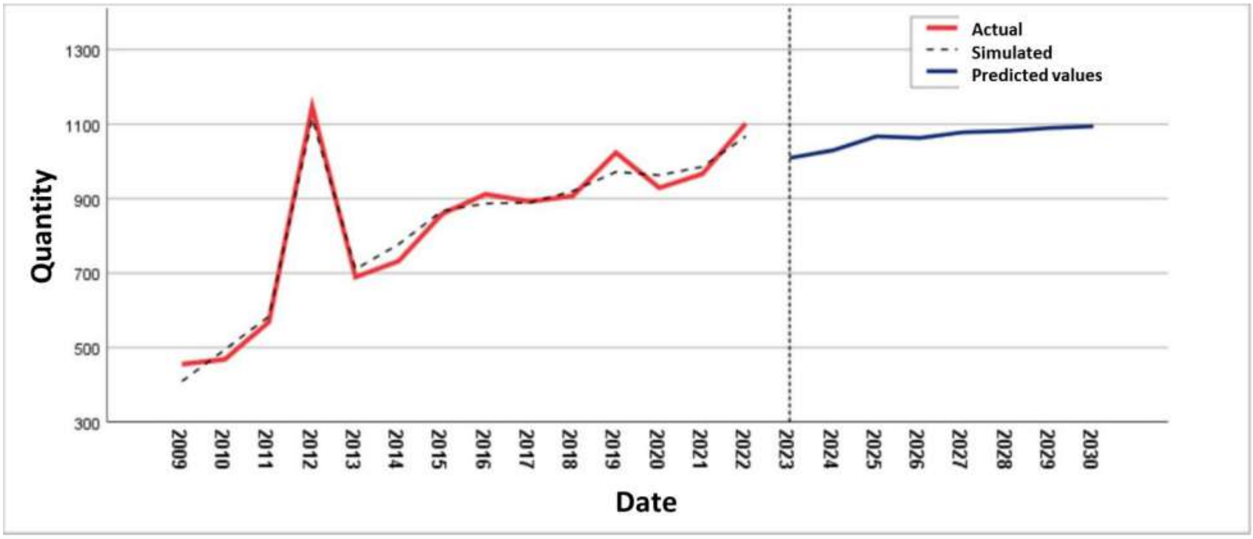
Figure 10 – Forecast of primary incidence of CVD in the Tyumen Oblast adults (18 years and older)

Figures 11, 12, 13 show the most striking examples of models displaying forecasting of increase (Figure 11), decrease (Figure 12), and stability (Figure 13) of the primary incidence of CVD morbidity in different districts of the Tyumen Oblast.

In a time series model of the detection of the primary incidence of CVD in Ishim and Ishim district MAPE – 3.5%, BIC – 8.9, R-square – 0.90.

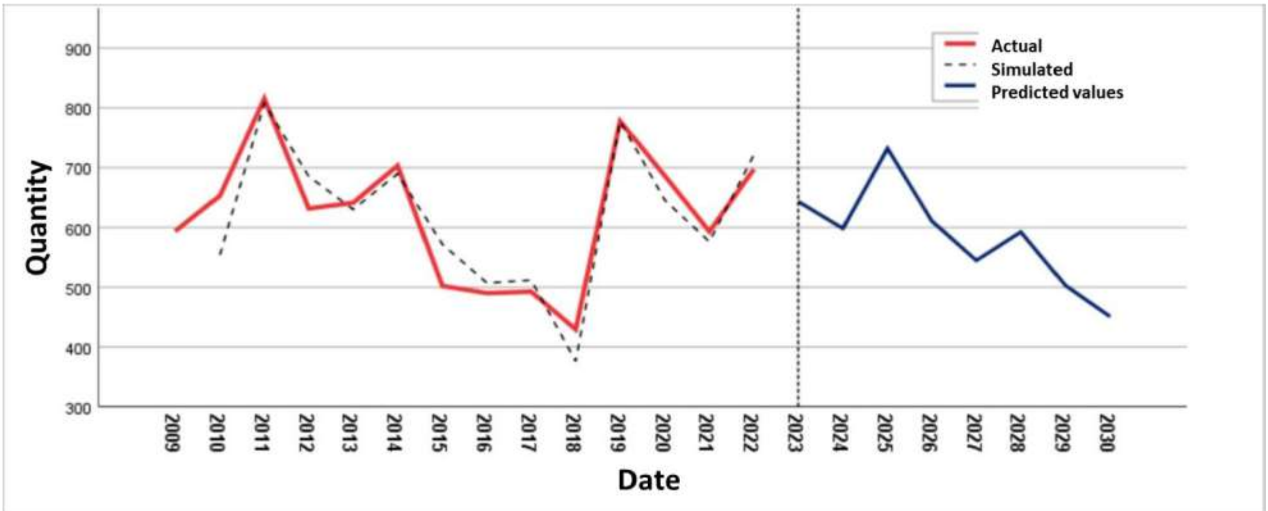
In Abatsky district, the time series model predicted a decrease in the detection of primary CVD incidence with MAPE – 5.7%, BIC – 9.31, R-squared – 0.9.

In the developed model for predicting the detection of primary incidence of CVD in Aromashevsky district, MAPE was 13.8%, BIC was 10.6, R-square was 0.9.



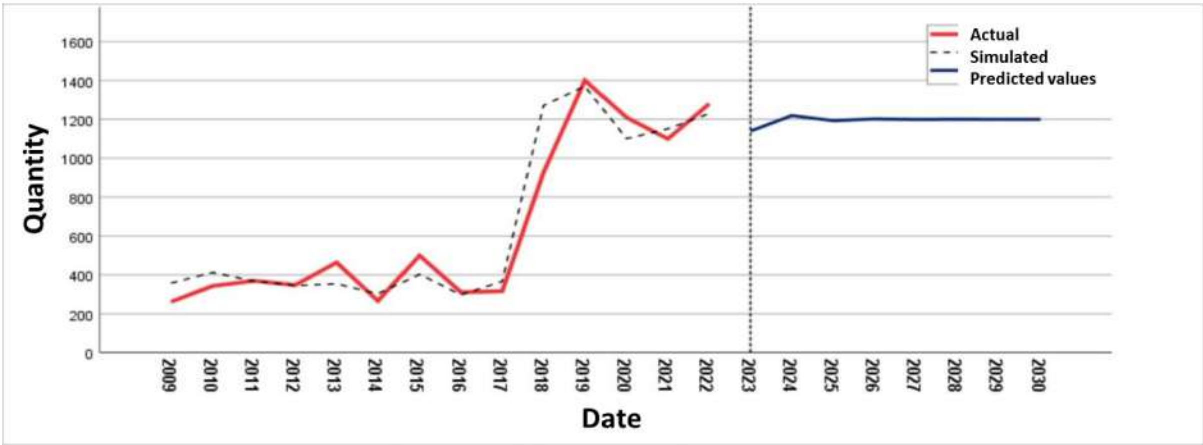
	2023	2024	2025	2026	2027	2028	2029	2030
Projected values	1009,3	1029,6	1067,1	1062,9	1078,2	1081,6	1089,6	1093,9
95% confidence interval	916,8-1101,7	926,0-1133,3	948,6-1185,7	940,7-1185,1	955,0-1201,3	958,2-1205,0	966,1-1213,1	970,4-1217,5

Figure 11 – Forecast of primary incidence of CVD in Ishim city and Ishim district (18 years and older)



	2023	2024	2025	2026	2027	2028	2029	2030
Projected values	643,3	598,5	732,1	610,5	544,7	592,3	502,6	450,7
95% confidence interval	515,5-771,1	441,8-755,2	557,9-906,4	390,4-830,6	300,1-789,3	328,9-855,8	209,9-795,2	137,9-763,5

Figure 12 – Forecast of detection of primary incidence of CVD in Abatsky district (18 years and older)



	2023	2024	2025	2026	2027	2028	2029	2030
Projected values	1139,2	1219,1	1192,8	1201,6	1199,2	1199,8	1199,7	1199,7
95% confidence interval	729,1-1715,7	728,7-1943,1	705,7-1917,3	710,1-1933,2	708,6-1929,5	708,9-1930,5	708,8-1930,3	708,8-1930,3

Figure 13 – Forecast of detection of primary incidence of CVD in Aromashevsky Raion (18 years and older)

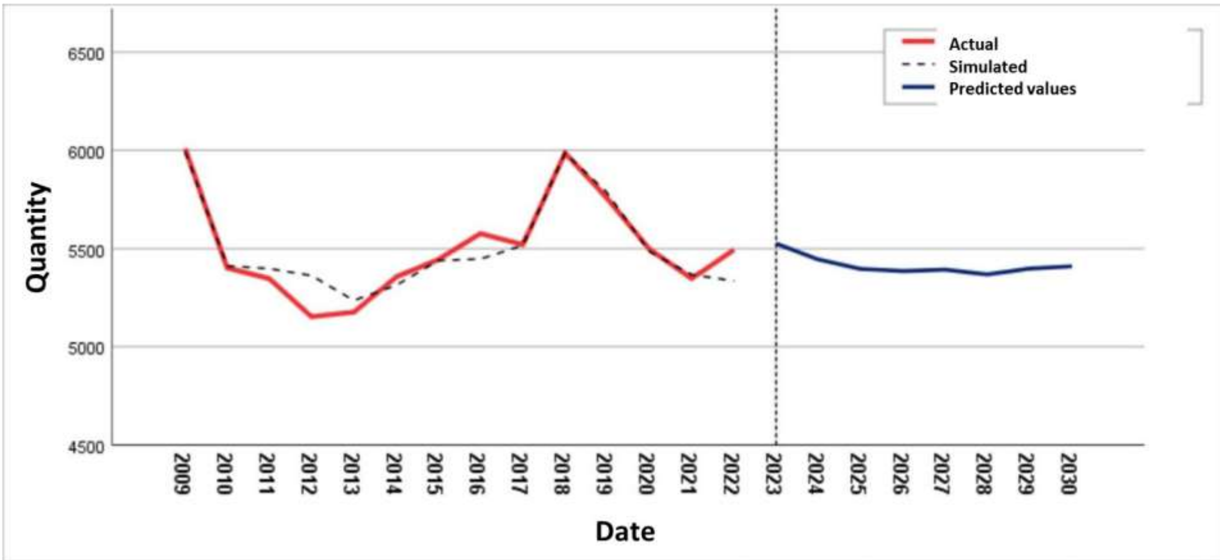
Forecasting models of the total incidence of adult (18 years and older) CVD in the Tyumen Oblast (without AD) until 2030 (per 1000 population)

The forecasting model was built taking into account the data on registration of cases of total incidence of CDI in the Tyumen Oblast since 2009 (Figure 14). The data obtained indicate a slight decrease in the detection of the total incidence of CDI in the Tyumen Oblast.

In the developed model, MAPE is 1%, BIC is 10.3, and R-squared is 0.9.

For some districts, an increase in the total incidence of CDI was forecasted: Ishim city and Ishimsky district, Armizonsky, Aromashevsky, Golyshmanovsky, Zavodoukovsky, Kazansky, N-Tavdinsky, Omutinsky, Sladkovsky, Tobolsky, Tyumen, Uvatsky and Yarkovsky districts.

Decrease in cases of total incidence of CVD was predicted for Abatsky, Berdyuzhsky, Vikulovsky and Isetsky districts.



	2023	2024	2025	2026	2027	2028	2029	2030
Projected values	5525,6	5444,9	5396,6	5385,8	5392,5	5368,4	5398,3	5410,2
95% confidence interval	5288,6-5771,1	5157,3-5745,3	5106,9-5699,3	5096,4-5688,2	5101,8-5696,5	5078,6-5671,4	5106,8-5702,9	5118,1-5715,6

Figure 14 – Forecast of the total incidence of CVD in the Tyumen Oblast adults (18 years and older)

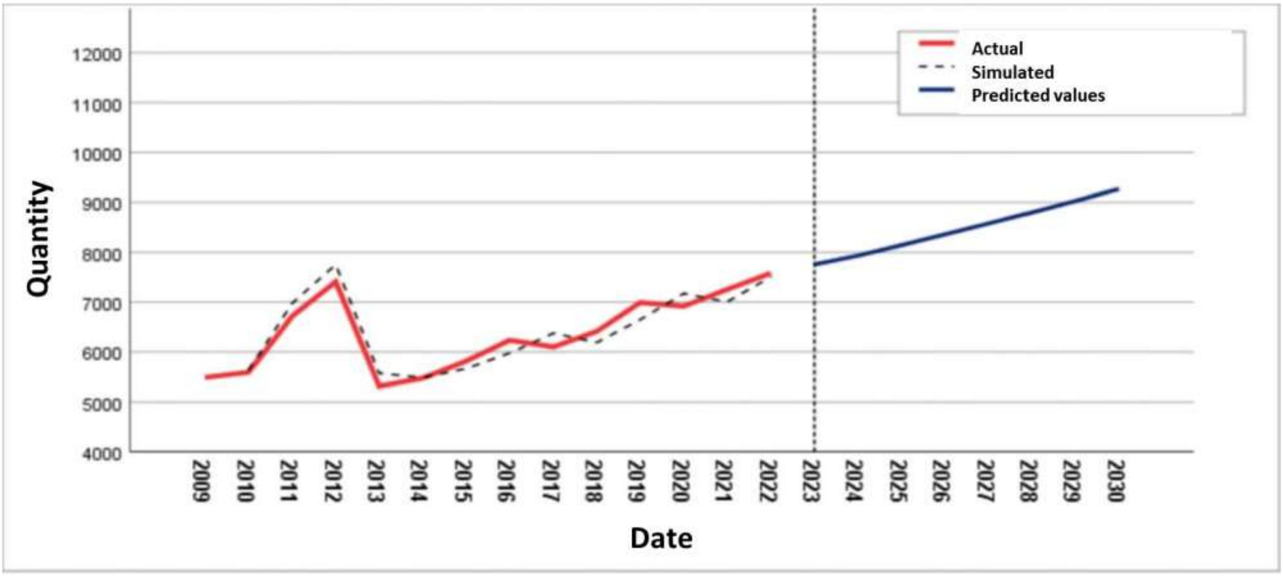
Minimal dynamics in predicting cases of total incidence of CVD was observed for such districts as Tyumen, Tobolsk, Vagaysky, Sorokinsky, Uporovsky, Yalutorovsky and Yurginsky.

Figures 15, 16, 17 show the most striking examples of models displaying forecasting of increase (Figure 15), decrease (Figure 16), and stability (Figure 17) of the total incidence of CVD in different districts of the Tyumen Oblast.

The time series model predicted an increase in the detection of the total incidence of CVD in Ishim city and Ishim district with a MAPE prediction error of 3.2%, BIC was 12.4, R-squared was 0.9.

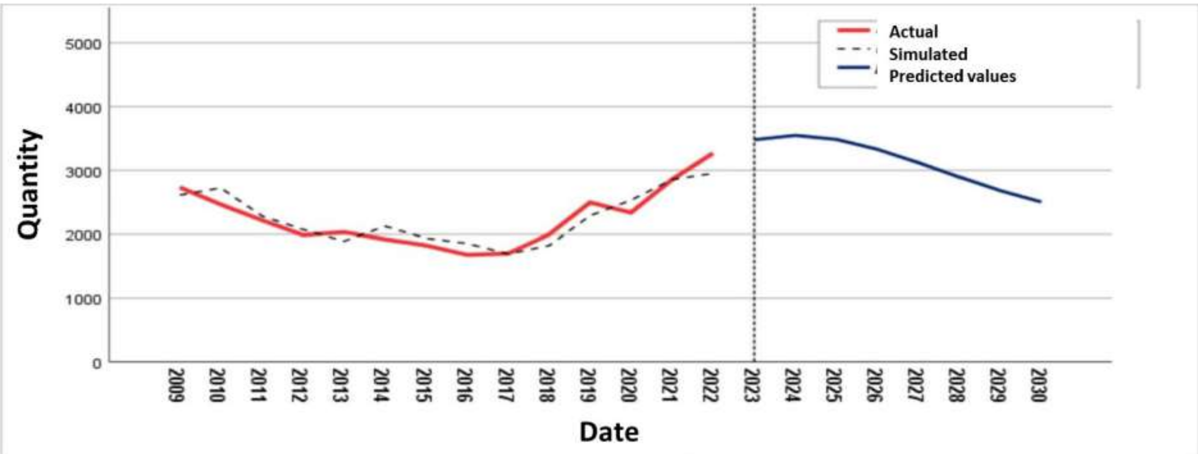
In the developed time series model of the detection of the total incidence of CVD in Iset district, MAPE was 6.6%, BIC was 11.8, R-square was 0.9.

In the time series model of detection of the total incidence of CVD in Tyumen city MAPE amounted to 1.5%, BIC – 11.9, R-square – 0.94.



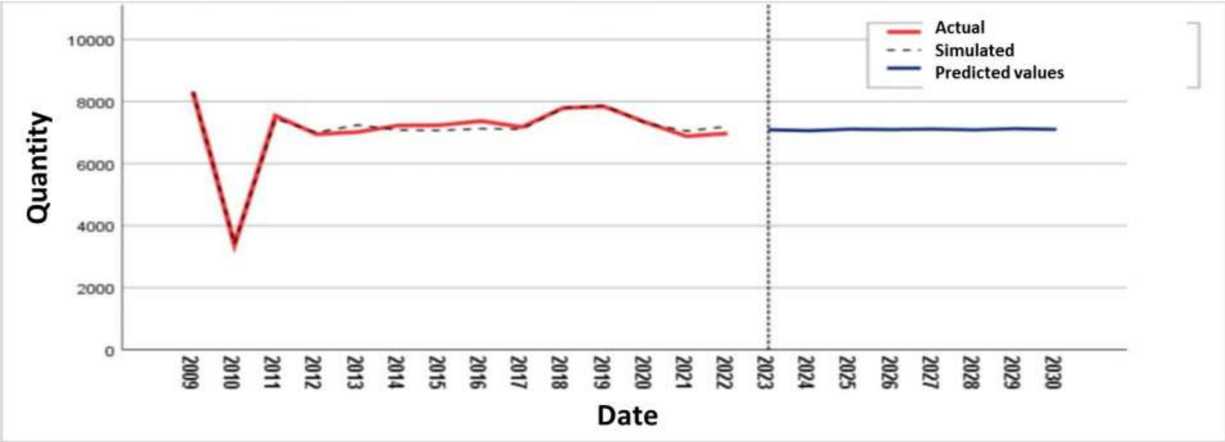
	2023	2024	2025	2026	2027	2028	2029	2030
Projected values	7756,5	7933,0	8142,1	8359,8	8577,9	8800,9	9030,6	9266,4
95% confidence interval	6976,3-8606,1	6788,6-9229,3	6781,3-9716,7	6807,7-10187,7	6834,9-10665,8	6872,1-11147,7	6921,5-11633,8	6979,9-12126,9

Figure 15 – Forecast of total incidence of CVD in Ishim city and Ishim rayon (18 years and older)



	2023	2024	2025	2026	2027	2028	2029	2030
Projected values	3481,2	3547,3	3485,6	3330,8	3121,3	2894,3	2680,9	2504,3
95% confidence interval	3030,0-3932,3	2710,4-4384,3	2310,8-4660,3	1899,3-4762,2	1521,9-4720,7	1204,8-4583,7	956,6-4405,2	773,9-4234,7

Figure 16 – Forecast of total incidence of CVD in Isetsky Raion (18 years and older)



	2023	2024	2025	2026	2027	2028	2029	2030
Projected values	7089,2	7060,0	7109,6	7095,5	7110,4	7087,1	7125,2	7100,5
95% confidence interval	6631,9-7546,5	6598,9-7521,0	6631,3-7587,9	6616,1-7574,9	6629,5-7591,2	6606,1-7568,2	6644,0-7606,4	6619,3-7581,7

Figure 17 – Forecast of total incidence of CVD in the city of Tyumen (18 years and older)

Taking into account the forecast values of the population of the Tyumen Oblast, the dynamics of morbidity and mortality from cerebrovascular diseases for the previous periods and the preservation of all conditions, we can conclude that the forecast values of the indicator of morbidity and mortality from cerebrovascular diseases will continue to decrease despite the growth of absolute values.

Summary

Thus, the objective prerequisites for the need to improve the system of neurological care for the population of the Tyumen Oblast were:

– increase in population with a further forecast of its growth, as well as life expectancy;
– higher mortality due to neurological diseases in rural areas;

– high rates of primary and repeated disability due to neurological diseases.

Against the background of optimization of neurological care, the detection of extrapyramidal and other motor disorders (p=0.1), multiple sclerosis (p=0.05) and epilepsy (p=0.05) increased statistically significantly in the period from 2009-2019 to 2020-2022. Moreover, in rural areas there was a statistically significant increase in the detection of epilepsy (p=0.1).

Also in the period 2020-2022, a statistically significant decrease in the total incidence of CVD among the urban population was observed compared to 2009-2019 (p=0.1). Significantly decreased mortality from CVD among both urban and rural population (p=0.01 and p=0.05, respectively).

Against the background of the ongoing optimization in the period from 2009-2019 to 2020-2022, a decrease in the dynamics of primary disability among the rural population of TO as a whole (p=0.1) and among persons of working age (p=0.0), including CVD among both urban (p=0.05) and rural (p=0.05) population was revealed. In addition, among persons of working age living in rural areas, there was a significant decrease in repeated disability from 2009-2019 to 2020-2022 (p=0.1), including epilepsy (p=0.0).

CHAPTER 4. ORGANIZATION OF MEDICAL CARE FOR THE POPULATION OF TYUMEN REGION WITH ACUTE CEREBRAL CIRCULATORY DISORDERS

The treatment of stroke has undergone significant changes in the last few decades, resulting in qualitative improvements in the provision of medical care to this category of patients. The results of clinical studies on the treatment, prevention and rehabilitation of STEMI have led to the introduction of new methods and techniques based on the principles of evidence-based medicine (thrombolytic therapy (TLT), early rehabilitation starting from the neurorehabilitation department, and secondary prevention of the disease). One of the main achievements in the treatment of stroke was the change in the organization of medical care for this category of patients and the creation of specialized vascular departments and centers.

Inpatient acute stroke treatment is most effective in specialized vascular units, which are key to patient recovery and are the foundation of the preclinical, clinical and outpatient phases of care. Conclusive data from a large number of randomized controlled clinical trials have been published showing improved outcomes of transient ischemic attack (TIA) and stroke in patients treated in specialized vascular units compared with patients treated in conventional neurological units. Thus, stroke patients treated in vascular centers had lower mortality, higher likelihood of independent self-care and independent living at home 1 year after stroke compared with patients treated in a conventional unit.

The ability to improve outcomes in stroke depends on judicious use of the therapeutic window immediately after the onset of symptoms. Measures should be taken to ensure prompt initiation of treatment and to facilitate access to skilled care.

The provision of medical care for TIA and stroke requires immediate recognition of stroke symptoms by the patient or the patient's community, prompt and organized paramedic assistance, including transport and notification of the emergency room of the patient being delivered, and timely and appropriate inpatient treatment. Paramedics should transport patients to the nearest hospital that is ready to receive acute stroke patients for initial diagnosis, stabilization, and immediate medical care, followed by transfer to the nearest vascular center or vascular unit if the patient's condition warrants. The key elements of hospital readiness for acute stroke patients are: availability of an acute stroke team (at least two staff members, 24/7, ready to see the patient within 15 minutes), protocols for emergency and critical care in the emergency room (annual education and training), the ability to quickly perform brain imaging studies and laboratory tests (time to results – 45 min), protocols for intravenous administration, and the ability to provide immediate medical care in the emergency room (annual education and training).

At present, one of the most important tasks of the Russian health care is to reduce mortality from STEMI. In order to solve this task, in 2007 the Federal Target Program on improvement of the organization of medical care for patients with vascular diseases (National Project "Health") was adopted [210The results of its implementation were the creation of regional vascular centers (RVCs) and primary vascular departments (PVDs), which were organized in the TR with our participation in order to provide the population with timely and quality medical care.

A comprehensive analysis of the main statistical indicators, as well as the quality of neurological care dictates the need to introduce in the region a unified program for patients with acute vascular pathology with subsequent secondary prevention, algorithms of primary prevention in patients with chronic cerebrovascular pathology, health education work in this area with wide coverage of the problem in the media, which is regulated by the order of the Department of Health of the Tyumen region of March 10, 2 [99].

It was decided that in order to improve morbidity and mortality rates from cerebral circulatory disorders it is necessary to create a step-by-step assistance to patients in accordance with the Order of medical care for patients with acute cerebral circulatory disorders (Order of the Ministry of Health and Social Development of Russia No. 389n of July 6, 2009). "On Approval of the Procedure for Providing Medical Care to Patients with Acute Cerebral Circulatory Disorders") [96].

At the same time, the timing and volume of activities carried out differ significantly between the RF subjects, which, according to experts, is due to different regional peculiarities. In 2008, the RF Ministry of Health sent a draft order No. 398n to the TO, which required to assess the readiness of the region to join this program. From 2008-2013 we prepared hospitals to join the vascular program. In June 2012, we submitted an application on the region's readiness to join the vascular program (TO Passport "Priority Measures for Prevention, Diagnosis and Treatment of Cardiovascular Diseases in 2013-2015") and the Tyumen Oblast joined this project in 2013.

4.1. Assessment of the efficiency of the organization of work of the vascular center and primary vascular departments in the period 2013-2022

At present, a relevant and promising direction of development of medical care for patients with CVD is the creation of vascular centers, treatment in which allows to provide effective assistance to the population in the first hours of the disease symptoms development due to the use of modern methods of diagnosis, treatment and rehabilitation. In order to provide timely and high-quality medical care to patients with STEMI in the Tyumen Oblast in 2013, a regional vascular center for 90 beds was opened in the Regional Clinical Hospital No. 2 (Tyumen) and primary vascular center in the Tyumen Oblast. (Tyumen) and primary vascular departments for 30 beds each at the Regional Clinical Hospital No. 3 (Tobolsk). (Tobolsk), Oblast Hospital No. 4 (Ishim) and Oblast Hospital No. 23 (Yalutorovsk) (Order of the Department of Health of the Tyumen Oblast No. 58os of March 10, 2011; Appendix A, p.362) (Figure 18) [110, 158].

When conducting a detailed assessment of the medical care provided to patients with acute cerebral circulatory disorders it was revealed that in accordance with the order of the Ministry of Health and Social Development of the Russian Federation dated November 15, 2012 № 928n "On Approval of the Procedure for the provision of medical care to patients with acute cerebral circulatory disorders" the deficit of beds is currently

51.8. This is due to the fact that 30 beds should be allocated for 150000 adults. During the detailed analysis it was determined that with the load of work of SAR No. 2 (GBUZ TO OB No. 4 in Ishim), in which the deficit of beds is 5 and RRC (GBUZ TO OKB No. 2) – the deficit of beds is 47.

In this regard, a primary vascular department for 30 beds was opened in the city of Tyumen in 2020 on the basis of the State Budgetary Institution of Tyumen Regional Clinical Hospital No. 1, with the functions of the second regional vascular center.

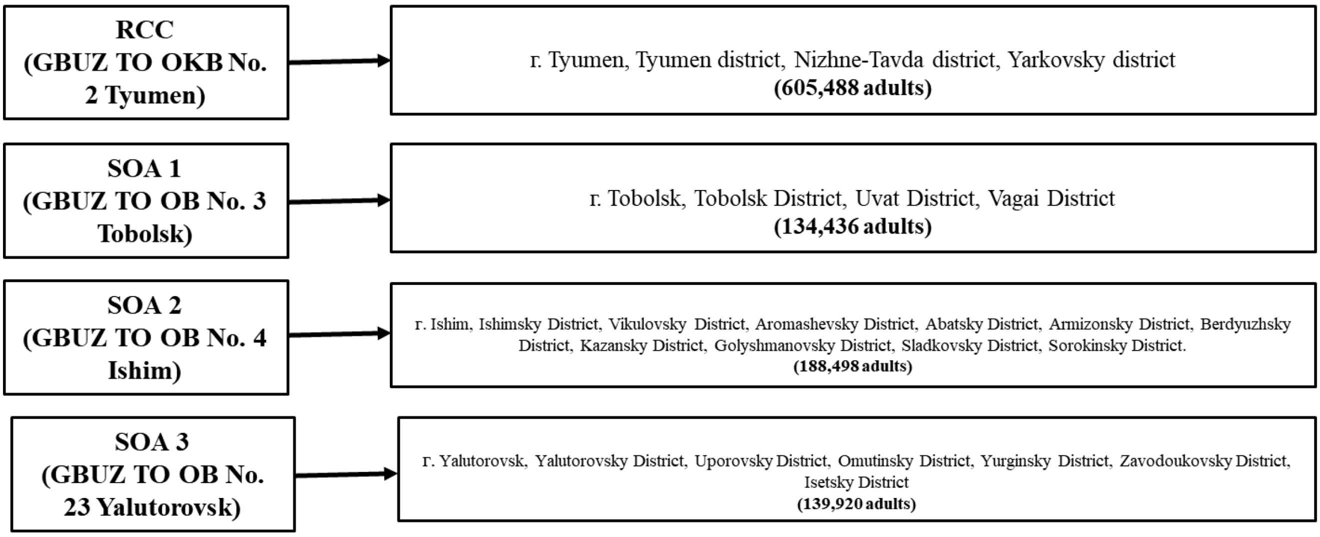


Figure 18 – Routing of patients with STEMI in the Tyumen Oblast until 2020

The administrative structure of the Tyumen Oblast is complex: within the region there are three districts – the south of the Tyumen Oblast, the Khanty-Mansiysk Autonomous Okrug – Yugra and the Yamalo-Nenets Autonomous Okrug [114].

As of 01.01.2023, medical assistance to the population of the Tyumen Oblast is provided in 50 medical organizations of the public health care system (48 institutions of regional subordination, 2 institutions of federal subordination), including 86 branches of the regional organizations (10 district hospitals; 15 district hospitals; 48 medical outpatient clinics; 13 branches of regional institutions), as well as the Tyumen Cardiology Center, a branch of the Federal State Budget Institution of Tomsk Research Medical Center of the Russian Academy of Sciences.

This territorial arrangement creates certain difficulties related to the routing of patients requiring both urgent and planned medical interventions. The lack of a clear understanding and algorithm for routing patients leads to their "chaotic" movement through different stages of medical care, which significantly worsens not only its availability, but also its quality.

Taking into account the regional peculiarities of the Oblast, at the first stage of optimization clinical recommendations on patient routing were developed taking into account the remoteness of each of the municipalities from the main health care institutions, since the effective functioning of the system of medical care for patients with neurological diseases is possible only if there is the maximum optimal resource provision and a clearly developed route of medical care. The development of patient routing stages contributes to a significant reduction in the time gap between the patient's initial visit to an ambulance/rural medical organization at the place of residence and the drawing up of a hospitalization/treatment plan in a specialized department.

According to the routing we have developed, patients are hospitalized in PCA № 1-3 or RCC. The Vascular Surgery Department is located in the RRC, where patients from the PCA are hospitalized if hemodynamically significant stenoses are detected in the acute period of STEMI.

In addition, patients with subarachnoid hemorrhages are hospitalized in the RCC, as it has a neurosurgery department where this category of patients undergoes surgical intervention.

When there are complex clinical cases, RRC physicians conduct telemedicine consultations with PCP physicians and/or patients, which not only helps the physicians' work but also enhances their knowledge.

In case of suspected STEMI, patients are routed as follows: an ambulance or sanaviation team admits the patient to a vascular center or department assigned to the area in which the patient lives. By the end of discharge from the vascular unit, depending on the patient's condition (rehabilitation potential), which is assessed using the Rankin Scale or the Rehabilitation Routing Scale, patients are referred to the second or third stages of rehabilitation: 0-1 points – to the outpatient unit for further preventive and therapeutic care; 2-3 points – to the third stage of rehabilitation; 3-4-5 – to the second stage (inpatient) of rehabilitation. 6 points – to the second stage of rehabilitation to a rehabilitation center. Those patients who have no or extremely low rehabilitation potential are referred to nursing units. Further, after discharge from the hospital, the patient is referred to the district polyclinic/FAP, where further treatment and rehabilitation activities are carried out in accordance with the program of dispensary follow-up of patients who have had a DNMK. If necessary, specialists of visiting multidisciplinary teams consult the attending physician/patient and adjust the treatment and rehabilitation plan, as well as conduct the necessary diagnostic tests.

The population living in the Yarkovsky, N-Tavda, Tyumen districts and the city of Tyumen was attached to the RHC of the Regional Clinical Hospital No. 2. In 2014, the total number of adults attached to the Regional Clinical Hospital No. 2 amounted to 605.5 thousand people. Travel time from the attached areas to the RRC ranged from 30 minutes (Tyumen city) to 2 hours (Yarkovsky District).

The population living in Tobolsk city, as well as Tobolsk, Uvat and Vagaysk districts were attached to the PSO No. 1 of the State Budgetary Institution of TO "Regional Hospital No. 3". In 2014, the total number of attached population amounted to 134.4 thousand people. Travel time from the attached territories to the RHC ranged from 30 minutes (Tobolsk) to 2.5 hours (Uvat District). Due to the large area of the region from the Uvat District (Zabolotye), patients can be hospitalized only by helicopter (sanaviation), which causes such a long travel time to the PCC.

The population living in Ishim city, Ishim, Abatsky, Armizonsky, Aromashevsky, Berdyuzhsky, Vikulovsky, Golyshmanovsky, Kazansky, Sladkovsky and Sorokinsky districts were attached to PCP No. 2 of the State Budgetary Institution of TO "Regional Hospital No. 4". In 2014, the total number of the attached population was 188.5 thousand people. Travel time from the attached areas to the RHC ranged from 60 minutes (Aromashevsky, Vikulovsky and Golyshmanovsky districts) to 75 minutes (Abatsky and Berdyuzhsky districts).

The population living in Zavodoukovsk, Yalutorovsky, Uporovsky, Zavodoukovsky, Yurginsky, Omutinsky and Isetsky districts were attached to PCSO No. 3 of the Regional Hospital No. 23. In 2014, the total number of the attached population was 139.9 thousand people. Travel time from the attached territories to the RHC ranged from 30 minutes (Zavodoukovsk) to 2 hours 15 minutes (Isetsky District).

The basis for the development of a network of vascular centers in the Tyumen Oblast was a comprehensive assessment of morbidity, mortality and disability of patients due to CVD, as well as the population, transport accessibility, readiness of medical organizations to open specialized centers on their basis, as well as the availability of material, technical and human resources.

The peculiarity of neurological care for patients with STEMI was that all PCPs (apart from RRCs) were equipped with CT angiography units (due to the large area of the region) in 2014. PCPs were equipped with magnetic resonance tomographs from 1.5 Tesla/computerized X-ray tomographs from 64 slices and/or computerized X-ray tomographs from 16 slices with software and related equipment for cardiac and cerebral studies, including perfusion and CT angiography.

In addition, in 2018, angioneurologist offices were set up, where patients are observed after discharge from vascular departments. We have developed an information program for interaction between the PCP and the angioneurologist's office: all necessary information about the patient (full name, gender, date of birth, residential address, social status, diagnosis, condition at discharge from the PCP/RCC according to Rankin scale, rehabilitation potential (Medical Rehabilitation Scale), recommended drug treatment and methods of secondary prevention) is entered into this program by specialists of the PCP and RCC, thanks to which the angioneurologist has all the information about the patient. In the future, the angioneurologist plans dispensary follow-up for each patient in the form of specific dates of examination, treatment correction, additional scheduled consultations with specialists, as well as determining the timing of the 2nd and 3rd stages of rehabilitation. All patients discharged from PCO/RRC after acute cerebral circulatory failure are registered under this program. A regular monitoring program has been developed, which evaluates the survival rate of patients, their disability and the effectiveness of rehabilitation measures (3, 6, 12, 18, 24 and 36 months after discharge from PCO/RRC). The patient's discharge epicrisis is transmitted via VIPnet secure communication to the polyclinic at the place of residence. Within 48 hours thereafter, the patient is visited by a general practitioner (to be registered as a "Chronic Patient") and within a week-10 days by a neurologist (to be registered in the angioneurologist's office).

An angioneurologist also consults patients with risk factors for stroke (arterial hypertension, atherosclerosis, stenosis of brachiocephalic arteries, diabetes mellitus, heart rhythm disorders) in order to draw up a program of primary stroke prevention (medication, additional examinations).

The activities of these offices are regulated by the following orders of the Russian Federation:

– Order of the Ministry of Health and Social Development of the Russian Federation No. 389n of July 06, 2009. "On Approval of the Procedure for Medical Care of Patients with Acute Cerebral Circulatory Disorders";
– Order of the Ministry of Health and Social Development of the Russian Federation No. 331 of July 11, 2008. "On the procedure for organizing monitoring of the implementation of measures aimed at improving the provision of medical care to patients with vascular diseases";
– Order of the Ministry of Health and Social Development of the Russian Federation No. 930 of November 30, 2009. "On Amendments to Order No. 331 of the Ministry of Health and Social Development of the Russian Federation of July 11, 2008 "On the Procedure for Organizing Monitoring of the Implementation of Measures to Improve the Provision of Medical Care to Patients with Vascular Diseases";
– Order of the Ministry of Health and Social Development of the Russian Federation No. 1044n of 30.12.2009. "On Approval of the Procedure for Providing Medical Care to Patients with Cardiovascular Diseases Requiring Diagnosis or Treatment Using Surgical and/or X-ray Endovascular Methods;
– Order of the Ministry of Health and Social Development of the Russian Federation No. 44n of February 02, 2010. "On Amendments to Order of the Ministry of Health and Social Development of the Russian Federation No. 389n of July 06, 2009 "On Approval of the Procedure for Providing Medical Care to Patients with Acute Cerebral Circulatory Disorders";

– Order of the Ministry of Health and Social Development of the Russian Federation No. 928n of November 15, 2012. "On Approval of the Procedure for the Provision of Medical Care to Patients with Acute Cerebral Circulatory Disorders";
– Order of the Tyumen Oblast Department of Healthcare No. 58os of March 10, 2011. "On the organization of medical care for patients with acute cerebral circulatory disorders" [110].

In addition, in order to organize and control the quality of work, we approved a commission to coordinate measures to improve the system of organization of medical care in these departments (Order of the Department of Health of the Tyumen Oblast No. 60os of March 10, 2011; Annex B, p.322). [110, 156]. The main functions of this commission are:

1. Monthly monitoring of the activities of vascular centers and departments;
2. Coordination of interaction between primary-level MIs and organizations providing medical care to patients with STEMI on prevention, detection and treatment of patients with this pathology;
3. Formation of proposals on elimination and prevention of shortcomings in the work on detection, prevention and treatment of patients with acute vascular diseases, improvement of the quality of medical care.

Improvement of the system of medical care for patients with STEMI and improvement of the organization of its quality is possible only on the basis of a detailed analysis of the work of vascular centers. This chapter presents the main results of the work of vascular centers and departments in the period 2013-2022, for which a special Card of monitoring of quality indicators of medical care for patients with STEMI was developed (Appendix D, p. 367).

4.1.1. Results of the work of SIG No. 1 of the State Budgetary Institution of TO "Regional Hospital No. 3" (Tobolsk)

During the evaluated period in the PSO No. 1 of the State Budgetary Institution of TO "Regional Hospital No. 3" Tobolsk received 6050 patients with STEMI (G45; I60-I66.9), including 5042 (83.3%) with MI (ischemic stroke) and 1008 (16.7%) with HI (hemorrhagic stroke) (Figure 19). There were significantly more patients with AI than GI, 6.1 times in 2013, 4.6 times in 2014, 5.4 times in 2015, 4.3 times in 2016, 3.7 times in 2017, 4.7 times in 2018, 4.7 times in 2019, 7.2 times in 2020, 5.3 times in 2021, and 6.2 times in 2022, which is consistent with the RF data (predominance of AI over GI in the ratio of 5:1) [210]. In general, for 10 years the frequency of hospitalization in specialized departments for patients with STEMI increased by 1.5 times.

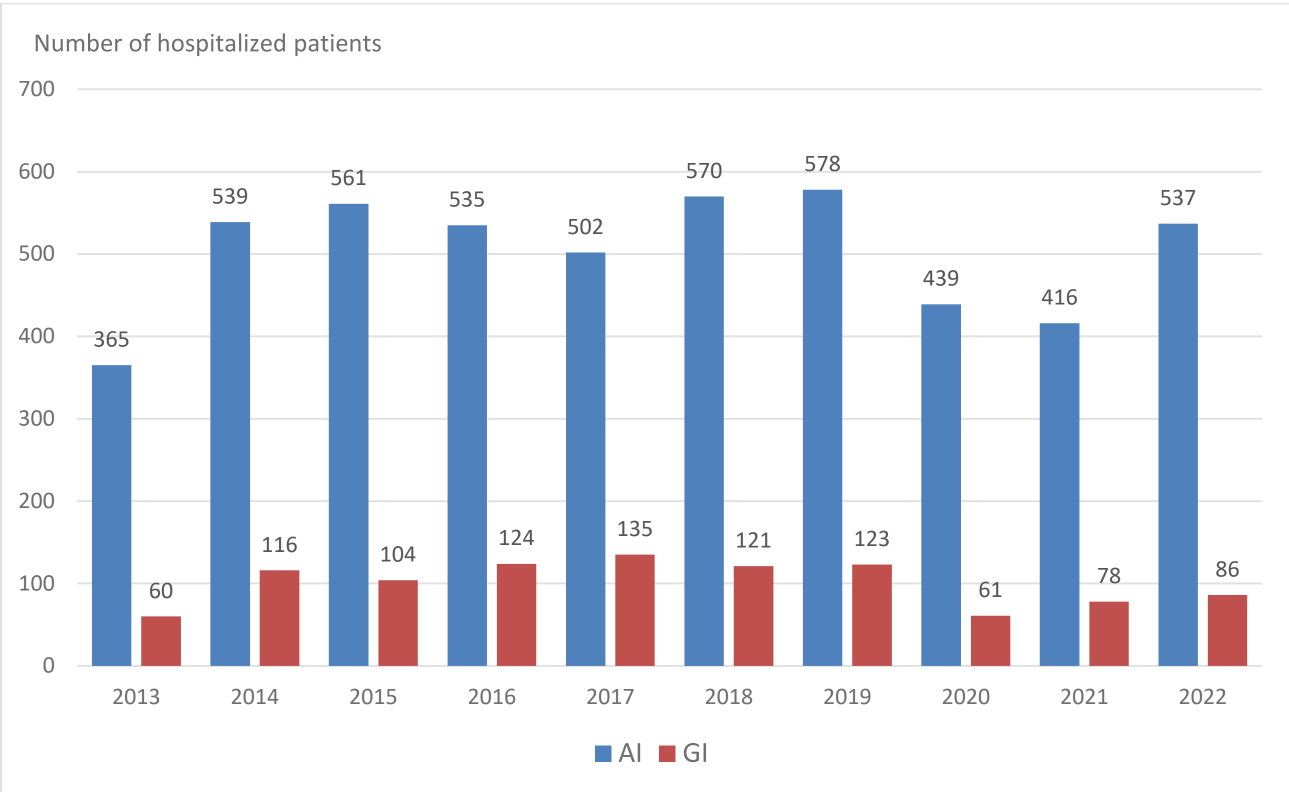


Figure 19 – Dynamics of hospitalized patients with MI and GI
for 2013-2022

An important parameter influencing the outcome and recovery of patients with ONMK is the time of hospitalization. In PSO #1, between 64.4% and 83.1% of patients were hospitalized in the first 24 hours, with this indicator in 2019 being the best 1.3 times that of 2014 and 1.3 times that of 2015; in 2022, this indicator slightly decreased to 71.4%.

The time of hospitalization is of particular importance for patients with AI, so we analyzed in detail the proportion of patients with AI hospitalized in the first 12 hours from the onset of the disease. The proportion of patients hospitalized in the first 3 hours has increased by 5.9% since 2013 (11.5% in 2013 and 17.4% in 2019), the maximum of this indicator was in 2021 (38.1%), but in 2022 it decreased to 18.1% [110]. The proportion of patients hospitalized in the first 3-6 hours increased meaningfully during the first two years of the PCP operation No. 1 – 1.9 times (from 8.9% to 16.5%), and in 2018 – 2.6 times compared to the 2013 figure and 1.4 times compared to 2014. In 2019, this indicator was lower due to a significant increase in the frequency of hospitalization in the first 3 and 6-9 hours. The maximum of this indicator was in 2022 and amounted to 27.3%. By 2019, the proportion of patients hospitalized in the first 6-9 hours increased by 14.1% (6.6% in 2013 and 20.7% in 2018), but this indicator decreased to 6.4% in 2022. Whereas, the proportion of patients hospitalized in the first 9-12 hours decreased by 35.2% by 2019 and 51.2% by 2022 during the evaluation period. [110].

Since 2015, the majority of patients with STEMI have been hospitalized in the department, bypassing the emergency room. Neuroimaging examination in the first 24 hours has also been performed in the majority of patients since 2014; moreover, in 2016, all patients with STEMI underwent neuroimaging in the first 24 hours. Neuroimaging study in the first 40 minutes from the moment of hospitalization was performed in more than 2/3 of patients since 2014, and by 2019 this rate was 89.2% and by 2022 it was 78.2%. Duplex scanning of extracranial arteries is performed practically in all patients with STEMI, while stenosis of extracranial arteries over 70% was detected in only 7.6% of patients (266 out of 3507), which is associated with better detection of this pathology at the outpatient stage.

The frequency of performing specialized medical care increased by 6.7% and was performed in 8.0% of patients with AI in 2019 and 13.0% in 2022, which is 11.7% more than in 2013 and 5% more than in 2019; the proportion of patients with clinical improvement after TLT increased by 57.9% by 2019 (from 33.3% in 2014 to 91.2% in 2019), and in 2022 was 86.4%. In the majority of cases, TLT was accompanied by a positive effect.

The proportion of patients who were independent in activities of daily living by the end of hospitalization (2 Rankin Scale scores or less) did not change significantly between 2013 and 2019, averaging 59.4% and increasing to 64.5% by 2022) (Table 26) [110].

Table 26 – Performance indicators of SIG No. 1 in the period 2013-2022

Indicators	**Years**									
	2013	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Number of hospitalized patients with STEMI (G45; I60-I66.9), n	425	655	665	659	637	691	701	500	494	623
Frequency of hospitalization of patients with STEMI in the first 24 hours, %	336 79,1%	438 66,9%	428 64,4%	493 74,8%	462 72,5%	574 83,1%	590 84,2%	460 92%	464 93,9%	445 71,4%
Proportion of patients with MI hospitalized in the first 3 hours, %	35 11,5%	106 23,0%	116 23,5%	59 13,6%	68 16,3%	66 13,0%	74 17,4%	77 15,4%	188 38,1%	113 18,1%
Proportion of patients with MI hospitalized in the first 3-6 hours, %	27 8,9%	76 16,5%	59 12,0%	72 16,6%	72 17,3%	110 23,2%	23 5,4%	108 21,6%	79 16,0%	170 27,3%
Proportion of patients with MI hospitalized in the first 6-9 hours, %	20 6,6%	49 10,6%	43 8,7%	37 8,5%	32 7,7%	52 10,9%	88 20,7%	75 15,0%	40 8,1%	40 6,4%
Proportion of patients with MI hospitalized in the first 9-12 hours, %	162 53,1%	32 6,9%	62 12,6%	38 8,8%	32 7,7%	60 12,6%	76 17,9%	26 5,2%	56 11,3%	12 1,9%
Proportion of patients with STEMI hospitalized bypassing the emergency room, %	147 34,6%	388 59,2%	610 91,7%	572 86,8%	506 79,4%	640 92,6%	668 95,3%	500 100%	447 91,0%	487 78,2%
Percentage of patients who underwent neuroimaging study	370 87,0%	655 100%	373 56,1%	659 100%	603 94,7%	617 89,3%	652 93,0%	500 100%	447 91,0%	487 78,2%
Percentage of patients who underwent neuroimaging study during of the first 24 hours from the moment of receipt, %	114 26,8%	633 96,6%	372 55,9%	659 100%	547 85,9%	540 78,1%	652 93,0%	500 100%	447 91,0%	487 78,2%

Table 26 continued

Indicators	Years									
	2013	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Percentage of patients who underwent neuroimaging study during of the first 40 minutes from the moment of admission, %	50 11,8%	632 96,5%	372 55,9%	659 100%	499 78,3%	530 76,7%	625 89,2%	500 100%	447 91,0%	487 78,2%
Frequency of duplex scanning extracranial arteries, %	208 48,9%	654 99,8%	665 100%	659 100%	636 99,8%	685 99,1%	698 99,6%	500 100%	447 91,0%	487 78,2%
Frequency of system execution thrombolytic therapy in patients with AI, %	6 1,3%	11 2,2%	16 3,7%	15 3,6%	23 4,8%	31 6,7%	34 8,0%	52 10,4%	47 9,5%	81 13,0%
Proportion of patients with clinical improvement after thrombolytic therapy, %	2 33,3%	11 100%	14 87,5%	12 80,0%	22 95,7%	29 94,0%	31 91,2%	42 80,8%	39 83,0%	70 86,4%
Proportion of patients with complications after of thrombolytic therapy, %	-	2 33,3%	-	-	-	-	1 2,9%	5 9,6%	5 10,6%	6 7,4%
Share of patients independent in daily life by the end of inpatient treatment, %	268 63,1%	344 52,5%	361 54,3%	409 62,1%	415 65,1%	416 60,2%	408 58,2%	325 65%	329 66,6%	402 64,5%
Lethality from STEMI, %	39 9,2%	83 12,7%	69 10,4%	72 10,9%	61 9,6%	63 9,1%	73 10,4%	67 13,4%	55 11,1%	78 12,5%

Overall, the number of hospitalized patients with STEMI (G45; I60-I66.9) between 2013-2019 was 633 ± 94 (95%DI 546-721) and between 2020-2022. – 431 ± 64 (95%DI 273-589) [p=0.2]. The mean absolute increase/decrease in the number of hospitalized patients with SNMD (G45; I60-I66.9) between 2013-2019 left 46.0%, and between 2020-2022 left 46.5%. – 43.5% (in the period 2013-2022, 24.9%). Average annual rate of growth/decline in the number of hospitalized patients with STEMI (G45; I60-I66.9) was 8.7% and 7.5% in 2013-2019 and 2020-2022, respectively (4.8% in 2013-2022).

The mortality rate is of significant importance in the assessment of inpatient hospital performance. Over the period 2013-2022, the mortality rate from STEMI in PCSO No. 1 remained stable at the level of 9-10%.

Lethality was significantly higher in patients with GI than with AI: 3.2 times higher in 2013, 2.1 times higher in 2014, 3.0 times higher in 2015, 2.9 times higher in 2016, 3.6 times higher in 2017, 3.7 times higher in 2018, 3.9 times higher in 2019, 3.3 times higher in 2020, 3.8 times higher in 2021, and 4.9 times higher in 2022.

The proportion of patients who died in the first 24 hours decreased in both AI and GI patients, whereas the proportion of patients who died in the first 7 days increased among GI patients and decreased among GI patients.

Mortality after TLT ranged from 0.2% to 1.2% for the period 2014-2022 (Table 27).

Table 27 – Mortality from STEMI in SIG #1 in the period 2013-2022

		2013	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
GI	Total	15 25,0%	22 28,2%	20 29,4%	29 28,4%	26 30,6%	27 28,4%	34 35,8%	21 34,4%	23 29,5%	33 38,4%
	In the first 24 hours	-	3 3,8%	1 1,5%	3 2,9%	-	1 1,1%	2 2,1%	3 4,9%	-	5 5,8%
	In the first 7 days	5 8,3%	7 8,9%	12 17,6%	7 6,9%	9 10,6%	12 12,6%	12 12,6%	7 11,5%	12 15,4%	20 23,6%
AI	Total	24 7,9%	61 13,2%	49 9,9%	43 9,9%	35 8,4%	36 7,6%	39 9,2%	46 10,5%	32 7,7%	42 7,8%
	In the first 24 hours	-	3 0,7%	2 0,4%	-	-	2 0,4%	-	5 1,1%	2 0,5%	5 0,9%
	In the first 7 days	13 4,3%	23 5,0%	24 4,9%	7 1,6%	8 1,9%	5 1,1%	14 3,3%	23 5,2%	19 4,6%	23 4,3%
	After TLT.	-	3 0,7%	-	1 0,2%	2 0,5%	1 0,2%	2 0,5%	5 1,1%	5 1,2%	6 1,1%

Thus, the performance indicators of PCSO No.1 for 2013-2022 have significantly improved by all analyzed indicators, which testifies to the effective organization of medical care for patients with STEMI.

4.1.2 Results of the work of SIG No. 2 of the State Budgetary Institution of TO "Regional Hospital No. 4" (Ishim)

In the period 2013-2022, 5507 patients with STEMI, including 4452 (80.8%) with AI and 1055 (19.2%) with GI, were hospitalized in PSO No. 2 of GBUZ TO "Regional Hospital No. 4" in Ishim (Figure 20) [156].

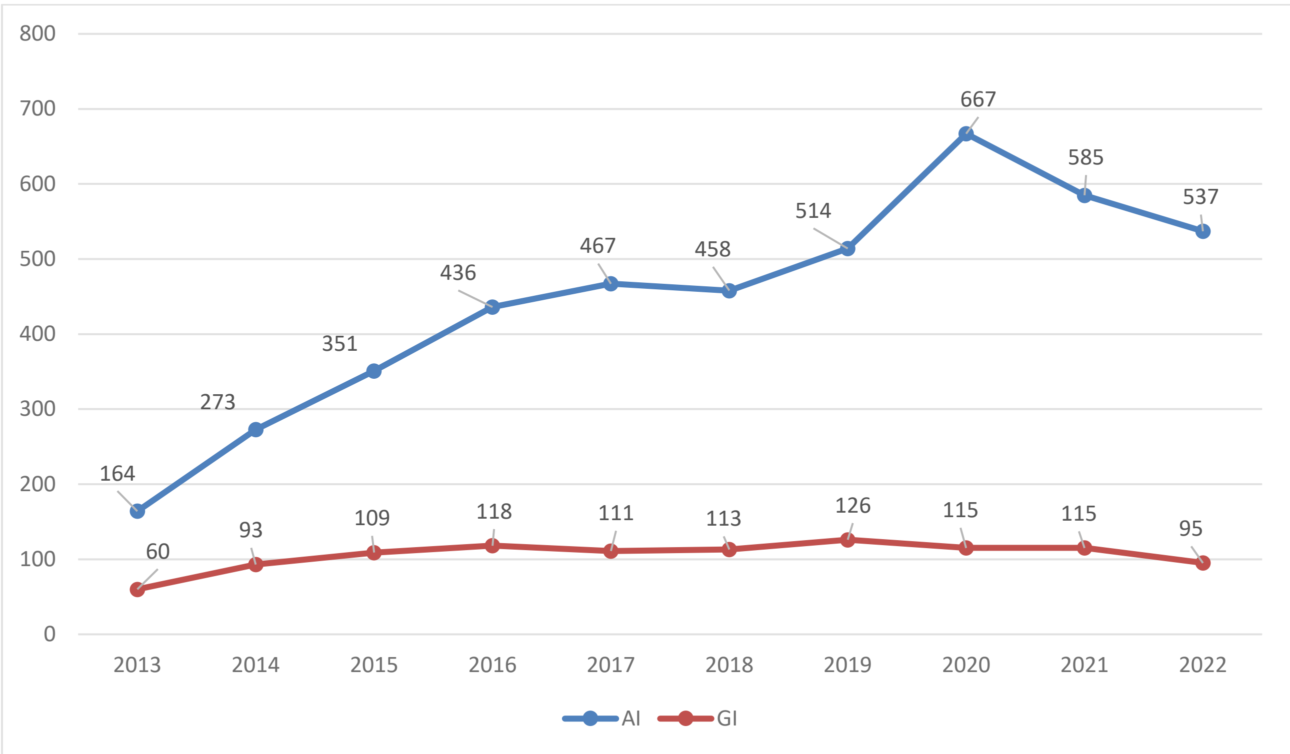


Figure 20 – Dynamics of hospitalized patients
of hospitalized patients with AI and GI in 2013-2022

There were significantly more patients with AI than GI: 2.7, 2.9, 3.2, 3.7, 4.1, 5.0, 4.1, 5.8, 5.1, and 5.7 times in 2013, 2014, 2015, 2016, 2017, 2018, 2018, 2019, 2020, 2021 and 2022, respectively.

The proportion of patients hospitalized in the first 24 hours after developing a STEMI increased by 6.4% (from 66.0% in 2013 to 72.4% in 2019) and by 26% by 2022, with the maximum improvement in this indicator observed between 2015 and 2016 by 15.3% (from 55.3% to 70.6%, respectively).

By 2019, there was an 11.1% increase in the proportion of AI patients hospitalized in the PCO in the first 3 hours (from 5.5% in 2013 to 19.5% in 2019), and this rate decreased to 10.5% in 2022. In 2019. 3.4% increase in the proportion of AI patients who were hospitalized in the first 3-6 hours from the onset of first symptoms (from 9.1% in 2013 to 12.5% in 2019), and in 2022 it was 9.4% [110].

The proportion of AI patients hospitalized in the first 6-9 hours increased each year from 2013 to 2016 by 2.1%, 6.7%, and 2.9%, but decreased by 4.5% from 2016-2017, 10.1% from 2017-2018, and 5.5% for 2018-2019, and decreased to 10.2% in 2022. The proportion of AI patients hospitalized in the first 9-12 hours decreased by 28.2% between 2013-2019 and was 13.9% in 2022. The majority of patients in PCO #2 are hospitalized bypassing the emergency room and the majority receive a neuroimaging study within the first 40 minutes of admission (average 87.2% from 2014-2019 and 100% in 2022).

Almost all patients undergo duplex scanning of extracranial arteries, and the incidence of stenosis greater than 70% was 13.1% (373 of 2845).

The frequency of performing systemic TLT increased by 4.9% by 2019 and by 5.5% by 2022, with the proportion of patients with clinical improvement after TLT increasing by 31.8% by 2019 and by 16.7% by 2022, complications after this type of therapy were observed from 2018 and amounted to 11.1% in 2022.

The proportion of patients independent by the end of hospitalization increased by 9.3% from 2013 to 2019 and by 18.1% from 2013 to 2022 (Table 28).

Overall, the number of hospitalized patients with STEMI (G45; I60-I66.9) between 2013-2019 was 564 ± 110 (95%DI 463-665) and between 2020-2022. – 720 ± 179 (95%DI 524-916) [$p=0.2$]. The mean absolute increase/decrease in the number of hospitalized patients with STEMI (G45; I60-I66.9) between 2013-2019 was 40.5% and between 2020-2022 was. -78.5% (in the period 2013-2022 – 21.2%). Average annual rate of growth/decline in the number of hospitalized patients with STEMI (G45; I60-I66.9) was 7.4% and -10.3% in 2013-2019 and 2020-2022, respectively (3.9% in the period 2013-2022).

Table 28 – Performance indicators of SIG No. 2 in the period 2013-2022

Indicators	Years									
	2013	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Number of hospitalized patients with STEMI (G45; I60-I66.9), n	456	429	479	575	654	656	699	804	709	647
Frequency of hospitalization of patients with STEMI in the first 24 hours, %	301 66,0%	271 63,2%	265 55,3%	406 70,6%	484 74,0%	467 71,2%	506 72,4%	679 84,5%	630 88,9%	595 92,0%
Proportion of patients with MI hospitalized in the first 3 hours, %	9 5,5%	25 9,2%	19 5,4%	31 7,1%	47 10,3%	94 20,5%	100 19,5%	122 15,2%	112 15,8%	68 10,5%
Proportion of patients with MI hospitalized in the first 3-6 hours, %	15 9,1%	49 17,9%	52 14,8%	61 14,0%	94 20,6%	79 17,2%	64 12,5%	408 50,7%	102 14,4%	61 9,4%
Proportion of patients with MI hospitalized in the first 6-9 hours, %	23 14,0%	44 16,1%	80 22,8%	112 25,7%	96 21,0%	51 11,1%	29 5,6%	104 12,9%	90 12,7%	66 10,2%
Proportion of patients with MI hospitalized in the first 9-12 hours, %	58 35,4%	23 8,4%	15 4,3%	48 11,0%	30 6,6%	35 7,6%	37 7,2%	88 10,9%	87 12,3%	90 13,9%
Proportion of patients with STEMI hospitalized bypassing the emergency room, %	361 84,1%	446 93,1%	526 91,5%	603 92,2%	653 99,5%	652 99,4%	696 99,7%	767 95,4%	694 97,9%	647 100%
Percentage of patients who underwent neuroimaging study	456 100%	428 99,8%	479 100%	575 100%	441 67,4%	656 100%	699 100%	767 95,4%	694 97,9%	647 100%
Percentage of patients who underwent neuroimaging study within the first 24 hours of admission, %	383 84,0%	428 99,8%	479 100%	575 100%	404 61,8%	656 100%	699 100%	767 95,4%	694 97,9%	647 100%
Percentage of patients who underwent neuroimaging study within the first 40 minutes of admission, %	72 15,8%	356 83,0%	436 91,0%	570 99,1%	386 59,0%	638 97,3%	654 93,6%	767 95,4%	694 97,9%	647 100%
Frequency of duplex scanning of extracranial arteries, %	73 16,0%	404 94,2%	455 95,0%	575 100%	653 99,8%	656 100%	695 99,4%	767 95,4%	694 97,9%	647 100%
Frequency of systemic thrombolytic therapy in patients with MI, %	4 1,5%	2 0,6%	8 1,8%	7 1,5%	28 6,1%	33 6,4%	42 6,6%	35 4,4%	40 5,6%	45 7,0%
Percentage of patients with clinical improvement after thrombolytic therapy, %	2 50,0%	1 50,0%	6 75,0%	6 85,7%	15 53,6%	27 81,8%	36 86,0%	29 82,9%	27 67,5%	30 66,7%

Indicators	Years									
	2013	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Proportion of patients with complications after of thrombolytic therapy, %	-	-	-	-	-	1 3,6%	2 6,1%	3 8,6%	4 10,0%	5 11,1%
Percentage of patients who are independent in daily living of life by the end of hospital treatment (Rankin scale score, not more than 2 points), %	200 43,9%	165 38,5%	184 38,4%	262 45,6%	307 46,9%	326 50,0%	372 53,2%	474 59,0%	432 60,9%	401 62,0%
Lethality from STEMI, %	32 7,0%	87 20,3%	105 21,9%	143 24,9%	170 26,0%	143 21,8%	129 18,5%	95 11,8%	87 12,3%	82 12,7%

In PCP No. 2, mortality from STEMI from 2014 to 2017 was higher than in other PCPs and RHCs of the Oblast, but by 2019 the rate normalized and amounted to 18.5%. The mortality from GI was higher than that from AI 2.1 times in 2013, 2.9 times in 2014, 3.4 times in 2015, 2.4 times in 2016, 2.5 times in 2017, 3.7 times in 2018, 3.6 times in 2019, 7.1 times in 2020, 5.2 times in 2021, and 5.9 times in 2022 (Table 29).

Table 29 – Mortality from STEMI in SIG No. 2 in the period 2013-2022

		2013	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
GI	Total	14 23,3%	43 46,2%	54 49,5%	56 47,5%	65 58,6%	59 52,2%	60 47,6%	52 45,2%	42 36,5%	40 42,1%
	In the first 24 h	1 1,7%	7 7,5%	21 19,3%	18 15,3%	10 9,0%	13 11,5%	5 4,0%	3 2,6%	20 17,4%	12 12,6%
	In the first 7 days	4 6,7%	25 26,9%	40 36,7%	32 27,1%	37 33,3%	33 29,2%	21 16,7%	32 27,8%	25 21,7%	14 14,7%
AI	Total	18 11,0%	44 16,1%	51 14,5%	87 20,0%	105 23,0%	84 18,3%	69 13,4%	43 6,4%	41 7,0%	38 7,1%
	In the first 24 h	1 0,6%	3 1,1%	4 1,1%	8 1,8%	11 2,4%	6 1,3%	4 0,8%	-	11 1,9%	17 3,2%
	In the first 7 days	9 5,5%	31 11,4%	37 10,5%	43 9,9%	60 13,1%	42 9,2%	24 4,7%	25 3,7%	21 3,6%	21 3,9%
	After TLT.	-	1 0,4%	-	-	-	1 0,2%	4 0,8%	3 0,5%	4 0,7%	5 0,9%

In the first 24 hours, the mortality rate for GI was high in 2015-2016, against the background of improvement of medical care measures in 2020, this indicator was the lowest and amounted to 2.6%. The mortality in the first 24 hours from AI was stable and averaged 1.3%. In the period 2014-2017, almost 1/3 of mortality from GI was observed in the first 7 days of patients' stay in the department, but by 2022 this indicator decreased to 14.7%. In AI, mortality in the first 7 days was stable from 2014 to 2017 (11.2%), and by 2022 it decreased to 3.9%.

Thus, high performance indicators of the organization of the work of SIG No. 2 were identified, the improvement of which was most pronounced after 2018.

4.1.3. Results of the work of SIG No. 3 of the Regional Hospital No. 23 (Yalutorovsk village)

In PSO No. 3 of GBUZ TO "Regional Hospital No. 23" in Yalutorovsk village in 2013-2022, 6418 patients with STEMI were hospitalized, including 5588 (87.1%) with AI and 830 (12.9%) with GI (Figure 21).

The ratio of AI to GI was on average 7:1: in 2013, there were 5.4 times more patients with AI than GI, in 2014. – 7.1 times, in 2015. – 8.4 times, in 2016. – 6.1 times, in 2017. – 6.1 times, in 2018. – 6.2 times, in 2019 – 6.7 times, in 2020 – 7.9 times, in 2021 – 7.9 times, in 2022 – 8.5 times [210].

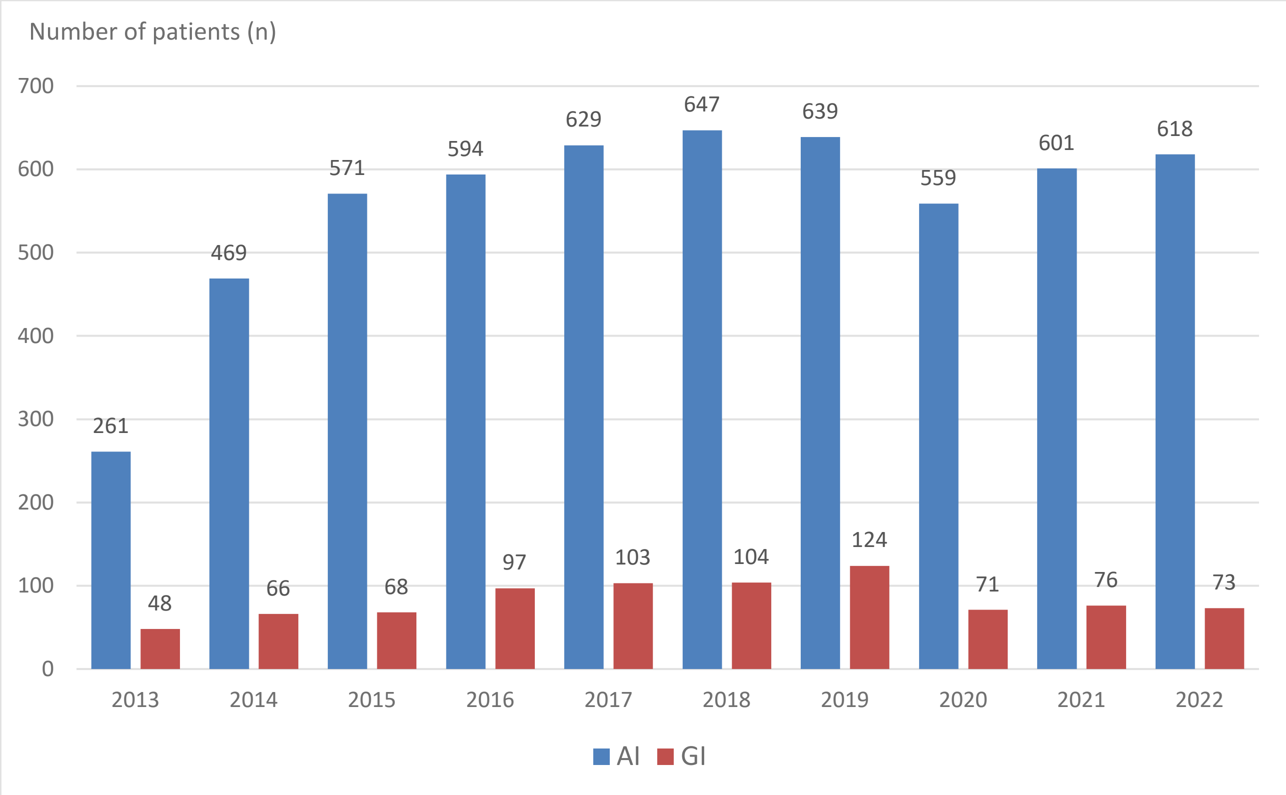


Figure 21 – Dynamics of hospitalized patients with AI and GI for 2013-2022

Over the evaluation period, the proportion of patients with SNMD hospitalized in PCP #3 in the first 24 hours increased by 12.2% by 2019 and 26.6% by 2022, the best rate being 94.2% in 2022. The proportion of patients hospitalized in the first 3 hours was unstable and averaged 31.1%, being the best in 2016 [110]. The same situation applies to the proportion of patients hospitalized in the first 3-6 hours: the average was 17.3%, being the highest in 2013 (30.3%) and the lowest in 2019 (8.5%). The proportion of patients hospitalized in the first 6-9 hours from the development of a SNMD was less than 10% between 2014 and 2016 and started to gradually increase by 6.1% by 2017 and 8.6% by 2018, while it was 5.8% and 8.4% in 2019 and 2022. The proportion of patients hospitalized in the first 9-12 hours remained stable and averaged 5.0% [110].

Since 2015, all patients with STEMI have been hospitalized in the department bypassing the emergency room. Neuroimaging examinations are performed on almost all patients, with the proportion of patients with STEMI who undergo them within the first 40 minutes of admission averaging 82.2% until 2019 and 100% starting in 2020. Duplex scanning of extracranial arteries is performed in almost all patients hospitalized in the department; stenosis of more than 70% was detected on average in 11.7% of patients (415 out of 3535).

The proportion of patients who received systemic TLT from 2013 increased by 5.7% by 2019 and by 6.7% by 2022.The proportion of patients with clinical improvement after TLT increased by 20.0% in 2019 to 100% in that year and was 86.8% in 2022. However, complications occurred in 3.3% of patients who received this treatment in 2018, and between 2020 and 2022, complications averaged 5.1% of patients [110].

Overall, the number of hospitalized patients with ONMC (G45; I60-I66.9) between 2013-2019 was 631 ± 163 (95%DI 481-782) and between 2020-2022. – 704 ± 33 (95%DI 622-787) [p=0.9]. The mean absolute increase/decrease in the number of hospitalized patients with STEMI (G45; I60-I66.9) between 2013-2019 was 75.7% and between 2020-2022 was. – 32.0% (in the period 2013-2022, 46.9%). The average annual rate of increase/decrease in the number of hospitalized patients with SNMD (G45; I60-I66.9) was 16.3% and -4.7% from 2013-2019 and 2020-2022, respectively (from 2013-2022 – 10.0%).

At the time of hospital discharge, the proportion of patients independent in activities of daily living was relatively stable, averaging 56.8%, with a gradual increase from 2019 to 64.4% of cases in 2022 (Table 30).

Table 30 – Performance indicators of SIG No. 3 in the period 2013-2022

Indicators	**Years**									
	2013	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Number of hospitalized patients with STEMI (G45; I60-I66.9), n	309	535	639	691	732	751	763	630	677	691
Frequency of hospitalization of patients with STEMI in the first 24 hours, %	209 67,6%	421 78,7%	499 78,1%	596 86,3%	564 77,0%	547 72,8%	609 79,8%	576 91,4%	632 93,4%	651 94,2%
Proportion of patients with MI hospitalized in the first 3 hours, %	50 19,5%	165 35,2%	113 21,7%	339 59,6%	192 32,5%	109 18,6%	165 30,6%	182 28,9%	202 29,8%	196 28,4%

Indicators	Years									
	2013	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Proportion of patients with MI hospitalized in the first 3-6 hours, %	79 30,3%	83 17,7%	105 20,2%	75 13,2%	100 16,9%	82 14,0%	46 8,5%	103 16,3%	125 18,5%	156 22,6%
Proportion of patients with MI hospitalized in the first 6-9 hours, %	75 28,7%	33 7,0%	40 7,7%	25 4,4%	62 10,5%	112 19,1%	31 5,8%	64 10,2%	57 8,4%	58 8,4%
Proportion of patients with MI hospitalized in the first 9-12 hours, %	36 7,2	33 7,0%	34 6,5%	12 2,1%	26 4,4%	37 6,3%	21 3,9%	43 6,8%	29 4,3%	37 5,4%
Proportion of patients with STEMI hospitalized bypassing the emergency room, %	31 10,0%	445 83,2%	639 100 %	691 100 %	732 100 %	751 100 %	763 100 %	630 100 %	677 100 %	691 100 %
Percentage of patients who underwent neuroimaging study	233 75,4%	535 100 %	591 92,5%	523 75,7%	613 83,7%	747 99,5%	603 99,0%	630 100 %	677 100 %	691 100 %
Percentage of patients who underwent neuroimaging study during of the first 24 hours from the moment of receipt, %	214 69,3%	535 100 %	591 92,5%	433 62,7%	613 83,7%	747 99,5%	603 99,0%	630 100 %	677 100 %	691 100 %

Table 30 continued

Indicators	Years									
	2013	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Percentage of patients who underwent neuroimaging study during of the first 40 minutes from the moment of admission, %	152 49,2%	534 99,8%	574 89,8%	381 55,1%	613 83,7%	747 99,5%	601 98,7%	630 100 %	677 100 %	691 100 %
Frequency of duplex scanning	200	525	639	691	729	751	759	630	677	691

Indicators	Years									
	2013	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
extracranial arteries, %	64,7%	98,1%	100 %	100 %	99,6%	100 %	99,5%	100 %	100 %	100 %
Frequency of system execution thrombolytic therapy in patients with AI, %	5 1,0%	4 0,7%	14 2,4%	30 5,1%	5 1,0%	39 6,2%	36 6,7%	32 5,1%	48 7,1%	53 7,7%
Percentage of patients with clinical improvement after thrombolytic therapy, %	4 80,0%	4 100%	12 85,7%	29 96,7%	4 80,0%	38 98,0%	36 100%	26 81,3%	43 89,6%	46 86,8%
Proportion of patients with complications after of thrombolytic therapy, %	-	-	-	-	-	1 3,3%	-	3 9,4%	1 2,1%	2 3,8%
Percentage of patients who are independent in daily living of life by the end of hospital treatment, %	185 59,9%	302 56,4%	380 59,5%	410 59,3%	407 55,6%	381 50,7%	430 56,4%	386 61,3%	429 63,4%	445 64,4%
Lethality from STEMI, %	49 15,9%	89 16,6%	104 16,3%	104 15,1%	129 17,6%	99 13,2%	100 13,1%	54 8,6 %	45 6,6 %	40 5,8 %

The mortality from STEMI in PCO No. 3 was stable over the evaluated period and averaged 15.4%. From GI, mortality was higher than from AI at 4.2 times in 2013, 2.7 times in 2014, 3.5 times in 2015, 4.6 times in 2016, 3.3 times in 2017, 4.6 times in 2018, 4.0 times in 2019-2020, 5.8 times in 2021, and 13.7 times in 2022. GI mortality decreased 15.7% from 2013 to 2022, and 15.8% in the first 7 days. For AI, mortality decreased by 1.2% and 5.7% in the first 24 hours and 7 days, respectively (Table 31) [210].

Table 31 – Mortality from STEMI in SIG #3 in the period 2013-2022

		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
GI	Total	18 48,6%	20 40,0%	35 (46,1%	40 51,9%	40 49,4%	40 46,0%	37 46,3%	18 25,4%	19 25,0%	24 32,9%
	In the first 24 h	4 10,8%	7 14,0%	6 7,9%	5 6,5%	5 6,2%	4 4,6%	7 8,8%	2 2,8%	2 2,6%	1 1,4%
	In the first 7 days	15 40,5%	11 22,0%	17 22,4%	19 24,7%	24 29,6%	31 35,6%	24 30,0%	13 18,3%	10 13,2%	18 24,7%
AI	Total	31 11,9%	69 14,7%	69 13,3%	64 11,2%	89 15,1%	59 10,1%	63 11,7%	36 6,4%	26 4,3%	15 2,4%
	In the first 24 hours	4 1,5%	4 0,9%	7 1,3%	5 0,9%	4 0,7%	3 0,5%	2 0,4%	1 0,2%	2 0,3%	2 0,3%
	In the first 7 days	19 7,3%	40 8,5%	40 7,7%	27 4,7%	39 6,6%	35 6,0%	30 5,6%	19 3,4%	14 2,3%	10 1,6%
	After TLT.	-	-	1 0,2%	-	1 0,2%	1 0,2%	-	3 0,5%	1 0,2%	2 0,3%

Thus, the assessment of the organization of the work of the PCP demonstrated the efficiency of this type of department. Due to the standardized protocol of patient management (diagnosis and treatment), no differences in the work of individual PCPs were found. The opening of the PCU allowed not only to increase the number of patients hospitalized for STEMI, but also to reduce mortality and improve the functional outcome of patients with this disease at the time of discharge. In addition, these departments allowed to introduce TLT, which is one of the most modern methods of treatment of patients with STEMI all over the world. Thus, this form of neurological care is necessary and reasonable.

4.1.4. Results of the work of the RRC of the State Budgetary Institution of TO "Regional Clinical Hospital No. 2"

A RRC was also opened in TO, which, unlike the PCS, also provides specialized and high-tech medical care for patients with STEMI [156]. In addition, the main tasks of the RRC include improving the quality and accessibility of medical care, reducing mortality and disability of the population, as well as coordinating the system of prevention, treatment and rehabilitation of STEMI and the work of the PCP, as well as conducting epidemiological monitoring of STEMI in TO. The RRC functions also include introduction of new types of diagnostics and treatment of patients with STEMI into practice and participation in research projects.

In 2013-2022, 18070 patients with STEMI, including 14720 (81.5%) with AI and 3350 (18.5%) with GI (the ratio of AI to GI on average is 1:5) were admitted to the RRC of SBUZ TO "Regional Clinical Hospital No. 2". In 2013, 3.7 times more patients with AI were admitted to the department than patients with GI, in 2014. – 3.9 times more, in 2015. – 4.3 times, in 2016. – 4.0 times, in 2017. – 5.2 times, in 2018. – 5.2 times, in 2019 4.5 times, in 2020. – 4.3 times, in 2021 4.1 times, and in 2022 4.7 times more (Figure 22) [210].

In the period 2013-2022, the rate of hospitalization of patients with STEMI in the first 24 hours was stable. The proportion of patients hospitalized in the first 3 hours from the time of illness increased by 9.6% from 2013 to 2019, and increased sharply from 2020, averaging 73.5% between 2020 and 2022. Meanwhile, the proportion of patients hospitalized in the first 3-6 hours decreased by 18.7% between 2013 and 2022 to 14.3% in 2022. There was also a decrease in the proportion of patients hospitalized in the first 6-9 and 9-12 hours by 13.7% and 6.6%, respectively. Since 2015, the majority of patients (average 94.5% between 2015-2019) were hospitalized bypassing the emergency room, and since 2022, 100% of cases and all had a neuroimaging study. The proportion of patients who underwent neuroimaging within the first 24 hours and 40 minutes of admission was stable, and from 2019 was 100%. Duplex scanning of extracranial arteries was performed in the majority of patients and stenosis greater than 70% was detected in 7.9% of cases (809 of 10278) [110, 210].

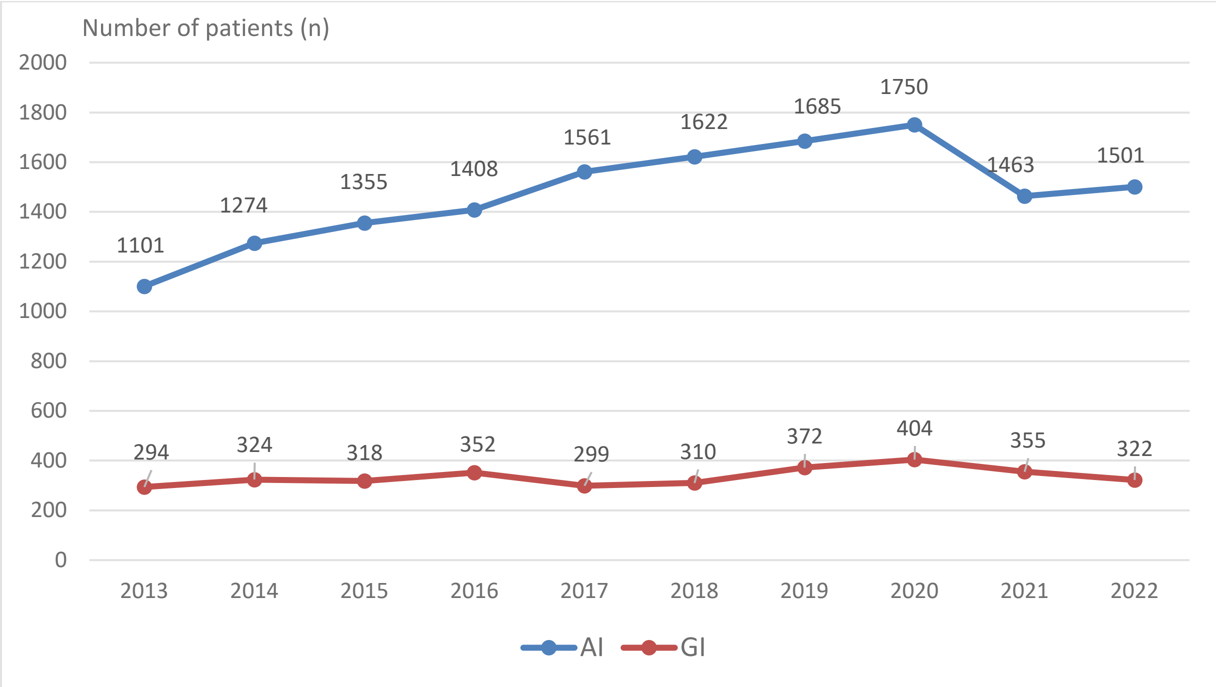


Figure 22 – Dynamics of hospitalized patients
of hospitalized patients with AI and GI in 2013-2022.

Systemic TLT started to be performed in the department starting from 2013 (as opposed to PCPs 1, 2 and 3), and the proportion of patients who underwent it increased by 2.3% by 2019 and 6.9% by 2022. Clinical improvement after TLT was at a stable level over the evaluation period, with a mean of 68.7%, and complications after TLT were observed in 7.2% of patients.

At the time of discharge from hospital, the proportion of independent patients was much higher than in the PCP, with a maximum observed in 2019 (73.4%), and in 2022 this figure was 59.2% (Table 32).

Table 32 – Performance indicators of the DHC in the period 2013-2022

Indicators	Years									
	2013	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Number of hospitalized patients with STEMI (G45; I60-I66.9), n	1561	1755	1887	1963	2076	2158	2239	2154	1818	1823
Frequency of hospitalization of patients with STEMI in the first 24 hours, %	1295 83,0%	1325 75,5%	1357 71,9%	1431 72,9%	1549 74,6%	1587 73,5%	1653 73,8%	1826 84,8%	1506 82,8%	1454 79,8%
Proportion of patients with MI hospitalized in the first 3 hours, %	86 7,8%	249 19,5%	268 19,8%	287 20,4%	319 20,4%	321 19,8%	294 17,4%	1664 77,3%	1335 73,4%	1275 69,9%
Proportion of patients with MI hospitalized in the first 3-6 hours, %	363 33,0%	254 19,9%	203 15,0%	204 14,5%	219 14,0%	215 13,3%	179 10,6%	356 16,5%	279 15,3%	261 14,3%
Proportion of patients with MI hospitalized in the first 6-9 hours, %	282 25,6%	185 14,5%	172 12,7%	178 12,6%	170 10,9%	160 9,9%	136 8,1%	586 27,2%	369 20,3%	217 11,9%
Proportion of patients with MI hospitalized in the first 9-12 hours, %	184 16,7%	89 7,0%	53 3,9%	80 5,7%	91 5,8%	77 4,7%	107 6,4%	153 7,1%	150 8,3%	185 10,1%
Proportion of patients with STEMI hospitalized bypassing the emergency room, %	2 0,1%	1214 69,2%	1790 94,9%	1888 96,2%	1961 94,5%	1994 92,4%	2140 95,6%	2154 100%	1818 100%	1823 100%
Percentage of patients who underwent neuroimaging study	1537 98,4%	1753 99,9%	1887 100%	1963 100%	2076 100%	2158 100%	2239 100%	2154 100%	1818 100%	1823 100%
Proportion of patients who underwent neuro-imaging examination within the first 24 hours of admission, %	1376 88,1%	1742 99,3%	1887 100%	1962 99,9%	2071 99,8%	2152 99,7%	2239 100%	2154 100%	1818 100%	1823 100%
Percentage of patients who underwent neuro-imaging examination during the of the first 40 minutes from the moment of admission, %	1268 81,2%	1677 95,6%	1868 99,0%	1957 99,7%	2046 98,6%	2052 95,1%	2239 100%	2154 100%	1818 100%	1823 100%
Frequency of duplex scanning extracranial arteries, %	1170 75,0%	1488 84,8%	1779 94,3%	1866 95,1%	1966 94,7%	2009 93,1%	2239 100%	2154 100%	1818 100%	1823 100%
Frequency of systemic thrombo-lytic therapy in patients with ischemic stroke, %	16 1,5%	22 1,7%	18 1,3%	33 2,3%	40 2,6%	60 3,7%	91 5,4%	152 7,1%	162 8,9%	152 8,3%

Table 32 continued

Proportion of patients with clinical improvement after thrombolytic therapy, %	10 62,5%	16 72,7%	14 77,8%	22 66,7%	27 67,5%	39 65,0%	78 85,7%	130 85,5%	136 84,0%	119 78,3%
Proportion of patients with complications after of thrombolytic therapy, %	1 6,3%	1 4,5%	-	2 6,1%	2 5,0%	4 6,7%	3 3,3%	15 9,9%	21 13,0%	26 17,1%

Share of patients independent in daily life by the end of inpatient treatment, %	325 20,8%	711 40,5%	892 47,3%	906 46,2%	997 48,0%	1015 47,0%	1236 73,4%	1345 62,4%	1103 60,7%	1080 59,2%
Lethality from STEMI, %	264 16,9%	327 18,6%	327 17,3%	368 18,7%	317 15,3%	353 16,4%	332 14,8%	332 15,4%	282 15,5%	263 14,4%

Overall, the number of hospitalized patients with SNMD (G45; I60-I66.9) between 2013-2019 was 1948 ± 237 (95%DI 1730-2167) and between 2020-2022 there was a statistically significant increase to 2629 ± 259 (95%DI 1986-3272) [p=0.1]. The mean absolute increase/decrease in the number of hospitalized patients with STEMI (G45; I60-I66.9) between 2013-2019 was 113.0% and between 2020-2022 was. -236.0% (in the period 2013-2022 – 99.2%). The average annual rate of increase/decrease in the number of hospitalized patients with STEMI (G45; I60-I66.9) was 6.2% and -8.4% from 2013-2019 and 2020-2022, respectively (5.2% in the period 2013-2022).

The mortality from STEMI was at the same level during the period under evaluation, 16.9% on average. It was always higher from GI than from AI: 1.9-fold in 2013, 2.7-fold in 2014, 2.3-fold in 2015, 2.9-fold in 2016, 3.5-fold in 2017, 3.7-fold in 2018, 3.4-fold in 2019, 3.6-fold in 2020, 4.4-fold in 2021, and 1.7-fold in 2022.

Over the evaluation period (2013 to 2022), mortality from GI increased by 1.6% during the first 24 hours and 4.4% during 7 days, whereas that from AI decreased by 1.0% and 3.4%, respectively (Table 33).

At the same time, the largest peak of mortality reduction was observed between 2012 and 2013, after the hospital became a regional vascular center: by 9.7% for any type of STEMI, by 14.9% for subarachnoid hemorrhage, by 31.6% for AI [95].

In addition, the second stage of rehabilitation for patients with STEMI is carried out in the Regional Treatment and Rehabilitation Center. In order to select patients and conduct the second stage of rehabilitation, the RRC has two subdivisions: consultative-diagnostic and inpatient. Patients are rehabilitated in 45 deployed beds of the 24-hour hospital. The second stage of rehabilitation is attended by 30% of the patients discharged from the hospital; 55% of the patients referred from the outpatient clinic out of the number of those who applied for help; 15% of the total number of disabled people with rehabilitation potential. Rehabilitation potential takes into account: the clinical course of STEMI, the volume and severity of brain damage, other functional disorders – complications of stroke, the psychological state of the patient, individual resources, compensatory capabilities of the organism, environmental factors affecting the viability and social activity of the patient. Criteria for assessing rehabilitation potential are important for selecting the optimal amount of rehabilitation care and transferring the patient from one stage of rehabilitation to another.

Table 33 – Lethality from STEMI in RHCs between 2013 and 2022

		2013	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
GI	Total	89 30,3%	132 40,7%	116 36,5%	156 44,3%	126 42,1%	145 46,8%	143 38,4%	150 37,1%	145 40,8%	52 16,1%
	In the first 24 h	10 3,4%	17 5,2%	13 4,1%	14 4,0%	11 3,7%	18 5,8%	18 4,8%	10 2,5%	11 3,1%	16 5,0%
	In the first 7 days	49 16,7%	79 24,4%	69 21,7%	87 24,7%	69 23,1%	85 27,4%	40 10,8%	68 16,8%	63 17,7%	68 21,1%
AI	Total	175 15,9%	195 15,3	211 15,6%	212 15,1%	191 12,2%	208 12,8%	189 11,2%	179 10,2%	136 9,3%	140 9,3%
	In the first 24 h	15 1,4%	9 0,7%	7 0,5%	20 1,4%	11 0,7%	4 0,2%	10 0,6%	7 0,4%	8 0,5%	6 0,4%
	In the first 7 days	99 9,0%	94 7,4%	98 7,2%	107 7,6%	95 6,1%	91 5,6%	52 3,1%	83 4,7%	71 4,9%	84 5,6%
	After TLT.	3 0,3%	5 0,4%	2 0,1%	5 0,4%	4 0,3%	6 0,4%	10 0,6%	14 0,8%	19 1,3%	22 1,5%

The basic principles of rehabilitation are adhered to: early onset, continuity, adequacy, comprehensiveness, stages, continuity and multidisciplinary approach. The multidisciplinary team consisted of the following specialists: neurologist, cardiologist, physiotherapist, psychotherapist, LFK doctor, LFK instructor, physiotherapist. The multidisciplinary rehabilitation approach provides for the application of a complex of medical, professional measures with the interaction of specialists of different profiles, including various types of assistance in overcoming the consequences of the disease, changing the lifestyle, reducing the impact of risk factors [97].

Thus, the opening of RCCs and PCPs has significantly improved the quality of care for patients with STEMI, which was manifested by an increase in the frequency of hospitalized patients with STEMI (due to the routing algorithm developed by us), as well as an increase in the use of high-tech care, primarily TLT (which is also associated with the developed routes of hospitalization of patients, since the use of this method of treatment is possible only in the "therapeutic window", i.e., the first 4.5 hours after the development of the disease), a decrease in mortality and an increase in the number of patients discharged from hospital. United in a single network with polyclinics, discharged patients do not remain without further observation, which allows for further rehabilitation measures, as well as measures aimed at preventing repeated cardiovascular accidents.

4.1.5. Performance results of SIG 4 GBUZ TO OKB 1

In 2020, PSO 4 of GBUZ TO OKB 1 was opened in TO. During 3 years of the department's operation, 1442 patients were hospitalized in it (1272 (88.2%) with AI and 170 (11.8%) with GI). There were 7.2, 6.9 and 8.1 times more patients with AI than with GI (Figure 23).

Table 34 presents the performance indicators of PSO 4 of GBUZ TO TO OKB No. 1 in the period 2020-2022. In 2021, the growth rate of the number of hospitalized patients amounted to 211.5, absolute increase – 301.0, and the growth rate – 111.5. In 2022, the growth rate of hospitalized patients was 130.6, the absolute increase was 175.0, and the growth rate was 30.7. In general, for the period of work of the PSO 4 of the State Budgetary Institution TO TO OKB No.1, the average absolute growth/decline was 238.0%, the average annual growth/decline rate was 66.2%.

The frequency of performing systemic TLT in patients with MI in the period from 2020-2022 was 12.3%, the proportion of patients with clinical improvement was 83.4%, and with complications – 9.0%.

Mortality rates improved for both GI and AI. Between 2020 and 2022, mortality from GI decreased by 4.9%, in the first 24 h. – by 6.4%, and in the first 7 days by 8.3%. For AI, mortality decreased by 21.8%, in the first 24 hours by 0.6%, and in the first 7 days by 2.6% (Table 35).

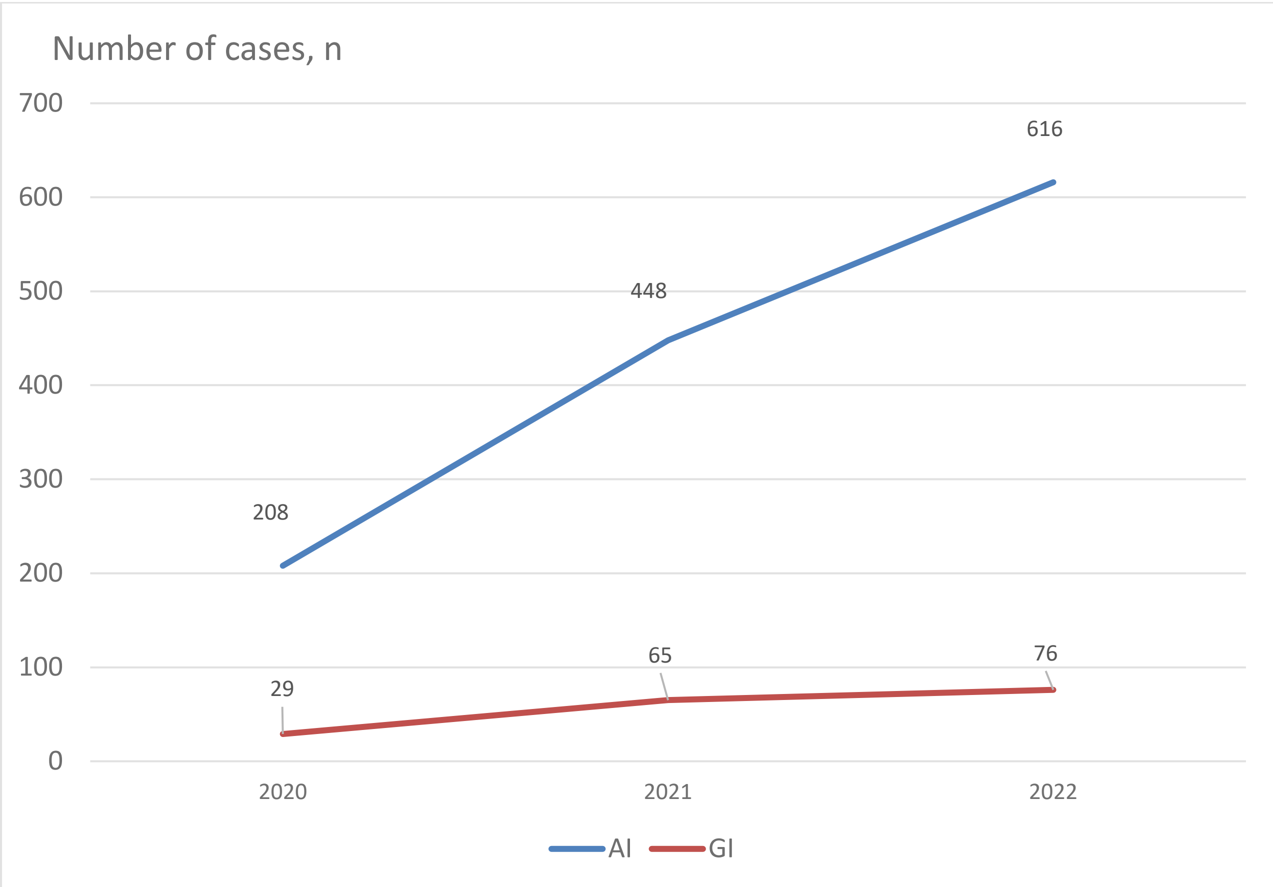


Figure 23 – Dynamics of hospitalizations of patients with AI and GI in PSO 4 of TBUH TO OKB 1 with AI and GI in 2020-2022

Table 34 – Performance indicators of SIG 4 GBUZ TO TO OKB No. 1 in the period of 2020-2022

Indicators	Years

	2020	2021	2022
Number of hospitalized patients with STEMI (G45; I60-I66.9), n	270	571	746
Frequency of hospitalization of patients with STEMI in the first 24 hours, %	159 58,9%	359 62,9%	746 100%
Proportion of AI patients hospitalized in the first 3 hours, %	32 11,9%	134 23,5%	152 20,4%
Proportion of MI patients hospitalized in the first 3-6 hours, %	15 5,6%	58 10,2%	52 7,0%
Proportion of patients with a MI hospitalized in the first 6-9 hours, %	12 4,4%	43 7,5%	69 (9,2%
Proportion of patients with a MI hospitalized in the first 9-12 hours, %	2 0,7%	44 7,7%	46 6,2%
Proportion of patients with STEMI who were hospitalized bypassing the emergency room, %	122 45,2%	524 91,8%	641 85,9%
Proportion of patients who underwent neuroimaging studies examination, %	122 45,2%	524 91,8%	641 85,9%
Proportion of patients who underwent neuroimaging within the first 24 hours of admission, % (CT) Within the first 24 hours of admission, % (CT)	122 45,2%	524 91,8%	641 85,9%
Proportion of patients who underwent neuroimaging study within the first 40 minutes of admission, % (CT) within the first 40 minutes of admission, % (CT)	122 45,2%	524 91,8%	641 85,9%
Frequency of duplex scanning of extracranial arteries, %	122 45,2%	524 91,8%	641 85,9%
Frequency of systemic thrombolytic therapy in patients with MI, %	35 13,0%	70 12,3%	87 11,7%
Proportion of patients with clinical improvement after thrombolytic therapy, %	29 82,9%	56 80,0%	76 87,4%
Share of patients with complications after thrombolytic therapy thrombolytic therapy, %	3 8,6%	9 12,8%	5 5,7%
Proportion of patients who are independent in daily life by the end of hospitalization, %	126 46,7%	256 44,8%	343 46,0%
Lethality from STEMI, %	76 28,1%	74 13,0%	82 11,0%

Table 35 – Lethality from STEMI in PSO 4 of GBUZ TO TO OKB No. 1 in the period 2020-2022

Type of STEMI	Indicators	Years

		2020	2021	2022
GI	Total	14 (48,3%)	23 (35,4%)	33 (43,4%)
	In the first 24 hours.	3 (10,3%)	1 (1,5%)	3 (3,9%)
	In the first 7 days.	7 (24,1%)	11 (16,9%)	12 (15,8%)
AI	Total	62 (29,8%)	51 (11,4%)	49 (8,0%)
	In the first 24 hours.	3 (1,4%)	-	5 (0,8%)
	In the first 7 days.	9 (4,3%)	27 (6,0%)	21 (3,4%)

4.1.6. Comparative characteristic of the work of RRCs and SIGs and their role in reducing mortality and deaths from CVD in the Tyumen Oblast

During the comparative assessment of RRC and PCU performance we did not reveal any differences in their performance indicators. Table 36 presents the combined results of the vascular center and 3 vascular departments, in which we can clearly see an improvement in such indicators as the frequency of hospitalization of patients with STEMI in the first 24 hours, neuroimaging studies in the first 40 minutes, performance of TLT against the background of a decrease in the number of complications after this procedure, an increase in the number of patients independent in everyday life by the end of treatment, and a decrease in mortality [110].

Overall, the number of hospitalized patients with ONMC (G45; I60-I66.9) between 2013-2019 was 3777 ± 572 (95%DI 3248-4306), and between 2020-2022 there was a statistically significant increase to 5166 ± 108(95%DI 4897-5434) [p=0.1]. The mean absolute increase/decrease in the number of hospitalized patients with STEMI (G45; I60-I66.9) between 2013-2019 was 275.2% and between 2020-2022 was. -1.0% (in the period 2013-2022 – 275.1%). The average annual rate of increase/decrease in the number of hospitalized patients with STEMI (G45; I60-I66.9) was 8.2% and -0.0% from 2013-2019 and 2020-2022, respectively (7.4% in the 2013-2022 period).

Table 36 – Combined performance indicators of RDCs and SIGs Tyumen Oblast in the period 2013-2022

Indicators	Years									
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Number of hospitalized patients with STEMI (G45; I60-I66.9), n	2751	3374	3670	3888	4099	4256	4402	5229	5041	5227
Frequency of hospitalization of patients with STEMI in the first 24 h.	2141 77,8%	2455 72,8%	2549 69,5%	2926 75,3%	3059 74,6%	3175 74,6%	3358 76,3%	3538 67,7%	3420 67,8%	3712 71,0%
Patients with AI hospitalized in the first 3 h.	142 7,8%	545 22,0%	516 19,0%	716 25,2%	626 20,6%	590 18,8%	633 20,0%	769 14,7%	915 18,2%	790 15,1%
Patients with STEMI hospitalized bypassing the emergency room	180 6,5%	2408 71,4%	3485 95,0%	3677 94,6%	3802 92,7%	4038 94,9%	4212 96,9%	5229 100%	5041 100%	5227 100%
Patients who underwent neuroimaging studies	2596 94,4%	3371 99,9%	3330 90,7%	3720 95,7%	3733 91,1%	4178 98,2%	4402 100%	5229 100%	5041 100%	5227 100%
Patients who underwent neuroimaging study during of the first 40 minutes of admission	1542 56,0%	3199 94,8%	3250 88,6%	3567 91,7%	3544 86,5%	3967 93,2%	4326 98,3%	5229 100%	5041 100%	5227 100%
Frequency of systemic TLT in patients with MI	31 1,3%	61 2,1%	76 2,5%	141 4,5%	194 6,1%	236 6,6%	226 6,0%	306 5,9%	367 7,3%	418 8,0%
Patients with clinical improvement after TLT	19 62,5%	38 62,5%	63 83,3%	106 75,4%	145 75,0%	176 74,5%	201 88,7%	256 83,7%	301 82,0%	341 81,6%
Patients with complications after TLT, %	1 6,3%	3 9,4%	-	2 3,3%	2 2,6%	6 4,3%	6 3,1%	29 9,5%	40 10,9%	41 9,8%
Patients who are independent in their daily activities of life by the end of hospitalization	978 35,6%	1522 45,1%	1817 49,5%	1987 51,1%	2126 51,9%	2138 50,2%	2446 55,6%	2683 51,3%	2549 50,6%	2671 51,1%
Lethality from STEMI	383 13,9%	586 17,4%	605 16,5%	687 17,7%	677 16,5%	662 15,6%	634 14,4%	624 11,9%	543 10,8%	545 10,4%

By creating an effective algorithm for organizing the activities of the vascular center and departments, there is a reduction in mortality in patients with MI both in the first 24 hours after its occurrence (due to the optimization of routing, the process of hospitalization and the fastest possible diagnostic and therapeutic measures, including TLT) [110], and in the first 7 days (optimization of the organization of treatment and rehabilitation measures) and after TLT (optimization of the algorithm of activity organization and experience accumulation) (Table 37).

Table 37 – Mortality from STEMI in RCCs and PCCs of the Tyumen Oblast in 2013-2022

Type of stroke	n	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
		451	545	571	649	576	605	673	680	689	652
GI (4070)	Total	136 30,1%	217 39,8%	225 39,4%	281 43,3%	257 44,6%	271 44,8%	274 40,7%	155 22,8%	252 36,6%	182 27,9%
	In the first 24 h	15 3,3%	34 6,2%	41 7,2%	40 6,2%	26 4,5%	36 6,0%	32 4,8%	21 3,1%	34 4,9%	27 4,1%
	In the first 7 days.	73 16,2%	122 22,4%	138 24,2%	145 22,3%	139 24,1%	161 22,6%	97 14,4%	127 18,7%	121 17,6%	132 20,2%
	n	1831	2477	2719	2846	3035	3142	3163	3623	3513	3812
AI (19267)	Total	247 13,5%	369 14,9%	380 14,0%	406 14,3%	420 13,8%	391 12,4%	360 11,4%	366 10,1%	286 8,1%	284 7,5%
	In the first 24 h	20 1,1%	19 0,8%	20 0,7%	33 1,2%	26 0,9%	15 0,5%	16 0,5%	16 0,4%	23 0,7%	35 0,9%
	In the first 7 days.	140 7,6%	188 7,6%	199 7,3%	184 6,5%	202 6,7%	173 5,5%	120 3,8%	159 4,4%	152 4,3%	159 4,2%
	After TLT.	3 0,2%	9 0,4%	3 0,1%	6 0,2%	7 0,2%	9 0,3%	16 0,5%	28 0,8%	38 1,1%	40 1,1%

Overall, there was a statistically significant reduction in GI mortality between 2020-2022 compared to 2013-2019 (from 40.8% to 29.1%; p<0.01), including in the first 24 h (from 5.5% to 4.1%; p=0.1) and the first 7 days of hospitalization (from 21.5% to 18.8%; p=0.1).

There was also a decrease in mortality from AI between 2020-2022 compared with 2013-2019 (from 13.4% to 8.6%; p<0.01), including in the first 7 days of hospitalization (from 6.3% to 4.3%; p<0.01) and after TLT (from 0.3% to 0.9%; p<0.01).

Using the combined performance indicators of RRC and PCS, we conducted a correlation analysis to assess both inpatient treatment and mortality rates in the oblast as a whole.We found a negative correlation between the frequency of TLT and CVD mortality (r= -0.9; p<0.01), indicating that an increase in this therapeutic measure contributes to a decrease in the overall hospital mortality rate; therefore, both RRCs and PCPs are recommended to increase the frequency of TLT in patients with MI (Figure 24).

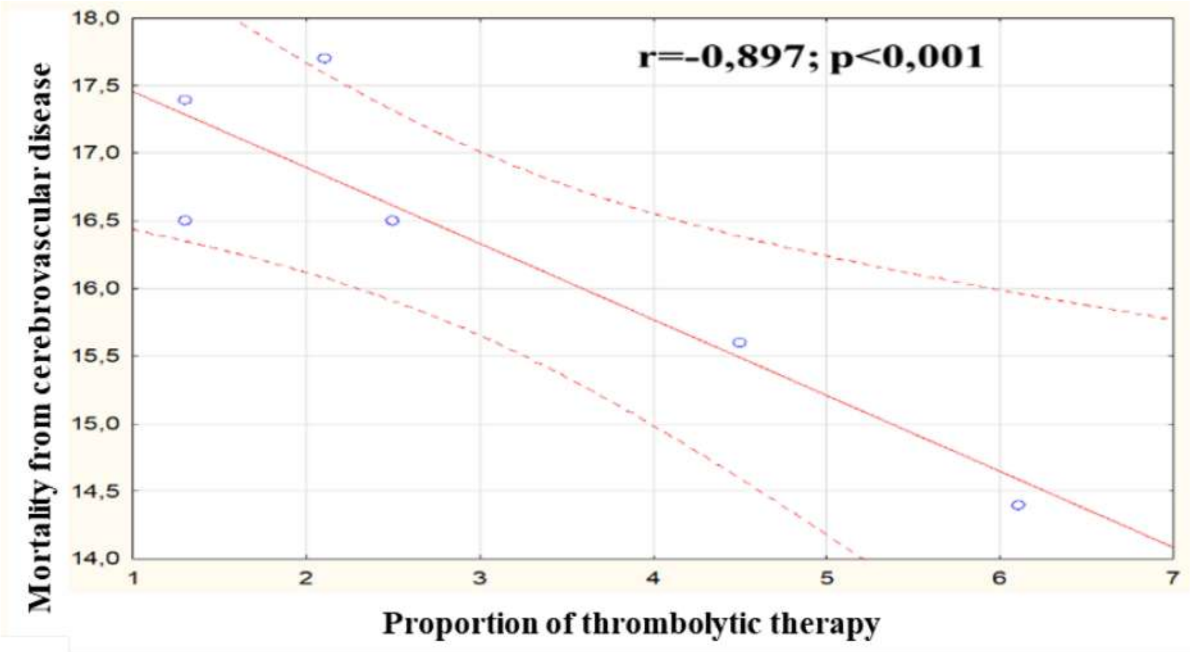


Figure 24 – Correlation between the frequency of TLT and mortality rates from CVD in the period 2014-2022 among RCC and PCP patients

We found a weak negative correlation between the index of neuroimaging examination in the first 40 minutes after patient hospitalization and mortality from CVD (r= -0.6; p<0.05), which indicates the significance of compliance with the developed algorithm of diagnostic organization in improving the performance of vascular centers and departments (Figure 25).

When assessing the correlation between the RCC and PCP performance indicators and epidemiologic data on CVD in the Tyumen Oblast, a negative correlation between the number of patients independent in daily life by the end of inpatient treatment and CVD mortality in the rural population of TO per 100000 population from 2014 to 2022 was revealed (r= -0.2; p<0.01). The results suggest that the more patients are discharged independent in activities of daily living, the better their quality of life, the lower their

CVD mortality due to frequent complications such as development of pneumonia, pressure sores, etc., which are the main causes of mortality after hospital discharge among patients with CVD (Figure 26) [110].

However, the presence of a weak correlation relationship requires more careful attention to the population living in rural areas and further optimization of measures aimed at reducing morbidity, mortality and disability due to CVD.

When assessing the relationship between the number of patients independent in daily life by the end of inpatient treatment and mortality from CVD in the urban population of TO per 100000 population from 2014 to 2022, a high correlation relationship was revealed (r= -0.9; p<0.01), which may be due to the fact that in the city, after discharge from the RRC, patients are referred for further follow-up to the polyclinic at the place of residence, where treatment and rehabilitation programs for this category of patients are actively developed (Figure 27).

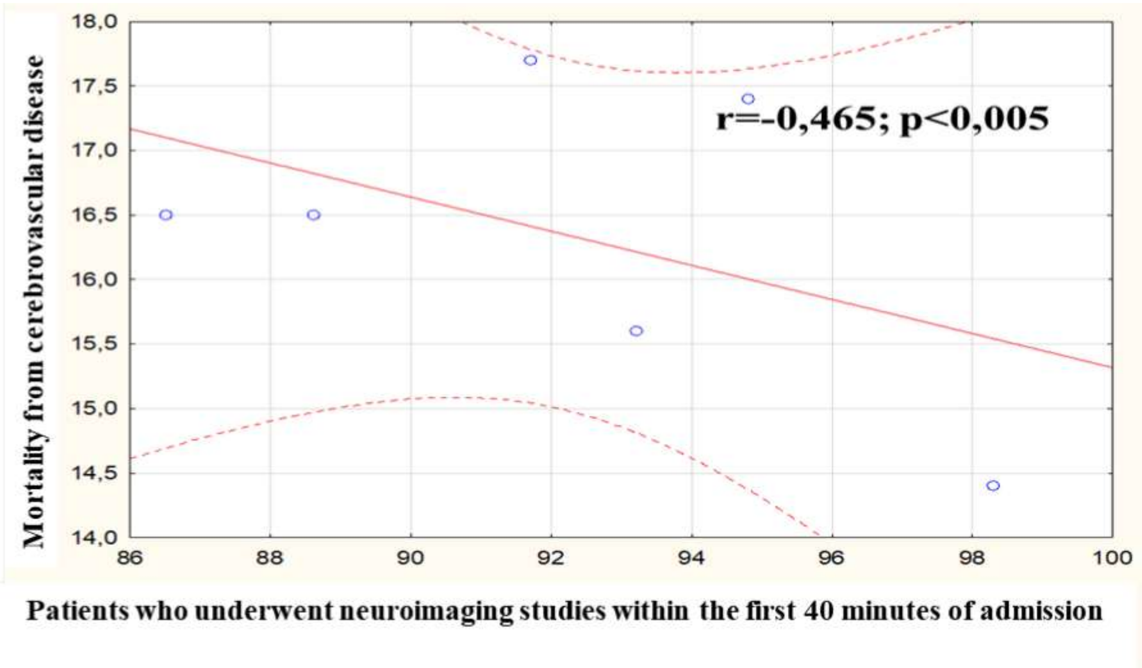


Figure 25 – Relationship between the frequency of neuroimaging examinations within 40 minutes of admission and mortality rate from CVD in the period 2014-2022 among RRC and PCP patients

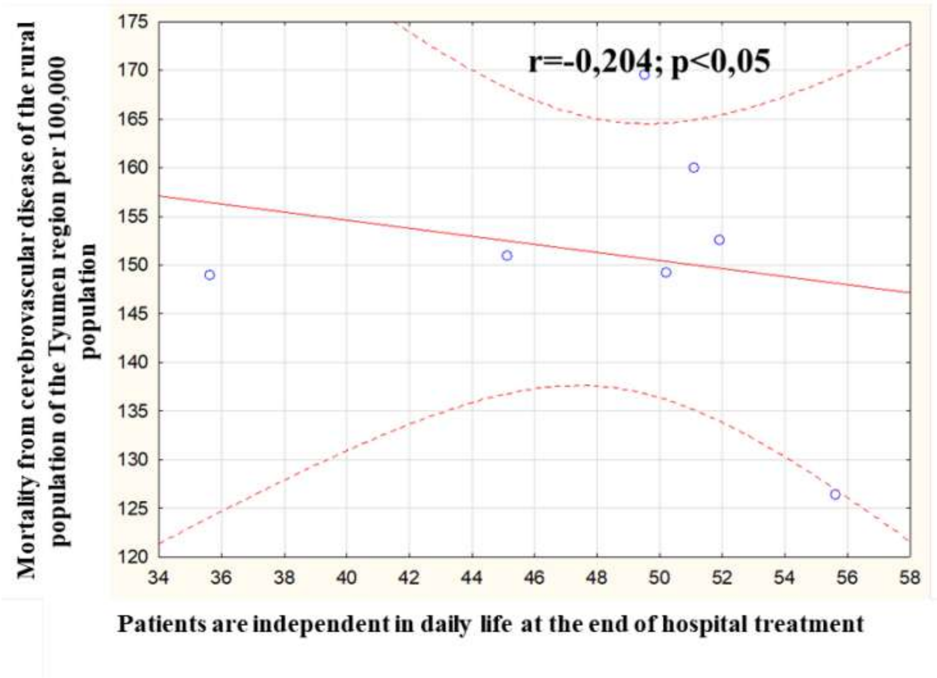


Figure 26 – Relationship between the number of patients independent in activities of daily living by the end of hospitalization and mortality from CVD in rural populations in the period 2014-2022 among RHC and PCP patients

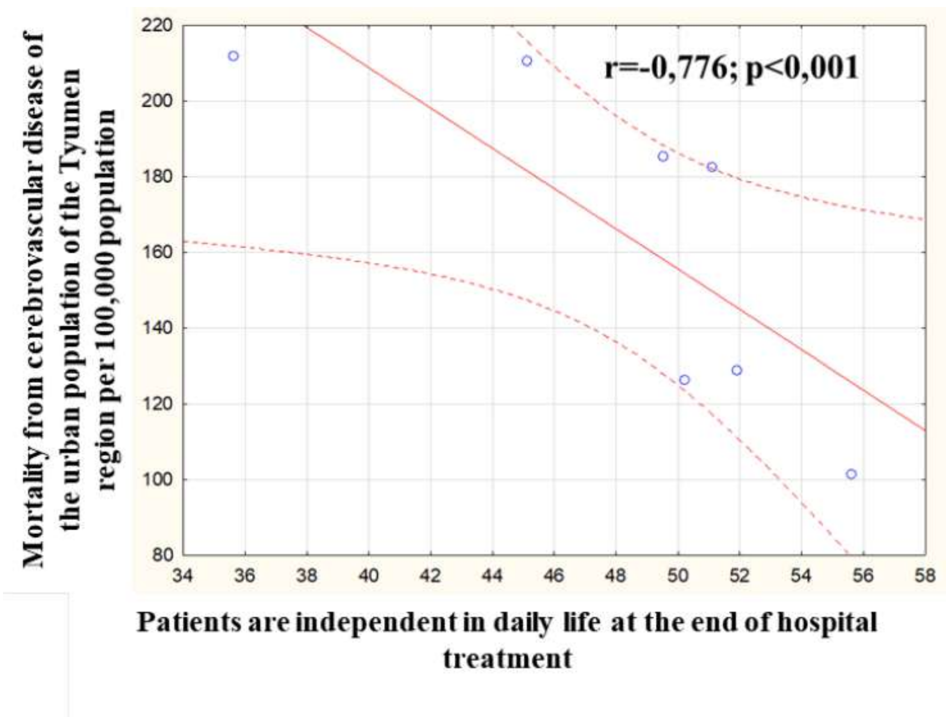


Figure 27 – Relationship between the number of patients independent in activities of daily living by the end of hospitalization and CVD mortality in urban populations in the period 2014-2022 among RHC and PCP patients

In rural areas, due to problems with the accessibility of these medical organizations, not all patients have the opportunity for follow-up, which may partially explain the low correlation.

The significance of TLT and its impact on mortality rate is beyond doubt. Thus, a negative high correlation between the frequency of TLT and mortality from CVD of the population living in both rural (r= – 0.8 p<0.01) and urban (r= -0.9 p<0.01) areas was revealed (Figures 28, 29).

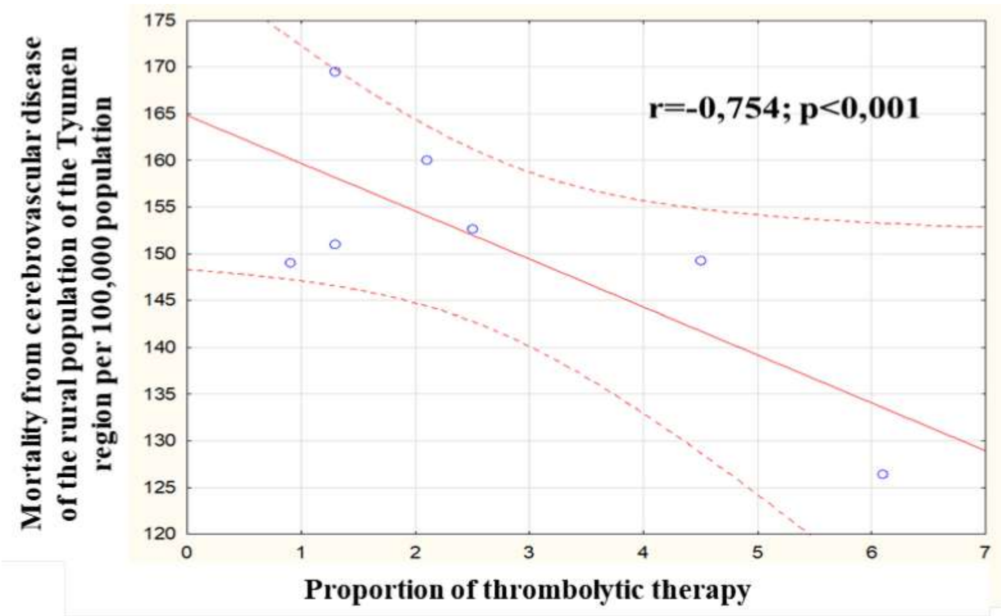


Figure 28 – Correlation between the frequency of TLT and mortality rates Mortality from CVD in rural population in the period 2014-2022 among RRC and PCP patients

Thus, the conducted study of the organization of RRC and PCS activities on epidemiological indicators associated with CVD demonstrated that the performance of neuroimaging study in the first 40 minutes after the patient's hospitalization, as well as the increase in the frequency of TLT and the proportion of patients independent in everyday life by the end of treatment, are interrelated with the reduction of mortality both among urban and rural population of TO from CVD. In addition, it was revealed that these indicators are interrelated with the reduction of hospital mortality, which should also be taken into account when conducting further activities aimed at optimizing the organization of care for patients with STEMI.

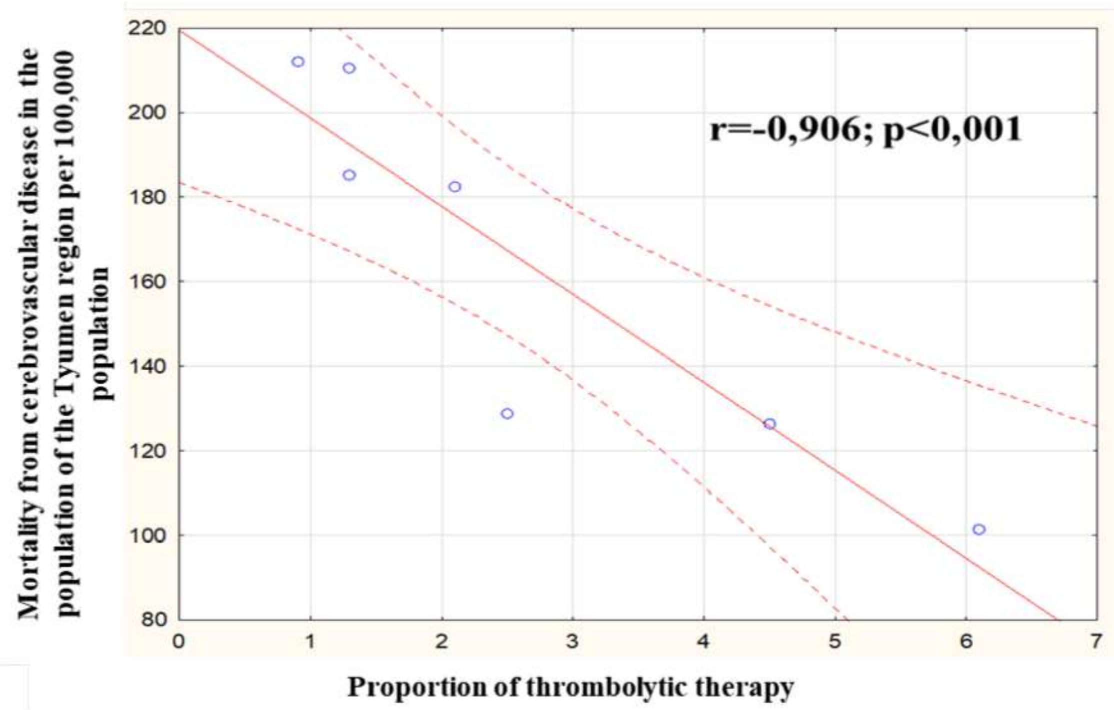


Figure 29 – Relationship between the frequency of performing TLT and CVD mortality in urban populations between 2014 and 2022 among RCC and PCP patients

4.2 Assessment map of the organization of the quality of medical care in the vascular center and primary vascular departments

We developed the card in accordance with the Order of the Ministry of Health and Social Development of Russia № 389n of July 6, 2009. "On approval of the order of medical care for patients with acute cerebral circulatory disorders" and the Ministry of Health of the Russian Federation Order No. 928n of November 15, 2012. "On Approval of the order of medical care for patients with acute cerebral circulatory disorders" (order of the DOH of TO No. 682 of 28.10.2013 and No. 379 of 14.06.2018; Appendix B (p. 364) and D [p. 365]) [210].

The card of evaluation of the organization of quality of medical care for a patient with STEMI is inserted in each card of an inpatient, form 003/u, in primary vascular departments and in the regional vascular center. The assessment is performed by the head of the department before submitting the inpatient card to statistics.

In accordance with these orders, patients with suspected STEMI are hospitalized "by an ambulance brigade to medical organizations that provide round-the-clock medical care in the specialty of neurology", with the patient with suspected STEMI bypassing the emergency room of the medical organization. Upon entering the examination room, the patient is examined by a neurologist, whose task is to assess the state of vital functions and systems of the patient's body, the patient's general condition, neurological status; in addition, if medically indicated, measures are taken to restore the disturbed vital functions of the patient's body, as well as electrocardiography, blood sampling to determine the level of platelets, peripheral blood glucose", INR and ACTR, which are determined during the course of the examination, as well as the patient's blood glucose level. The next stage is to conduct neuroimaging study of the brain of a patient with signs of STEMI in the department of radial diagnostics or CT/MRI room) in order to verify the diagnosis. The neurologist on duty receives the conclusion of the neuroimaging study not more than 40 minutes after the patient's admission to the medical organization.

If the diagnosis of a STEMI is confirmed, all patients, "including those with transient ischemic attacks, are transferred to the intensive care unit; at the same time, no more than 60 minutes should pass from the moment of admission to the medical organization until transfer to the specialized department. In the presence of GI according to the neuroimaging study in the first hour of hospitalization it is also necessary to hold a consultation with a neurosurgeon in order to make a decision on treatment tactics (by a consilium of doctors). In addition, neurosurgeon's consultation in the first 24 hours from the onset of the disease is carried out in patients with malignant AI in the middle cerebral artery basin, according to the results of which the consilium of doctors makes a decision on the treatment tactics. The duration of stay of a patient with STEMI in the intensive care ward is determined by the severity of his condition, but it cannot be less than 24 hours, which are necessary both for evaluation of the pathogenetic variant of stroke and for determining the tactics of further treatment and rehabilitation measures aimed at preventing recurrent STEMI. In the first 3 hours of the patient's stay in the intensive care unit are carried out":

- assessment of neurological status;
- assessment of somatic status;
- assessment of swallowing function;
- nutritional status assessment;
- laboratory blood tests (detailed general and biochemical tests, coagulogram);
- urinalysis;
- duplex scanning of extracranial sections of brachiocephalic vessels;
- determining the patient's management tactics;
- prescribing the necessary measures to prevent a recurrent STEMI.

During the remainder of a patient's stay in the ICU, the patient with a SNMD is given:

- monitoring of neurological status;
- monitoring of somatic status (control of cardiovascular, respiratory and hemostasis systems);
- monitoring of laboratory values;
- measures aimed at preventing somatic complications (pneumonia, venous thromboembolic complications);
- activities aimed at preventing recurrent STEMI;
- nutritional status assessment;
- early rehabilitation.

Such investigations as transcranial Doppler monitoring, transcranial microembolization, systemic thrombolytic therapy or thromboembolectomy, transthoracic echocardiography are performed in the intensive care unit if medically indicated.

All measures aimed at preventing recurrent ONMK are carried out to the patient not later than 3 days from the moment of the disease development and include both medication (continued in outpatient conditions after the patient's stay in hospital) and surgical methods of treatment.

Interventions related to the restoration of impaired functions after a STEMI are carried out by a multidisciplinary team, which includes a physical therapist, physiotherapist, medical rehabilitation doctor, physical therapy instructor, speech therapist, psychologist, social worker and other specialists, if there are appropriate indications.

In addition, after discharge from hospital, patients with STEMI are referred to specialized medical and sanatorium-resort organizations for further rehabilitation measures if indicated.

In accordance with these criteria, the quality of organization of medical care organization for STEMI patients in the Tyumen Oblast was assessed. It was revealed that in the PCP the violations of patient routing significantly decreased in the period 2013-2019 in 26.7 times (p<0.01). Examination of patients by a neurologist within the first 10 minutes after admission to the hospital by 2019 was performed for almost all patients, whereas in 2013. – Only 20%, which is 4.9 times less frequent (p<0.0) [210]. C 2016, all patients had a neuroimaging study performed within the first 40 minutes of hospitalization, whereas in 2013 this figure was 50%. In SAC, CT angiography and/or MR angiography and X-ray contrast angiography of cerebral vessels were performed in 100% of patients from 2017, whereas in 2013. – Only 50% were performed. Measures such as assessment of peripheral blood glucose, platelet glucose, ACTH and INR levels in the first 20 minutes of hospitalization have been performed in 100% of patients since 2014.

Upon admission to the intensive care unit, assessment of neurological and somatic status, assessment of the degree of impaired consciousness and coma according to the Glasgow scale and neurological status according to the NIH stroke scale no later than 3 hours from the moment of admission to the hospital, monitoring of vital functions (BP, pulse, respiration, blood oxygen saturation, diuresis), individual nutritional support no later than 24 hours from the moment of admission to the hospital with subsequent daily correction, determination of management tactics and prevention of recurrent vascular disorders.

If in 2013 duplex scanning of extracranial sections of brachiocephalic vessels and duplex transcranial scanning in the first 3 hours of patients' admission to the BITR were performed in 35% of patients, in 2022 – 91%, which is 2.6 times more frequent ($p<0.01$). Since 2015, consultation with a neurosurgeon within the first hour of diagnosis of intracranial hemorrhage was performed in 100% of patients, whereas in 2013. – 50%. Since 2014, all patients were started on BITR or ICU treatment in the first hour of admission to the hospital. Standardized screening testing of swallowing function in the first 3 hours of hospital admission was performed in 100% of patients from 2014, and determination of the pathogenetic variant of AI according to TOAST criteria was performed from 2015. Rehabilitation measures in the first 2 days from the moment of hospitalization, as well as assessment of the severity of neurological deficit according to Rankin scale on the first day of admission and at the time of discharge from the hospital were performed in all patients from 2016, whereas in 2013. – 60.0%, in 2014. – 65.0% and in 2015. – 85,0% [210].

In 2022, 94.0% of patients improved their functional status by at least 1 point on the Rankin scale against the background of treatment and rehabilitation measures, whereas in 2013. – 50.0% (Table 38) [210].

In RHCs, the Quality of Care Scorecard found that there was only a 2% disruption in the routing of SNF patients in 2022, which was 10.5 times less frequent than in 2013 ($p<0.01$) [210], 6.5 times less frequent than in 2014 ($p<0.01$), and 4.0 times less frequent than in 2015 ($p<0.01$). Within the first 10 minutes of a patient's admission to the hospital, examination by a neurologist was performed by 100% as of 2019, compared to 2013. – only 59.0%. Since the opening of the RRC, all patients with ONMCA were performed CT/MRI of the brain with a description of the findings within the first 40 minutes of hospitalization, as well as CT angiography and/or MR angiography and X-ray contrast angiography of cerebral vessels [210]. Since 2014, all patients have had their peripheral blood glucose, platelet glucose, ACEI and INR determined within 20 minutes of hospitalization.

Table 38 – Results of implementation of the map for assessing the quality of organization of medical care for patients with STEMI in the PCP for 2013-2022

Indicators of the card for assessing the quality of the organization of medical care	**Years**									
	2013	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Routing Violation	80	45	25	16	11	5	3	11	19	7
Performed an examination by a neurologist within 10 minutes of admission to the hospital	20	50	90	90	95	95	98	100	100	100
Head CT and head MRI with description and interpretation of the result no later than 40 minutes from the moment of admission to the hospital was performed	50	90	98	100	100	100	100	100	100	100
CT-angiography and/or MR-angiography and X-ray contrast angiography of cerebral vessels (in case of SAC) performed	50	65	75	78	100	100	100	100	100	100
Determination of peripheral blood glucose level no later than 20 minutes from the moment of admission to the hospital was performed	80	100	100	100	100	100	100	100	100	100
Performed determination of platelet level in the blood no later than 20 minutes from the moment of admission to the hospital	80	100	100	100	100	100	100	100	100	100
Determination of INR and ACEI levels within 20 minutes from the moment of admission to the hospital was performed	80	100	100	100	100	100	100	100	100	100
In BITR within 3 hours of admission for all patients with STEMI										
Neurological and somatic status was assessed	100	100	100	100	100	100	100	100	100	100
Duplex scanning of extracranial sections of brachiocephalic vessels, duplex scanning of transcranial vessels was performed	35	40	45	48	52	68	69	89	93	91
Management tactics have been determined	100	100	100	100	100	100	100	100	100	100
Systemic intravenous thrombolysis was performed not later than 40 minutes from the moment of diagnosis (in ischemic stroke in the presence of medical indications and absence of medical contraindications)	0	50	60	75	80	90	100	94	92	96

Table 38 continued

Indicators of the card for assessing the quality of the organization of medical care	Years									
	2013	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Consultation with a neurosurgeon within 60 minutes of the diagnosis of intracranial hemorrhage was performed	50	90	100	100	100	100	100	100	100	100
Started treatment in an intensive care unit (ward) or intensive care unit no later than 60 minutes from the moment of admission to the hospital	50	100	100	100	100	100	100	100	100	100
Performed standardized screening testing of swallowing function no later than 3 hours from the time of admission to the hospital	80	100	100	100	100	100	100	100	100	100
Performed assessment of the degree of impaired consciousness and coma on the Glasgow Stroke Scale and neurologic status on the NIH Stroke Scale no later than 3 hours from the time of admission to the hospital	100	100	100	100	100	100	100	100	100	100
Performed vital signs monitoring	100	100	100	100	100	100	100	100	100	100
Started individual nutritional support no later than 24 hours from the moment of admission to the hospital with further daily correction	100	100	100	100	100	100	100	100	100	100
Determination of the pathogenetic variant of ischemic stroke according to TOAST criteria was performed	50	90	100	100	100	100	100	100	100	100
Prevention of recurrent vascular disorders was performed	100	100	100	100	100	100	100	100	100	100
Started medical rehabilitation no later than 48 hours from the moment of admission to hospital	60	65	85	100	100	100	100	100	100	100
Performed Rankin Scale scores in the first 24 hours from the time of admission to the hospital and at the time of discharge from the hospital	60	65	85	100	100	100	100	100	100	100
Rankin Scale score decreased by at least 1 point during the hospital stay	50	65	74	82	86	90	92	89	91	94

Assessment of neurologic status and determination of patient management tactics in BITR within 3 hours of admission were performed in all patients since 2013. Duplex scanning of extracranial sections of brachiocephalic vessels as well as transcranial duplex scanning within 3 hours of admission to BITR was performed in 85.0% of patients in 2019, whereas in 2013. – only 40.0%, which is 2.1 times less frequent ($p<0.01$), and from 2020 this method of investigation within 3 hours from the moment of admission to the BITR was performed in 100% of cases.

Systemic intravenous thrombolysis no later than 40 minutes from the moment of diagnosis (in AI in the presence of medical indications and absence of medical contraindications) as of 2018 was performed in 100% of patients, and in 2013. – 50,0%.

Consultation with a neurosurgeon within 60 minutes of the diagnosis of intracranial hemorrhage, treatment in the BICU or intensive care unit within 60 minutes of admission to the hospital, assessment of the degree of impaired consciousness and coma on the Glasgow scale and neurological status on the NIH stroke scale within 3 hours of admission to the hospital, monitoring of vital functions (BP, pulse, respiration, blood oxygen saturation, diuresis), individual nutritional support no later than 24 hours from the moment of admission to the hospital with subsequent daily correction, determination of the pathogenetic variant of ischemic stroke according to TOAST criteria, as well as prevention of recurrent vascular disorders with medications were performed in 100% of patients in the period 2013-2022., and standardized screening testing of swallowing function not later than 3 hours from the moment of admission to the hospital – to all patients from 2015. Medical rehabilitation no later than 48 hours from hospital admission and Rankin Scale scores within the first 24 hours of hospital admission and at the time of hospital discharge have been performed in all patients with SNMD since 2015 [210].

As a result of treatment and rehabilitation measures, a decrease in the severity of neurologic deficit on the Rankin scale by at least 1 point during the hospital stay was observed in 94.0% of patients in 2019 and 2022, whereas in 2013. – In 50.0%, which is 1.9 times less frequent ($p<0.01$), in 2014. – in 68.0%, which was 1.4 times less frequent in 2019 and 2022 ($p<0.01$) (Table 39) [210].

A comparative analysis of medical care for patients with STEMI revealed that some indicators were higher in RRCs than in PCPs. Thus, routing violations were more frequently detected in PCPs than in RRCs throughout the entire observation period: in 2014. – 3.5 times ($p<0.01$), in 2015. – 3.1 times ($p<0.01$), in 2016. – in 3.2 times ($p<0.01$), in 2017. – 3.7 times ($p<0.01$), in 2018. – 1.9 times ($p<0.01$) and in 2019 2.0 times ($p<0.01$). Examination by a neurologist performed within the first 10 minutes of admission to the hospital was 1.6 times less frequently performed in 2014 in the PCP than in the RRC ($p<0.01$), but no differences between the vascular center and the departments have been observed since 2015 due to the elimination of this violation in the PCP. In the PCP only from 2016 onwards, all patients underwent neuroimaging studies within the first 40 minutes of hospitalization, whereas in the RCC, starting from the opening. CT angiography and/or MR angiography and X-ray contrast angiography of cerebral vessels (for SAC) were performed less frequently in 2014-2016 in PCO patients than in RCC by 1.5 ($p<0.01$), 1.3 ($p>0.1$) and 1.3 ($p>0.1$) times, respectively, but since 2017 this violation has been completely eliminated in PCO.

Table 39 – Results of implementation of the card for assessing the organization of the quality of medical care for patients with STEMI in the RRC for 2013-2022

Indicators of the card of assessment of the organization of the quality of medical care	**Years**									
	2013	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Routing Violation	21	13	8	5	3	2,6	1,5	7	12	2
Performed an examination by a neurologist within 10 minutes of admission to the hospital	59	78	90	92	95	98	100	100	100	100
Head CT and head MRI with description and interpretation of the result no later than 40 minutes from the moment of admission to the hospital was performed	100	100	100	100	100	100	100	100	100	100
CT-angiography and/or MR-angiography and X-ray contrast angiography of cerebral vessels (in case of SAC) performed	100	100	100	100	100	100	100	100	100	100
Determination of peripheral blood glucose level no later than 20 minutes from the moment of admission to the hospital was performed	80	100	100	100	100	100	100	100	100	100
Performed determination of platelet level in the blood no later than 20 minutes from the moment of admission to the hospital	80	100	100	100	100	100	100	100	100	100
Determination of INR and ACEI levels within 20 minutes from the moment of admission to the hospital was performed	80	100	100	100	100	100	100	100	100	100
BITR within 3 hours of admission for all patients with STEMI										
Neurological and somatic status was assessed	100	100	100	100	100	100	100	100	100	100

Table 39 continued

Indicators of the card of assessment of the organization of the quality of medical care	Years									
	2013	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Duplex scanning of extracranial sections of brachiocephalic vessels, duplex scanning of transcranial vessels was performed	40	52	55	58	68	82	85	100	100	100
Management tactics have been determined	100	100	100	100	100	100	100	100	100	100
Performed systemic intravenous thrombolysis within 40 minutes of diagnosis	50	85	90	90	90	100	100	100	100	100
Consultation with a neurosurgeon within 60 minutes of the diagnosis of intracranial hemorrhage was performed	100	100	100	100	100	100	100	100	100	100
Started treatment in an intensive care unit (ward) or intensive care unit no later than 60 minutes from the moment of admission to the hospital	100	100	100	100	100	100	100	100	100	100
Performed standardized screening testing of swallowing function no later than 3 hours from the time of admission to the hospital	90	95	100	100	100	100	100	100	100	100
Performed assessment of the degree of impaired consciousness and coma on the Glasgow Stroke Scale and neurologic status on the NIH Stroke Scale no later than 3 hours from the time of admission to the hospital	100	100	100	100	100	100	100	100	100	100
Monitoring of vital functions (BP, pulse, respiration, blood oxygen saturation, diuresis) was performed	100	100	100	100	100	100	100	100	100	100
Started individual nutritional support no later than 24 hours from the moment of admission to the hospital with further daily correction	100	100	100	100	100	100	100	100	100	100
Determination of the pathogenetic variant of ischemic stroke according to TOAST criteria was performed	100	100	100	100	100	100	100	100	100	100
Prevention of recurrent vascular disorders with medications was performed	100	100	100	100	100	100	100	100	100	100
Started medical rehabilitation no later than 48 hours from the moment of admission to hospital	70	85	100	100	100	100	100	100	100	100
Performed Rankin Scale scores in the first 24 hours from the time of admission to the hospital and at the time of discharge from the hospital	70	85	100	100	100	100	100	100	100	100
Rankin Scale score decreased by at least 1 point during the hospital stay	50	68	74	83	85	92	94	93	91	94

In BITR, the main violation in both the RCC and the PCO was the duplex scanning of the BCA, which should be performed within the first 3 hours from the moment of admission of a patient with a STEMI. Despite the improvement of this indicator during 6 years of work of vascular center and departments, it continues to be lower in PCP. TLT violations were absent from 2018 in the RRC and from 2019 in the PCP; however, in 2014-2016, the proportion of these violations was significantly higher in the PCP than in the RRC: in 2014. – 1.7 times ($p<0.01$), in 2015. – 1.5 times ($p<0.01$) and in 2016. – 1.2-fold ($p>0.1$). All patients received medical rehabilitation no later than 48 hours from the moment of admission to hospital from 2015 in RRC and from 2016 in PCP. In 2014 and 2015, this rate was significantly lower in the PCP than in the RRC, by a factor of 1.3 and 1.2, respectively ($p>0.1$). In 2014, the PCP was also 1.3 times more likely not to have a Rankin Scale assessment in the first 24 hours from admission to the hospital and at the time of discharge, but since 2015 in the RCC and 2016 in the PCP it is performed in all patients.

Thus, the implemented cards for assessing the quality of organization of medical care for patients with STEMI made it possible to achieve an increase in the completeness of compliance with the norms of drug and rehabilitation care for this category of patients, which, in turn, was manifested in the reduction of mortality and improvement of functional outcome of patients at the time of discharge from hospital.

4.3. Results of the questionnaire survey of students of schools for stroke patients and their relatives

Raising awareness of stroke among the population of the Tyumen Oblast

Analysis of the organization of the quality of work of vascular centers has shown the need for activities to raise public awareness.

Educational activities carried out in vascular departments

Despite the high risk of recurrent stroke, patients who have had a first stroke often continue to lead unhealthy lifestyles, thereby further increasing their risk of [237, 317]. Low awareness of stroke, especially of risk factors, is one of the presumed reasons for continued unhealthy lifestyle behaviors and low risk factor control in this population. For example, in a study including 182 patients with a history of stroke or TIA, A. Sloma et al. (2010) found that less than 50% of the subjects were aware that diabetes mellitus was a major risk factor for these diseases [335]. The lack of awareness of the influence of various risk factors on the occurrence of stroke is of concern because, for example, the presence of diabetes mellitus increases the risk of stroke by 10% at any age [325]. It is unclear why awareness is so low, as the risk factors for stroke are well studied (elevated blood pressure, high blood glucose, elevated cholesterol, obesity, smoking, stress, etc.). Ongoing studies regularly demonstrate that many stroke patients do not control their existing risk factors [242, 269, 341]. In addition to general knowledge about stroke and risk factors, recognizing stroke symptoms plays an important role in stroke patients. Due to the increased risk of recurrent stroke, patients with previous stroke should be well aware of the symptoms of the disease and seek immediate medical attention when they occur. Research findings demonstrate that awareness of stroke symptoms is low both in the general population and among patients with previous stroke [252, 267, 295, 312, 330]. Low recognition of stroke symptoms may be associated with delayed seeking medical attention. That is, patients who are more aware of early signs/symptoms of stroke are more likely to seek emergency medical care [287, 306, 356], seek medical attention sooner and thereby contribute to improved stroke outcomes [331].

The main challenge is to educate and create awareness in the population of the benefits that can be achieved by adhering to a healthy lifestyle and diet, whereas smoking and some dietary preferences should rather be seen as addiction options. Thus, structured treatment programs may be warranted in many situations.

There is now a consensus among researchers that stroke awareness alone does not facilitate secondary prevention [295, 356]. In particular, increased awareness does not necessarily lead to proper control of risk factors in stroke patients. Although awareness alone is usually insufficient to change behavior, such changes may not occur in the absence of correct information. Thus, risk factor control programs should, at a minimum, include information, goal-setting, practical skills training, and problem-solving opportunities for coping with the consequences of a chronic illness such as stroke. Such programs should also emphasize self-efficacy and self-management skills. Such programs should be:

– structured and time-consuming;
– be conducted at each stage/level of engagement with the health system;
– include different formats (individual or group sessions);
– emphasize all modifiable risk factors;
– to key information about belief and belief systems.

Emphasis should be placed on ensuring that standardized information is presented in a uniform and consistent manner across all settings and groups.

We organized schools for patients with STEMI and their relatives in all vascular departments of the Tyumen region, where the main risk factors of stroke, primary and secondary prevention measures and the basics of care for patients with stroke consequences were explained in detail in an accessible language, using audio-visual aids. We have developed regulations on such schools, determined their structural position within the vascular departments [156].

The objectives of their creation are:

– optimizing, improving, increasing the availability and quality of medical preventive care for the population, in particular for patients with acute cerebral circulatory failure (ACBF);
– raising awareness of patients with STEMI about the disease and risk factors for its development;

– increased responsibility for maintaining one's health;
– formation of a rational and active attitude towards the disease in patients;
– formation of motivation for health improvement, adherence to treatment and fulfillment of doctor's recommendations [105, 156].

The main **objectives of the** schools are:

– raise awareness of patients about the causes and symptoms of disease exacerbations and the impact of behavioral risk factors on health;
– to teach patients the basics of self-control, means and skills of pre-hospital self-help in case of exacerbation and development of complications of the disease;
– to teach the basics of a healthy lifestyle, principles of therapeutic nutrition [156].

The following 10 topics were developed for each school, which were positively reviewed by the scientific staff of the Federal State Budgetary Educational Institution of Higher Education "Tyumen State Medical University" of the Ministry of Health of the Russian Federation:

1. Arterial hypertension and stroke.

– informing patients about the disease and factors influencing the development of the disease;
– teaching patients to self-analyze their own risk factors;
– informing about the need to take regular medications prescribed by the doctor.

2. Obesity as a risk factor for stroke. Healthy eating.

– educating patients about the impact of overweight and obesity;
– informing about the principles of nutrition for the prevention of overweight and obesity;
– raising awareness of the nutritional characteristics of cardiovascular disease and obesity.

3. Smoking and health.

– raising awareness of the role of smoking on health and the condition of various organs and systems, primarily on the cardiovascular system
– characteristics of "active" and "passive" smoking on health status;

– teaching self-analysis of the reasons for smoking, "why does a person smoke?"; teaching modern ways and methods of smoking cessation.

4. Physical activity and health.

– to motivate patients and their families to increase physical activity in a controlled manner;
– raising patient awareness of the role and importance of physical activity for human health and cardiovascular function;

5. Stress and health.

– increasing patients' knowledge of the nature of stress, controllable and uncontrollable risk factors;
– awareness of emotionally and problem-oriented methods of coping with fear;
– training in stress self-assessment, stress management and coping techniques.

6. Primary prevention of vascular disease.

– raising awareness of risk factors for stroke development;
– formation of motivation to lead a healthy lifestyle.

7. Secondary prevention of vascular disease.

– imparting the necessary knowledge about the risks of recurrent stroke;
– learning to assess a particular patient's risk factors;
– informing you about the need to take the medications prescribed by your doctor on a regular basis.

8. Positioning in rehabilitation.

– teaching relatives of bedridden patients different laying techniques that can prevent pressure sores, secondary infections, and contractures.

9. The place of the speech therapist in the education of relatives who have suffered from a CNMI (communication strategies):

– informing about the peculiarities of communication with a non-speaking patient who has had a STEMI;
– demonstrating techniques and ways of interacting with a non-speaking patient;

– familiarizing relatives with methodological literature and manuals on the topic of the class for independent correction of speech disorders at the outpatient stage.

10. Life after stroke.

– formation of adaptation skills to new living conditions;
– transfer of methods and ways of learning to adapt to new life conditions;
– teaching the patient to eat independently (use cutlery), using technical aids if necessary;
– teaching the patient personal hygiene (washing, brushing teeth, shaving, combing hair), using technical aids if necessary;
– teaching the patient to dress him/herself, use the toilet and bathroom;
– individual recommendations on further restoration of self-care skills at the outpatient stage.

In PCO #1, 286 people (66.8% of patients and 33.2% of relatives) were trained in 2014, in 2015. – 294 (66.3% of patients and 33.7% of relatives), in 2016. – 301 (65.8% of patients and 34.2% of relatives), in 2017. – 294 (66.7% of patients and 33.3% of relatives), in 2018. – 302 (67.5% of patients and 32.5% of relatives), and in 2019, 312 (68.3% of patients and 31.7% of relatives) people [111, 156]. During the pandemic, the number of individuals who attended the topics of the STEMI prevention schools decreased dramatically: 141 individuals (87.2% of patients and 12.8% of relatives) were trained in 2020, 98 individuals (100% of patients) in 2021, and 204 (76.5% of patients and 23.5% of relatives) in 2022 [Figure 30].

The most popular topic of the school for both patients and their relatives in PCP No. 1 was "Life after stroke", which was listened to by 92.1% and 96.8% of patients and their relatives in 2014. 92.1% and 96.8% of patients and their relatives, respectively, in 2015. – 91.3% and 93.9%; in 2016. – 89.4% and 92.2%; in 2017. – 92.3% and 95.9%; in 2018. – 89.2% and 96.9% and in 2019, 87.8% and 100% of patients and their relatives, respectively, and "Stress and Health" attended by 97.4% and 91.6% of patients and their relatives, respectively, in 2014, 95.9% and 88.9% of attendees in 2015, 96.5% and 83.5%

in 2016, 96.9% and 89.8% in 2017, 94.1% and 91.8% in 2018, and 89.7% and 89.9% of patients and their relatives, respectively, in 2019.

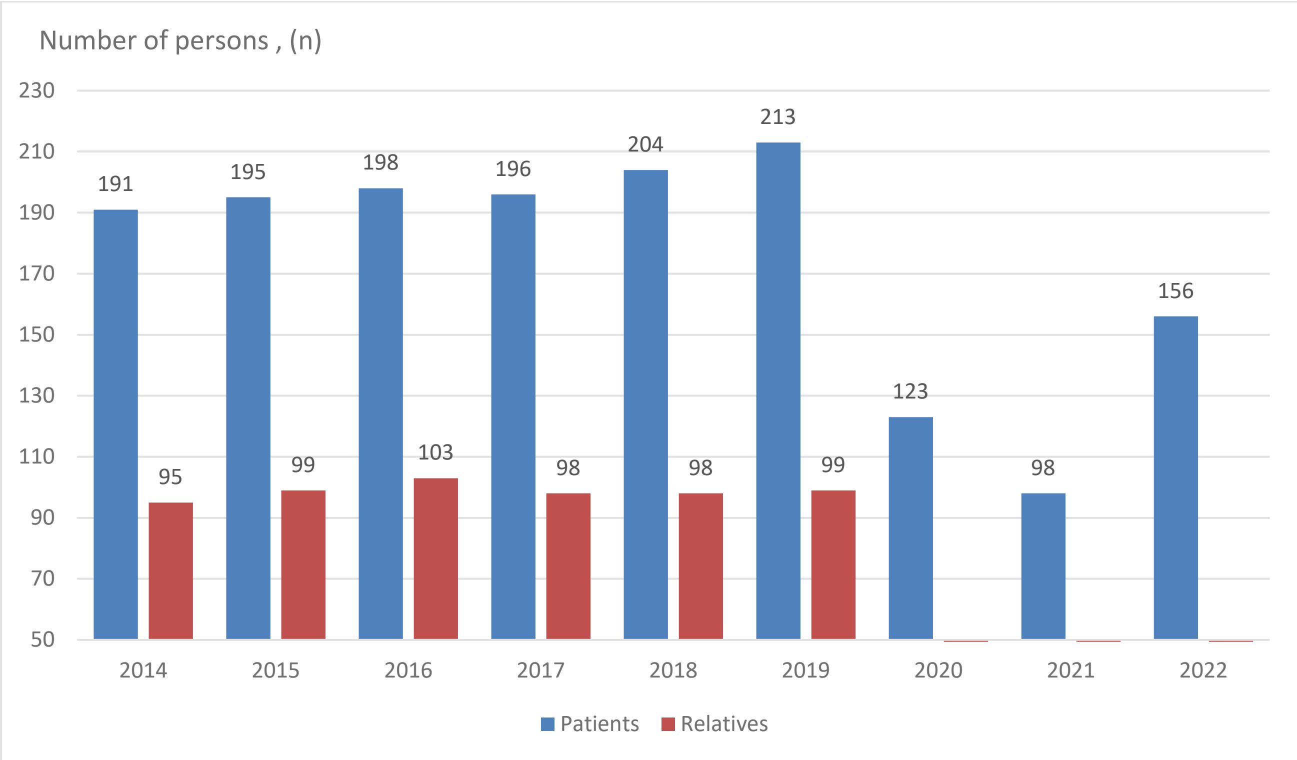


Figure 30 – Total number of patients and their relatives who listened to the topics of schools on the prevention of STEMI in SIG #1 for 2014-2022

The topic "Arterial hypertension and stroke" was listened to in 2014. 87.4% of patients and 90.5% of relatives, in 2015. – 88.2% and 84.8%, in 2016. – 85.9% and 84.5%, in 2017. – 89.3% and 92.9%, in 2018. – 85.3% and 91.8%, and in 2019, 85.4% and 91.9% of patients and their relatives, respectively.

The topic "Obesity as a risk factor for stroke. Healthy Eating" was attended by 53.4% of patients and 77.9% of relatives in 2014, 50.3% and 68.7% in 2015, 52.5% and 73.8% in 2016, 52.0% and 60.2% in 2017, 55.9% and 80.6% in 2018, and 54.0% and 76.8% of patients and relatives, respectively, in 2019.

The topic "Smoking and health" was popular with 2/3 of listeners on average. Thus, in 2014 it was listened to by 69.1% of patients and 61.1% of relatives, in 2015. – 50.3%

and 68.7%, in 2016. – 52.5% and 73.8%, in 2017. – 52.0% and 60.2%, in 2018. – 69.1% and 70.4%, and in 2019, 66.7% and 71.7% of patients and their relatives, respectively.

In 2014, the topic "Physical activity and health" was listened to by 80.1% of patients and 65.3% of relatives, in 2015. – 69.7% and 62.6%, in 2016. – 68.2% and 62.1%, in 2017. – 68.4% and 67.3%, in 2018. – 77.0% and 72.4%, and in 2019, 76.1% and 73.8 of patients and their relatives, respectively.

"Primary prevention of vascular diseases" was listened to by 67.5%, 69.7%, 68.2%, 68.4%, 66.2% and 62.9% of patients between 2014 and 2019. and 72.6%, 62.6%, 62.1%, 67.3%, 70.4%, and 71.7% of their relatives, and the topic "Secondary prevention of vascular diseases" was listened to by 75.9%, 79.5%, 75.3%, 78.6%, 66.2%, and 62.9% of patients from 2014-2019 and 83.2%, 63.6%, 65.0%, 69.4%, 70.4%, and 71.7% of their relatives.

Positioning in Rehabilitation was the topic listened to least often by patients, whereas among relatives this topic was one of the most popular.

Thus, only 34.0%, 34.9%, 36.4%, 36.2%, 34.3%, and 35.7% of patients listened to this topic in 2014-2019, whereas among the relatives of patients, 100%, 97.0%, 95.1%, 100%, 100%, and 100% listened to this topic, respectively.

The topic "The place of a speech therapist in the education of relatives who have had a stroke" was also rarely attended by patients and their relatives, which is due to the specificity of the topic of this lecture and the fact that speech disorders develop in an average of 1/3 of stroke patients. In 2014, this lecture was attended by 40.8% and 49.5% of patients and their relatives, respectively, in 2015. – 39.0% and 52.5%, in 2016. – 39.9% and 51.5%, in 2017. – 35.2% and 73.5%, in 2018. – 38.7% and 72.4%, and in 2019, 38.0% and 73.7% of patients and their relatives, respectively (Table 40).

During the pandemic, there was a dramatic decrease in the number of patients who completed the full school course, accompanied by a lower percentage of patients completing each class topic.

Thus, the topic "Arterial hypertension and stroke" was listened to by 1040 (86.9%) patients and 529 (89.4%) relatives until 2020, after 2020. – 224 (59.4%) and 31 (46.9%), respectively ($p<0.01$). The topic "Obesity as a risk factor for stroke. Healthy diet" was

attended by 635 (53.1%) patients and 432 (72.9%) relatives until 2020, after 2020. – 117 (31.0%) and 19 (28.8%), respectively (p<0.01). The topic "Physical activity and health" was listened to by 930 (77.7) patients before the pandemic and 117 (46.9%) during the pandemic [p<0.01], and among relatives, 404 (68.2%) and 44 (66.7), respectively (p=0.8).
Table 40 – Number of patients and their relatives who listened to school topics on prevention of STEMI in PCP No. 1 for 2014-2022

School topics		2014	2015	2016	2017	2018	2019	2020	2021	2022
Arterial hypertension and stroke	patiens	167	172	170	175	174	182	98	32	94
	relatives	86	84	87	91	90	91	12	0	19
Obesity as a risk factor for stroke. Healthy eating	patiens	102	98	104	102	114	115	36	14	67
	relatives	74	68	76	59	79	76	8	0	11
Smoking and health	patiens	132	136	135	134	141	142	57	39	54
	relatives	58	62	64	66	69	71	5	0	9
Physical activity and health	patiens	153	155	149	154	157	162	62	51	64
	relatives	62	63	67	68	71	73	8	0	36
Stress and health	patiens	186	187	191	190	192	191	101	94	131
	relatives	87	88	86	88	90	89	6	0	45
Primary prevention of vascular diseases	patiens	129	128	131	133	135	134	83	87	101
	relatives	69	71	72	70	69	71	18	0	41
Secondary prevention of vascular diseases	patiens	145	146	144	148	151	150	97	73	98
	relatives	79	78	80	76	77	76	18	0	42
Positioning in rehabilitation	patiens	65	68	72	71	70	76	31	26	27
	relatives	95	96	98	98	98	99	10	0	24
The place of the speech therapist in the education of relatives who have suffered from a neurological disorder	patiens	78	76	79	69	79	81	41	4	11
	relatives	47	52	53	72	71	73	2	-	8
Life after a stroke	patiens	176	178	177	181	182	187	102	99	120
	relatives	92	93	95	94	95	99	-	-	26
A new coronavirus infection and stroke	patiens							123	98	156
	relatives							-	-	48

Among patients and their relatives, 1137 (94.9%) and 528 (89.2%) people listened to the topic "Stress and Health" between 2014-2019, and between 2020-2022. – 326 (86.5% and 51 (77.3%) patients and their relatives, respectively ($p<0.01$ and $p=0.05$). Statistically significant differences were also found for listening to the topic "Primary prevention of vascular diseases", which was listened to by 790 (66.0%) patients and 422 (71.3%) relatives before the pandemic and by 271 (71.9%) patients and 59 (89.4%) relatives during the pandemic ($p=0.03$ and $p=0.02$). For the topic "Secondary prevention of vascular diseases", no statistically significant differences were found among patients, among whom 884 (73.9%) and 268 (71.1%) patients listened to it before and during the pandemic, respectively ($p=0.3$), whereas significantly more relatives listened to this topic during the pandemic than before it (60 (90.9%) and 466 (78.7%), respectively, $p=0.1$).

Both before and during the pandemic, the topic "Positioning in rehabilitation" was listened to by a small number of both patients (422 (35.3%) and 84 (22.3%), respectively; $p<0.01$) and relatives (584 (98.7%) and 23 (51.5%), respectively; $p<0.01$). The number of both patients and relatives who listened to the topic "The place of the speech therapist in the education of relatives who have experienced a SNMD" also decreased during the pandemic compared to 2014-2019. – Among patients from 462 (38.6%) to 56 (14.9%) [$p<0.01$] and among relatives from 368 (62.2%) to 10 (15.2%) [$p<0.01$]. The topic "Life after stroke" remained one of the most requested topics, but the percentage of patients (321 (85.2%) and 1081 (90.3%), respectively; $p=0.06$) and relatives (26 (39.4% and 568 (95.9%), respectively; $p<0.01$) who listened to it was significantly lower between 2020 and 2022 than between 2014 and 2019 [$p<0.01$].

During the pandemic period, a new school topic "Emerging Coronavirus Infection and Stroke" was introduced and 377 (100%) patients and 48 (72.7%) relatives attended between 2020 and 2022 (Table 40).

There were 1,956 trainees in PCP #2 between 2014 and 2022: in 2014. – 214 people (66.8% of patients and 33.2% of relatives), in 2015. – 245 people (62.9% of patients and 37.1% of relatives), in 2016. – 253 people (63.6% of patients and 36.4% of relatives), in 2017. – 248 people (63.7% of patients and 36.3% of relatives), in 2018. – 256 people

(63.3% of patients and 36.7% of relatives), in 2019 264 people (63.3% of patients and 36.7% of relatives), in 2020. – 140 people (85% of patients and 15% of relatives), in 2021 – 123 people (100% of patients) and in 2022 – 210 people (73.3% of patients and 26.7% of relatives (Figure 31) [111].

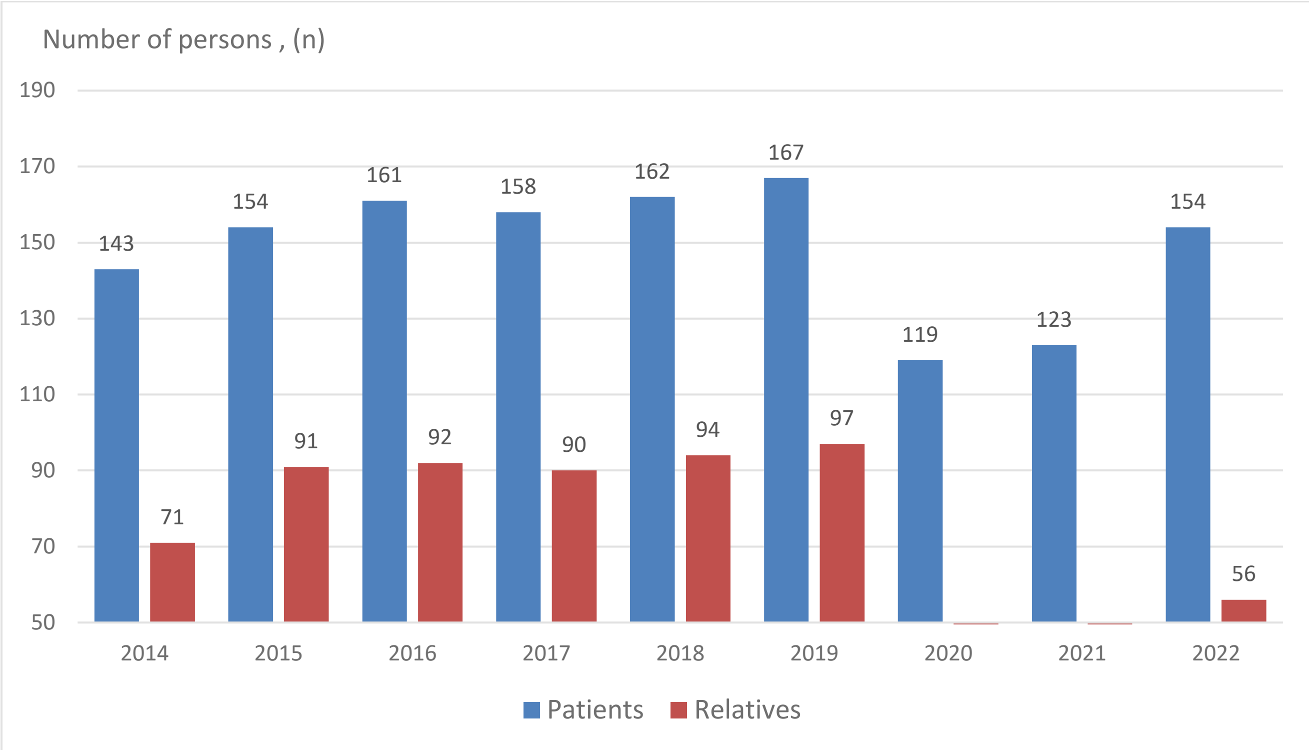


Figure 31 – Total number of patients and their relatives who listened to the topics of schools on the prevention of STEMI in PCSO #2 for 2014-2022

In PCP #2, the most popular topics of the conducted schools were "Arterial hypertension and stroke", which was listened to by 93.7% of patients and 95.8% of their relatives in 2014, 89.0% and 78.0% in 2015, 86.3% and 79.3% in 2016, 89.2% and 80.0% in 2017, 87.7% and 78.7% in 2018 and 86.2% and 77.3% of patients and their relatives, respectively, in 2019, and Life after Stroke, which was listened to by 95.1% and 98.6% of patients and relatives in 2014, respectively, 89.0% and 75.8% in 2015, 85.7% and 77.2% in 2016, 89.2% and 80.0% in 2017, 86.4% and 75.5% in 2018, and 85.6% and 75.3% in 2019.

The second most popular topics were "Stress and health", "Primary prevention of vascular diseases" and "Secondary prevention of vascular diseases". Thus, in 2014, these three topics were listened to by 90.2%, 91.6% and 89.5% of patients and 78.9%, 87.3% and 87.3% of relatives, in 2015. – 84.4%, 85.7%, 83.8% of patients and 60.4%, 70.3%, 69.2% of relatives, in 2016. – 82.6%, 83.9%, 80.1% of patients and 62.0%, 70.7%, and 70.7% of relatives, in 2017. – 86.1%, 86.7%, 84.2% of patients and 64.4%, 74.4%, 76.7% of relatives, in 2018. – 85.8%, 87.7% and 84.6% of patients and 63.8%, 74.5% and 75.5% of relatives and in 2019 85.0%, 86.2% and 82.6% of patients and 63.9%, 74.2% and 74.2% of relatives.

The topic "Obesity as a risk factor for stroke. Healthy nutrition" was listened to by 68.5% and 87.3% of patients and relatives respectively in 2014, in 2015. – 65.6% and 71.4%, in 2016. – 64.0% and 69.6%, in 2017. – 65.8% and 74.4%, in 2018. – 66.0% and 69.1%, and in 2019, 65.3% and 68.0% of patients and relatives, respectively.

The lecture "Smoking and Health" was attended by 87.4% of patients and 64.8% of relatives in 2014. 87.4% of patients and 64.8% of relatives, in 2015. – 82.5% and 52.7%, in 2016. – 81.4% and 52.2%, in 2017. – 84.2% and 56.7%, in 2018. – 83.3% and 55.3%, and in 2019, 81.4% and 55.7% of patients and relatives, respectively.

Physical activity and health lecture was attended by 92.3%, 86.4%, 83.9%, 86.7%, 85.8% and 84.4% of patients between 2014-2019 and 63.4%, 51.6%, 54.3%, 57.8%, 57.4%, 56.7% of relatives during the same period, respectively.

As well as in PCP No. 1, patients least frequently attended the topics "Positioning in rehabilitation" and "The place of the speech therapist in the education of relatives who have suffered from SNMK": 39.2% and 33.6% in 2014, 37.0% and 31.8% in 2015, 36.6% and 31.7% in 2016, 39.2% and 33.5% in 2017, 39.5% and 32.1% in 2018, and 38.9% and 37.7% in 2019, whereas these topics were more sought after among relatives: 95.8% and 64.8% in 2014, 75.8% and 49.5% in 2015, 75.0% and 51.1% in 2016, 64.4% and 53.3% in 2017, 62.8% and 52.1% in 2018, and 59.8% and 52.6% in 2019 (Table 40).

During the pandemic, the percentage of listeners statistically significantly decreased for almost all topics of the school. Thus, the topic "Arterial hypertension and stroke" was listened to by 837 (88.6%) patients and 433 (80.9%) relatives before the pandemic, and during the pandemic – by 305 (77.0%) patients and 19 (24.7%) relatives ($p<0.01$). The topic "Obesity as a risk factor for stroke. Healthy nutrition" was listened to in the period 2014-2019. 622 (65.8%) patients and 389 (72.7%) relatives, and in the period 2020-2022. – 198 (50.0%) and 8 (10.4%) patients and relatives, respectively ($p<0.01$). The same trend was observed for the topic "Smoking and Health" – among relatives, 787 (83.3%) and 235 (59.4%) people listened to this topic before and during the pandemic, respectively ($p<0.01$), and among patients, 299 (55.9%) and 17 (22.1%) people listened to this topic, respectively ($p<0.01$). The topic "Physical activity and health" was attended by 817 (86.5%) patients and 303 (56.6%) relatives between 2014-2019, and between 2020-2022. – 221 (55.8%) and 23 (29.9%), respectively ($p<0.01$). For the topic "Stress and Health", there was no difference in the percentage of attendees among patients before and during the pandemic (809 (85.6%) and 343 (86.6%), respectively; $p=0.6$), whereas among relatives during the pandemic this topic was attended by fewer attendees (348 (65.1%) and 24 (31.2%), respectively; $p<0.01$). The topic "Primary prevention of vascular disease" was listened to by 821 (86.9%) and 400 (74.8%) patients and relatives before the pandemic, respectively, and by 307 (77.5%) and 21 (27.3%), respectively, during the pandemic ($p<0.01$). The topic "Secondary prevention of vascular disease" was listened to by 794 (84.0%) and 402 (75.1%) patients and relatives before the pandemic, respectively, and 310 (78.3%) and 22 (28.6%) during the pandemic, respectively ($p=0.0$ and $p<0.01$).

The topic "Positioning in rehabilitation" also saw a decrease in the number of attendees during the pandemic: among patients from 363 (38.4%) to 91 (22.9%) [$p<0.01$], among relatives from 381 (71.2%) to 11 (14.3%) [$p<0.01$]. The least demanded topic during the pandemic was "The place of the speech therapist in the education of relatives who had suffered a SNMD", which was listened to by 38 (9.6%) and 7 (9.1%) patients and relatives, respectively, whereas before the pandemic this topic was listened to by 316 (33.4%) patients and 286 (53.5%) relatives ($p<0.01$). The topic "Life after stroke" was listened to by 835 (88.4%) and 426 (79.6%) patients and relatives between 2014 and 2019, respectively, while between 2020 and 2022. – 301 (76.0%) and 19 (24.7%) patients and relatives, respectively ($p<0.01$). The topic "New coronavirus infection and stroke" during the pandemic period was attended by 396 (100%) patients and 47 (61.0%) relatives (Table 41).

In PCP #3, 231 people (66.7% of patients and 33.3% of relatives) attended a school dedicated to raising awareness of stroke among patients and their relatives in 2014, in 2015. – 253 people (64.0% of patients and 36.0% of relatives), in 2016. – 261 people (62.8% of patients and 37.2% of relatives), in 2017. – 272 people (61.8% of patients and 38.2% of relatives), in 2018. – 283 people (61.1% of patients and 38.9% of relatives), in 2019 285 people (66.3% of patients and 33.7% of relatives), in 2020. – 124 (89.5% of patients and 10.5% of relatives), in 2021 – 94 (100% of patients) and in 2022 – 173 (75.7% of patients and 24.3% of relatives) [Figure 32] [111].

Table 41 – Number of patients and their relatives who listened to the topics of the schools on the prevention of STEMI in PCO #2 for 2014-2022

School topics		2014	2015	2016	2017	2018	2019	2020	2021	2022
Arterial hypertension and stroke	patiens	134	137	139	141	142	144	82	92	131
	relatives	68	71	73	72	74	75	0	0	19
Obesity as a risk factor for stroke. Healthy eating	patiens	98	101	103	104	107	109	46	47	105
	relatives	62	65	64	67	65	66	0	0	8
Smoking and health	patiens	125	127	131	133	135	136	29	94	112
	relatives	46	48	48	51	52	54	0	0	17
Physical activity and health	patiens	132	133	135	137	139	141	52	78	91
	relatives	45	47	50	52	54	55	0	0	23
Stress and health	patiens	129	130	133	136	139	142	115	100	128
	relatives	56	55	57	58	60	62	0	0	24
Primary prevention of vascular diseases	patiens	131	132	135	137	142	144	92	69	146
	relatives	62	64	65	67	70	72	0	0	21
Secondary prevention of vascular diseases	patiens	128	129	129	133	137	138	95	69	146
	relatives	62	63	65	69	71	72	0	0	22
Positioning in rehabilitation	patiens	56	57	59	62	64	65	21	31	39
	relatives	68	69	69	58	59	58	0	0	11
The place of the speech therapist in the education of relatives who have	patiens	48	49	51	53	52	63	12	15	11
	relatives	46	45	47	48	49	51	-	-	7

suffered from a neurological disorder										
Life after a stroke	patiens	136	137	138	141	140	143	68	101	132
	relatives	70	69	71	72	71	73	-	-	19
A new coronavirus infection and stroke	patiens							119	123	154
	relatives							21	-	26

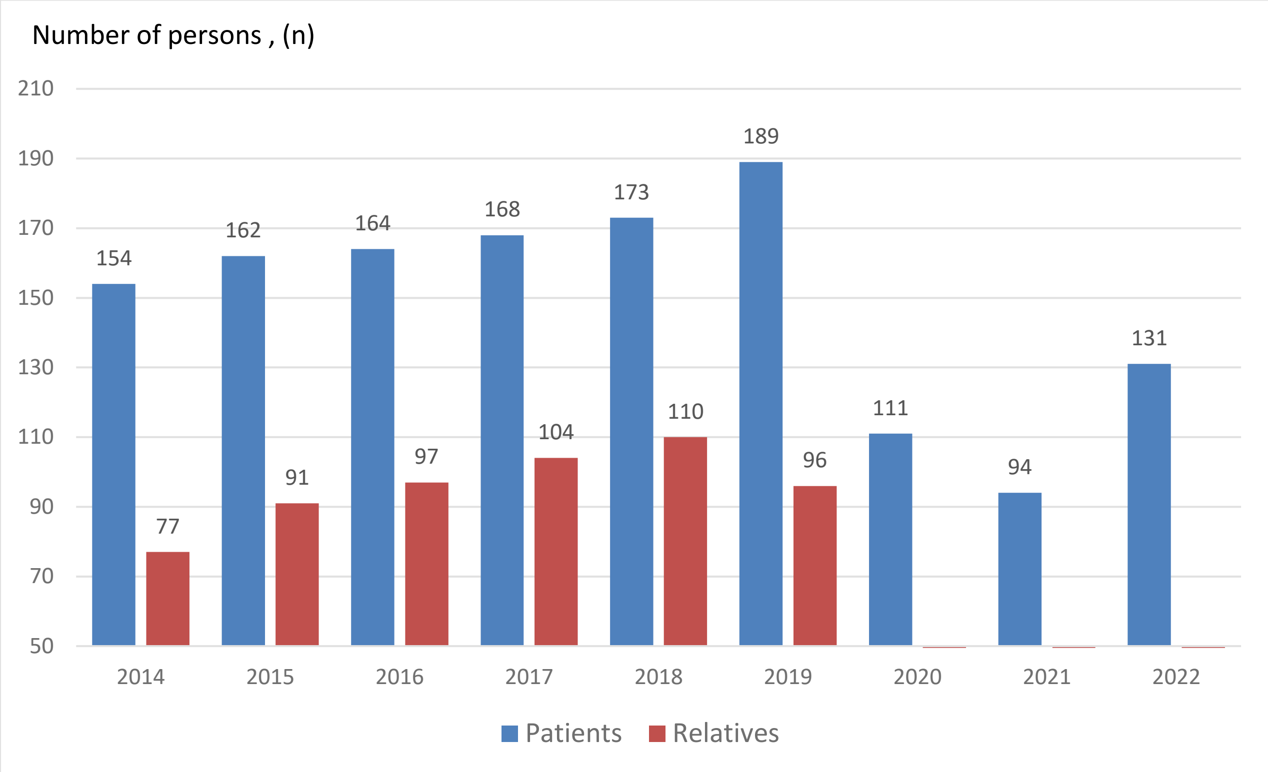


Figure 32 – Total number of patients and their relatives who attended topics of schools on prevention of STEMI, in SIG No. 3 for 2014-2022

A total of 1346 patients and 630 relatives attended the stroke prevention school between 2014 and 2022.

In 2014, 8 topics were visited with almost equal frequency: "Arterial hypertension and stroke" – 81.2% of patients and 89.6% of relatives, "Obesity as a risk factor for stroke. Healthy diet" – 79.2% of patients and 70.1% of relatives, "Smoking and health" – 75.3% of patients and 61.0% of relatives, "Physical activity and health" – 74.0% of patients and 58.4% of relatives, "Stress and health" – 80.5% of patients and 88.3% of relatives, "Primary prevention of vascular disease" – 85.1% of patients and 84.4% of relatives, "Secondary prevention of vascular disease" – 81.8% of patients and 81.8% of relatives, and "Life after stroke" – 96.8% of patients and 93.5% of relatives. "Positioning in rehabilitation" and "The place of the speech therapist in the education of relatives who had suffered a VSD" were the least demanded among patients – attended by only 46.8% and 52.6% in 2014 – but very important for relatives, who listened to these topics in 74.0% and 80.5% of cases [156].

The same trend was observed in the other years. The lecture "Arterial hypertension and stroke" was attended by 78.4% of patients and 78.0% of relatives in 2015, in 2016. – 78.7% and 75.3%, in 2017. – 77.4% and 69.2%, in 2018. – 76.3% and 64.5%, and in 2019, 70.9% and 78.1%, respectively. The topic "Obesity as a risk factor for stroke. Healthy diet" was attended by 77.2% and 61.5% of patients and their relatives in 2015, 75.6% and 56.7% in 2016, 76.8% and 53.8% in 2017, 75.7% and 55.5% in 2018, and 71.4% and 64.6% in 2019, respectively. The topic "Smoking and Health" was attended by 74.1% of patients in 2015, 75.6% in 2016, 74.4% in 2017, 74.0% in 2018 and 69.8% in 2019, and 56.0%, 53.6%, 48.1%, 48.2%, 56.3% of relatives, respectively. The lecture "Physical activity and health" was attended in 2015. 71.0% and 47.3% of patients and their relatives respectively, in 2016. – 70.7% and 45.4%, in 2017. – 70.8% and 46.2%, in 2018. – 69.9% and 37.3%, and in 2019, 65.1% and 46.9% of patients and their relatives, respectively. The topic "Stress and Health" was attended by 77.2%, 77.4%, 78.6%, 76.9% and 70.9% of patients in 2015, 2016, 2017, 2018 and 2019 and 78.0%, 72.2%, 68.3%, 65.5% and 77.1% of relatives, respectively. The lectures "Primary prevention of vascular disease" and "Secondary prevention of vascular disease" were attended by 80.2% and 78.4% of patients and 73.6% and 71.4% of relatives in 2015, and in 2016. – 80.5% and 78.7% of patients and 70.1% and 69.1% of relatives, in 2017. – 79.2% and 78.0% of patients and 68.3% and 67.3% of relatives, in 2018. – 78.0% and 66.4% of patients and 76.3% and 64.5% of relatives, and in 2019, 73.0% and 78.1% of patients and 71.4% and 72.9% of relatives. Less than ½ of the patients listened to the topics "Positioning in rehabilitation" and "The place of the speech therapist in the education of relatives who have had a SNMD": 45.7% and 50.6% in 2015, 47.6% and 51.2% in 2016, 48.8% and 51.2% in 2017, 48.6% and 53.2% in 2018, and 45.0% and 52.4% in 2019, whereas relatives attended these lectures more actively: 71.4% and 69.2% in 2015, 74.2% and

69.1% in 2016, 85.6% and 65.4% in 2017, 80.0% and 65.5% in 2018 and 97.9% and 78.1% in 2019, respectively The "Life after stroke" lecture was the most requested lecture, attended by 93.2%, 93.3%, 93.5%, 91.9% and 85.7% of patients from 2015 to 2019 and 76.9%, 75.3%, 71.2%, 68.2% and 79.2% of relatives (Table 41) [111].

During the pandemic period, as well as in other SIGs, a lower percentage of listeners for each topic was observed. For example, the topic "Arterial hypertension and stroke" was listened to by 777 (79.9%) patients and 431 (74.9%) relatives until 2020, after 2020. – 218 (64.9%) and 43 (78.2%), respectively ($p<0.01$ and $p=0.6$). The topic "Obesity as a risk factor for stroke. Healthy diet" was listened to by 766 (75.8%) patients and 344 (59.8%) relatives until 2020, after 2020. – 144 (42.9%) and 21 (38.2%), respectively ($p<0.01$ and $p=0.02$). Patients who listened to the topic "Smoking and Health" were 745 (73.8%) and 124 (36.9%) before and during the pandemic, respectively ($p<0.01$), and relatives were 307 (53.4%) and 21 (38.2%), respectively ($p=0.01$). The topic "Physical activity and health" was listened to by 708 (70.1) patients before the pandemic and 187 (55.7%) during the pandemic [$p<0.01$], and among relatives, 266 (46.3%) and 28 (50.9), respectively ($p=0.5$). Among patients and their relatives, 775 (76.7%) and 426 (74.1%) people listened to the topic "Stress and Health" between 2014-2019, and between 2020-2022. – 253 (75.3%) and 54 (98.2%) patients and their relatives, respectively ($p=0.71$ and $p=0.01$). Statistically significant differences were also found for listening to the topic "Primary prevention of vascular diseases", which was listened to by 799 (79.7%) patients and 419 (72.9%) relatives before the pandemic and by 214 (63.7%) patients and 47 (85.5%) relatives during the pandemic ($p<0.01$ and $p=0.02$). The topic "Secondary prevention of vascular disease" also showed statistically significant differences both among patients who listened to it in the number of 780 (77.2%) and 406 (70.6%) before and during the pandemic, respectively ($p<0.01$), and among relatives who listened to this topic in a higher percentage of cases during the pandemic than before it (47 (85.5%) and 406 (70.6%), respectively, $p=0.1$). Both before and during the pandemic, the topic "Positioning in Rehabilitation" was listened to by a small number of both patients (475 (47.0%) and 90 (26.8%), respectively; $p<0.01$) and relatives (465 (80.9%) and 17 (30.9%), respectively; $p<0.01$). The number of both patients and relatives who listened to the topic "The place of the speech therapist in the education of relatives who have experienced a SNMD" also decreased during the pandemic compared to 2014-2019. – Among patients from 524 (51.9%) to 58 (17.3%) [p<0.01] and among relatives from 407 (70.8%) to 12 (21.8%) [p<0.01]. The topic "Life after stroke" remained one of the most requested topics, but the percentage of patients (248 (73.8%) and 931 (92.2%), respectively; p=0.06) and relatives (51 (92.7% and 248 (73.8%), respectively; p<0.01) who listened to it was significantly lower between 2020 and 2022 than between 2014 and 2019 [p<0.01]. The school topic "New coronavirus infection and stroke" was attended by 336 (100%) patients and 55 (100.0%) relatives between 2020-2022 (Table 42).

Thus, the data obtained for each PCP show the demand for our educational activities both among patients and their relatives. Rehabilitation and further prevention of cardiovascular events is possible only with the active participation of the patient himself, and this is what these educational activities are aimed at. However, it is important to note that not all patients attend these schools and further improvement of medical care should be aimed at attracting more students.

Over the 9 years of the school's existence, 4,195 trainees were trained at the RRC: 462 in 2014 (66.7% of patients and 33.3% of relatives), 524 in 2015 (64.0% of patients and 36.0% of relatives), 574 in 2016 (59.6% of patients and 40.4% of relatives), 584 in 2017 (60.1% of patients and 39.9% of relatives), 624 in 2018. (58.3% patients and 41.7% relatives), 632 in 2019 (63.6% patients and 36.4% relatives), 342 in 2020 (88.0% patients and 12% relatives), 215 in 2021 (100% patients), and 448 in 2022 (88.4% patients and 11.6% relatives) (Figure 33).

The most popular topic of the school for patients and their relatives in RRC was "Arterial hypertension and stroke", which was listened to in 2014. 96.1% of patients and 92.2% of relatives, in 2015. – 92.0% and 71.5%, in 2016. – 87.4% and 62.5%, in 2017. – 86.0% and 63.9%, in 2018. – 85.7% and 58.1%, and in 2019, 78.4% and 65.2% of patients and their relatives, respectively.

The topic "Obesity as a risk factor for stroke. Healthy Eating" was attended by 78.2% of patients and 81.2% of relatives in 2014, 75.0% and 62.0% in 2015, 71.9% and 54.3% in 2016, 70.7% and 54.5% in 2017, 68.7% and 49.2% in 2018, and 62.4% and 56.5% of patients and relatives, respectively, in 2019.

The topic "Smoking and health" was listened to by 63.6% of patients and 63.6% of relatives in 2014, in 2015. – 60.8% and 49.5%, in 2016. – 58.8% and 42.2%, in 2017. – 57.8% and 42.5%, in 2018. – 56.6% and 38.8%, and in 2019, 52.0% and 44.8% of patients and their relatives, respectively.

Table 42 – Number of patients and their relatives who attended school topics on prevention of STEMI in PCP No. 3 for 2014-2022

School topics		2014	2015	2016	2017	2018	2019	2020	2021	2022
Arterial hypertension and stroke	patiens	125	127	129	130	132	134	69	37	112
	relatives	69	71	73	72	71	75	9	0	34
Obesity as a risk factor for stroke. Healthy eating	patiens	122	125	124	129	131	135	21	25	98
	relatives	54	56	55	56	61	62	5	0	16
Smoking and health	patiens	116	120	124	125	128	132	19	22	83
	relatives	47	51	52	50	53	54	4	0	17
Physical activity and health	patiens	114	115	116	119	121	123	48	34	105
	relatives	45	43	44	48	41	45	7	0	21
Stress and health	patiens	124	125	127	132	133	134	99	46	108
	relatives	68	71	70	71	72	74	13	0	41
Primary prevention of vascular diseases	patiens	131	130	132	133	135	138	105	28	81
	relatives	65	67	68	71	73	75	11	0	36
Secondary prevention of vascular diseases	patiens	126	127	129	131	132	135	105	31	79
	relatives	63	65	67	70	71	70	11	0	36
Positioning in rehabilitation	patiens	72	74	78	82	84	85	24	12	54
	relatives	57	65	72	89	88	94	5	0	12
The place of the speech therapist in the education of relatives who have suffered from a neurological disorder	patiens	81	82	84	86	92	99	15	7	36
	relatives	62	63	67	68	72	75	4	-	8

Life after a stroke	patiens	149	151	153	157	159	162	99	42	107
	relatives	72	70	73	74	75	76	12	-	39
A new coronavirus infection and stroke	patiens							11	94	131
	relatives							13	-	42

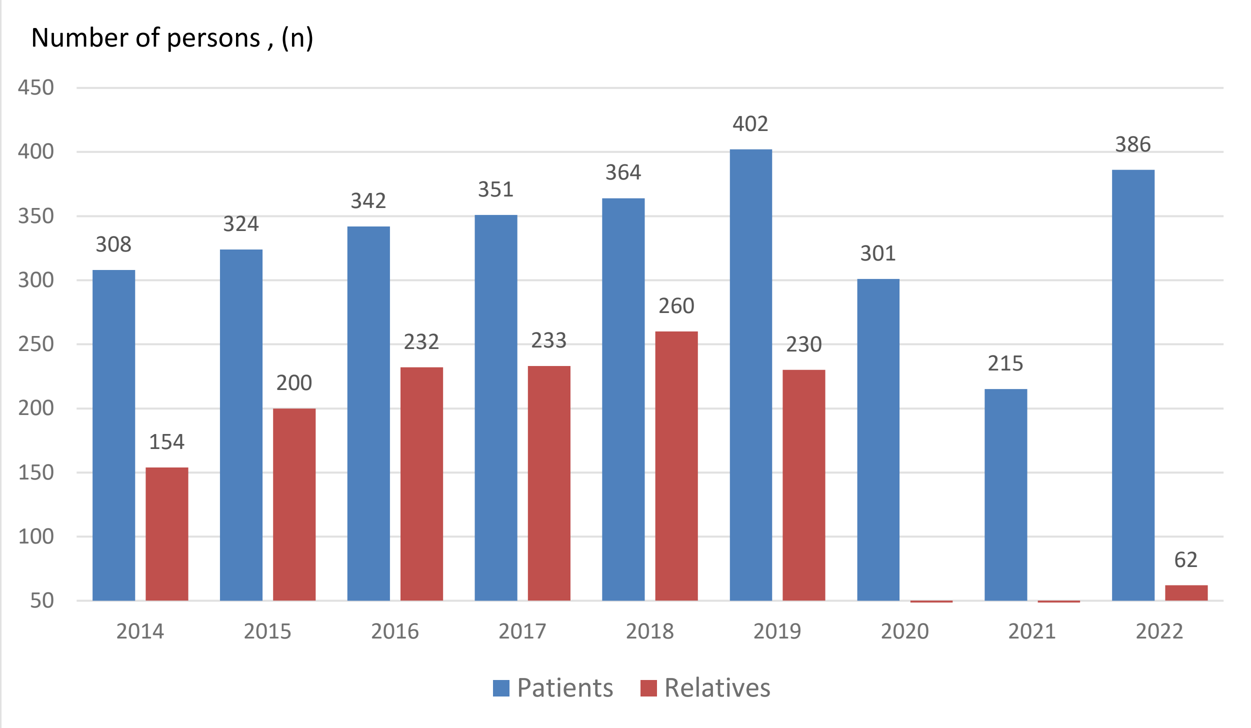


Figure 33 – Total number of patients and their relatives who listened to the topics of the CNMC prevention schools at the RRC for 2014-2022

In 2014, the topic "Physical activity and health" was listened to by 57.8% of patients and 65.6% of relatives, in 2015. – 55.2% and 51.0%, in 2016. – 52,9% and 44.4%, in 2017. – 51.9% and 43.8%, in 2018. – 50.8% and 40.0%, and in 2019, 47.0% and 45.7% of patients and their relatives, respectively.

The Stress and Health Lecture was attended by 54.9% and 72.7% of patients and their relatives respectively in 2014, 53.1% and 57.0% in 2015, 50.6% and 49.6% in 2016, 50.1% and 49.8% in 2017, 49.2% and 45.0% in 2018, and 45.0% and 51.7% of patients and their relatives respectively in 2019.

"Primary prevention of vascular disease" was listened to by 52.6%, 50.3%, 48.2%, 48.1%, 47.0%, and 43.0% of patients between 2014 and 2019. and 73.4%, 57.0%, 50.0%, 50.2%, 45.4% and 51.3% of their relatives in the same years, respectively, while the topic

"Secondary prevention of vascular diseases" was listened to by 60.1%, 57.7%, 55.0%, 54.4%, 53.0% and 48.5% of patients for 2014-2019 and 72.7%, 56.5%, 49.6%, 49.8%, 45.4%, 51.7% of relatives in the same years, respectively.

The topic "Positioning in rehabilitation" was listened to least often by patients, whereas among relatives this topic was one of the most popular. Thus, only 58.1%, 55.9%, 53.5%, 52.7%, 50.5%, and 46.3% of patients listened to this topic in 2014-2019, whereas among relatives of patients, 100%, 100%, 93.5%, 93.6%, 84.6%, and 95.7% listened to this topic in the same years, respectively.

The topic "The place of a speech therapist in the education of relatives who had suffered from STEMI" was also rarely attended by patients and their relatives: in 2014, this lecture was listened to by 38.2% and 72.7% of patients and their relatives respectively, in 2015. – 55.0% and 53.0%, in 2016. – 30.4% and 47.4%, in 2017. – 30.5% and 48.1%, in 2018. – 30.2% and 43.5%, and in 2019, 28.4% and 49.1% of patients and their relatives, respectively.

The lecture "Life after stroke" was listened to in 2014. 78.6% and 85.7% of patients and their relatives, respectively, in 2015. – 75.3% and 66.5%; in 2016 – 71.6% and 56.5%; in 2017. – 70.4% and 57.5%; in 2018. – 69,0% и 51,9% and in 2019, 63.9% and 59.1% of patients and their relatives, respectively (Table 43).

Similarly to the PCP, in the RHC during the pandemic, the percentage of listeners statistically significantly decreased for all topics of the school. Thus, the topic "Arterial hypertension and stroke" was listened to by 1822 (87.1%) patients and 880 (67.4%) relatives before the pandemic, and during the pandemic – by 636 (70.5%) patients and 81 (78.6%) relatives ($p<0.01$ and $p=0.1$). The topic "Obesity as a risk factor for stroke.

Healthy Nutrition" was attended by 1479 (70.7%) patients and 760 (58.2%) relatives in the period 2014-2019. 1479 (70.7%) patients and 760 (58.2%) relatives, and in the period 2020-2022. – 331 (36.7%) and 37 (35.9%) patients and relatives, respectively ($p<0.01$). The same trend was observed for the topic "Smoking and Health" – among patients, 1212 (57.9%) and 273 (30.3%) people listened to this topic before and during the pandemic, respectively ($p<0.01$), and among relatives, 598 (45.8%) and 23 (22.3%) people listened to this topic, respectively ($p<0.01$). The topic "Physical activity and health" was attended by

1094 (52.3%) patients and 617 (47.2%) relatives between 2014-2019, and between 2020-2022. – 272 (30.2%) and 80 (77.7%), respectively (p<0.01).

Table 43 – Number of patients and their relatives who attended school topics The number of patients and their relatives who attended the topics of schools on prevention of STEMI in RRCs for 2014-2022.

School topics		2014	2015	2016	2017	2018	2019	2020	2021	2022
Arterial hypertension and stroke	patiens	296	298	299	302	312	315	198	184	254
	relatives	142	143	145	149	151	150	32	0	49
Obesity as a risk factor for stroke. Healthy eating	patiens	241	243	246	248	250	251	54	124	153
	relatives	125	124	126	127	128	130	14	0	23
Smoking and health	patiens	196	197	201	203	206	209	61	101	111
	relatives	98	99	98	99	101	103	9	0	14
Physical activity and health	patiens	178	179	181	182	185	189	81	67	124
	relatives	101	102	103	102	104	105	24	0	56
Stress and health	patiens	169	172	173	176	179	181	251	201	294
	relatives	112	114	115	116	117	119	39	0	61
Primary prevention of vascular diseases	patiens	162	163	165	169	171	173	264	119	201
	relatives	113	114	116	117	118	118	41	0	61
Secondary prevention of vascular diseases	patiens	185	187	188	191	193	195	264	119	201
	relatives	112	113	115	116	118	119	41	0	61
Positioning in rehabilitation	patiens	179	181	183	185	184	186	27	14	47
	relatives	154	216	217	218	220	220	9	0	19
Place of the speech therapist in the education of relatives who have suffered from a neurological disorder	patiens	101	103	104	107	110	114	31	21	26
	relatives	112	110	110	112	113	113	11	-	11
Life after a stroke	patiens	242	244	245	247	251	257	200	187	302
	relatives	132	133	131	134	135	136	38	-	54

A new coronavirus infection and stroke	patiens							301	215	386
	relatives							41	-	62

The topic "Stress and Health" showed differences in the percentage of attendees among patients before and during the pandemic (1050 (50.2%) and 746 (82.7%), respectively; $p<0.01$), whereas among relatives during the pandemic, this topic was attended by more attendees (693 (53.1%) and 100 (97.1%), respectively; $p<0.01$). The topic "Primary prevention of vascular disease" was listened to by 1003 (47.9%) and 696 (53.3%) patients and relatives before the pandemic and by 584 (64.8%) and 102 (99.0%), respectively, during the pandemic ($p<0.01$). The topic "Secondary prevention of vascular disease" was listened to by 1139 (54.5%) and 693 (53.1%) patients and relatives, respectively, before the pandemic, and 584 (64.8%) and 102 (99.0%), respectively, during the pandemic ($p<0.01$). On the topic of positioning in rehabilitation, the number of trainees also decreased during the pandemic: among patients from 1098 (52.5%) to 88 (9.8%) [$p<0.01$], among relatives from 1245 (95.3%) to 28 (27.2%) [$p<0.01$]. The topic "The place of the speech therapist in the education of relatives who have had a SNMD" was the least demanded topic during the pandemic, which was listened to by 78 (8.7%) and 22 (21.4%) patients and relatives, respectively, during the pandemic, whereas before the pandemic this topic was listened to by 639 (30.6%) patients and 670 (51.3%) relatives ($p<0.01$). The topic "Life after stroke" was listened to by 1486 (71.1%) and 801 (61.3%) patients and relatives between 2014-2019 and 2020-2022, respectively. – 689 (76.4%) and 92 (89.3%) patients and relatives, respectively ($p=0.0$ and $p<0.01$). The topic "New coronavirus infection and stroke" during the pandemic period was attended by 902 (100%) patients and 103 (100%) relatives (see Table 43).

Analysis of the data showed a significant interest from the audience (both patients and their relatives) in the topics discussed at these educational events. Our further recommendations will be aimed at attracting more attendees from both patients and their caregivers.

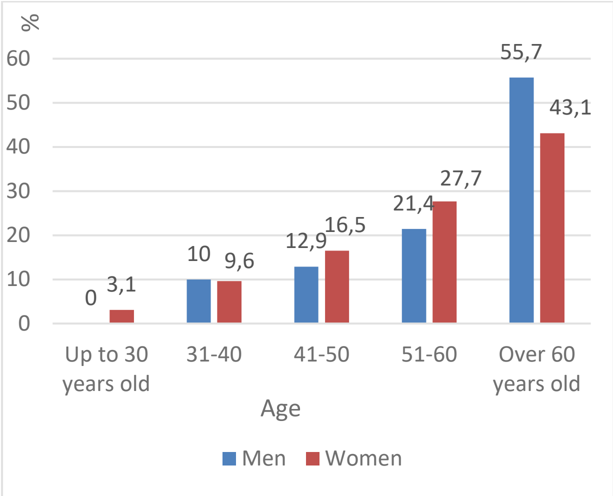
Knowledge about stroke (general information and risk factors) and recognition of symptoms are key factors in its secondary prevention. Considering the staggering annual incidence of stroke worldwide, including in the Russian Federation, secondary prevention becomes a serious problem. For this reason, it is necessary to have an understanding of the population's knowledge of stroke and its risk factors, the risk of recurrent stroke to develop strategies to facilitate the habitual behavioral changes necessary to reduce the likelihood of recurrent stroke. The scientific literature on stroke outcomes is extensive, whereas data on the knowledge of previous stroke patients about the disease and its symptoms are scarce.

The risk of stroke can be significantly reduced by medical interventions, the effectiveness of which has been proven in numerous randomized trials. To date, arterial hypertension is the most important risk factor for stroke, and therapy of dyslipidemia with statins can achieve an even greater reduction in stroke risk. Anticoagulant therapy for atrial fibrillation and carotid endarterectomy for symptomatic high-grade carotid stenosis are also highly effective methods of stroke prevention. At the same time, widespread use of aspirin, statins, or vitamins in healthy individuals is not a recommended preventive measure. Results of observational studies suggest that lifestyle changes, including a healthy diet, smoking cessation and cessation of alcohol abuse, regular physical activity, and achieving a normal body weight are effective stroke prevention measures. In the vascular centers of the Tyumen region over 6 years, 8254 people were trained in specially designed schools, which, in our opinion, is a significant contribution to the work on secondary prevention of the disease.

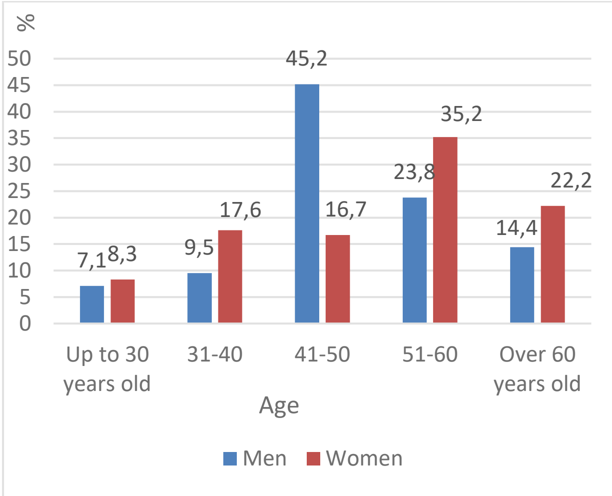
Based on the results of the schools' activities in each center, a questionnaire was administered to the trainees, using a questionnaire specially developed by us (Questionnaire for school trainees – patients who have suffered from STEMI and their relatives, Appendix E, p. 369). 328), where we clarified their opinion about the quality of information work and knowledge obtained.

In the three vascular centers, 550 questionnaires each were selected and analyzed, 400 (72.7%) patients and 150 (27.3%) relatives. Among patients in each group, there were 140 (35.0%) men and 260 (65.0%) women, and among relatives, there were 42 (28.0%) men and 108 (72.0%) women (Figure 34).

Also, in order to assess the effectiveness of the ongoing training, part of the questionnaire questions regarding the knowledge gained were distributed to 100 patients and their relatives (25 people in each PCP and RRC) who, for one reason or another, could not attend schools for stroke patients and their relatives.



Patients



Relatives

Figure 34 – Distribution of respondents of SIG No. 1 by gender and age

In PCP No. 1, respondents under the age of 30 years were among patients were 8 (2.0%) persons and 12 (8.0%) persons among relatives; at the age of 31-40 years – 39 (9.8%) and 23 (15.3%) people, 41-50 – 61 (15.3%) and 37 (24.7%) people, 51-60 – 102 (25.5%) and 48 (32.0%) people and above 60 years of age – 190 (47.4%) and 30 (20.0%) people of patients and their relatives respectively (Figure 34).

Among the respondents, 205 (37.3%) were employed: 148 (37.0%) patients and 57 (38.0%) relatives, – 242 (44.0%) were retired: 184 (46.0%) patients and 58 (38.7%) relatives – and 103 (18.7%) were not employed: 68 (17.0%) patients and 35 (23.3%) relatives (Table 44) [111].

All respondents gave a positive answer to the question "Is it necessary to conduct schools for stroke patients and their relatives? However, as a result of the questionnaire it was revealed that not all the trainees received enough information from the classes. The majority of respondents gave a positive answer to this question – 514 (93.5%) people: 376 (94.0%) patients and 138 (92.0%) relatives, – 2 (0.5%) people (relatives) gave a negative answer and 22 (5.5%) found it difficult to answer: 8 (5.7%) patients and 7 (4.7%)

relatives. 100% of respondents reported that the information provided in the classes was delivered in an accessible manner [111].

Table 44 – Social status of respondents of SIG No. 1

Status	Age, years									
	Up to 30	31-40	41-50	51-60	>60	Up to 30	31-40	41-50	51-60	>60
	Patients									
	Men (n=140)					Women (n=260)				
It's working	-	14 33,3%	-	18 42,9%	10 23,8%	8 7,5%	7 6,6%	29 27,4%	28 26,4%	34 32,1%
Pensioner	-	-	-	8 10,5%	68 89,5%	-	-	-	30 27,8%	78 72,2%
It's not working	-	-	18 81,8%	4 18,2%	-	-	18 39,1%	14 30,5%	14 30,5%	-
Student	-	-	-	-	-	-	-	-	-	-
	Relatives									
	Men (n=42)					Women (n=108)				
It's working	3 16,7%	-	9 50,0%	6 33,3%	-	5 12,8%	12 30,8	8 20,5%	6 15,4%	8 20,5%
Pensioner	-	-	-	4 40,0%	6 60,0%	-	-	-	32 66,7%	16 33,3%
It's not working	-	4 28,6%	10 71,4%	-	-	4 19,0%	7 33,3%	10 47,7%	-	-
Student	-	-	-	-	-	-	-	-	-	-

The majority of the surveyed trainees (502; 91.3%) reported that they had gained practical skills in patient care, of which 367 (91.7%) were patients and 135 (90.0%) relatives. Seven (1.3%) responded negatively to this question, 4 (1.0%) patients and 3 (2.0%) relatives. There were 41 (7.4%) respondents who found it difficult to answer, of whom 29 (7.3%) were patients and 12 (8.0%) were relatives [111].

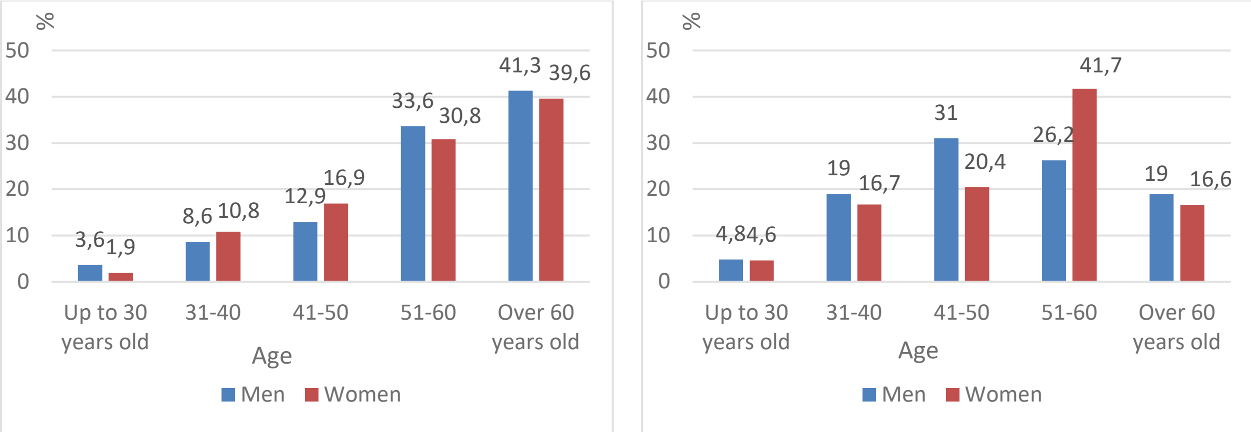
To the questions "Do you know the risk factors for stroke?" and "Can you name the first signs of stroke?" 100% of respondents gave a positive answer. Almost all trainees (539; 98.0%) gave a positive answer to the question "Can you help a person who has had a sudden stroke?", only 11 (2.0%) had difficulty answering it, including 8 (2.0%) patients and 3 (2.0%) relatives. 485 (88.2%) respondents reported that they received enough handouts (booklets, leaflets, methodological recommendations): 356 (89.0%) patients and 129 (86.0%) relatives, – 48 (8.7%) gave a negative answer to this question: 31 (7.8%) patients and 17 (11.3%) relatives, – 17 (3.1%) people found it difficult to answer: 13 (3.2%) patients and 4 (2.7%) relatives. Almost all respondents (521; 94.7%) were satisfied with the school for stroke patients and their relatives: 383 (95.8%) patients and 138 (92.0%) relatives. Only 13 (2.4%) people gave a negative answer to this question: 4 (1.0%) patients and 7 (4.7%) relatives – and 18 (3.3%) people found it difficult to answer: 13 (3.2%) patients and 5 (3.3%) relatives (Table 45) [110, 111].

Table 45 – Results of the questionnaire on the conducted schools for stroke patients and their relatives with PCO #1

Answer options	Patients		Relatives	
	Men	Women	Men	Women
Was the information you received in class sufficient?				
Yes	132 (94,3%)	244 (93,8%)	39 (92,9%)	99 (91,7%)
No	-	2 (0,8%)	1 (2,4%)	4 (3,7%)
I can't answer that	8 (5,7%)	14 (5,4%)	2 (4,7%)	5 (4,6%)
Did you gain practical nursing skills?				
Yes	121 (86,4%)	246 (94,6%)	35 (83,3%)	100 (92,6%)
No	2 (1,4%)	2 (0,7%)	2 (4,7%)	1 (0,9%)
I can't answer that	17 (12,2%)	12 (4,7%)	5 (12,0%)	7 (6,5%)
Can you assist a person who has had a sudden stroke?				
Yes	133 (95,0%)	259 (99,6%)	40 (95,2%)	107 (99,1%)
No	-	-	-	-
I can't answer that	7 (5,0%)	1 (0,4%)	2 (4,8%)	1 (0,9%)
Do you have enough handouts (booklets, leaflets, methodological recommendations)?				
Yes	117 (83,6%)	239 (91,9%)	38 (90,6%)	91 (84,2%)
No	16 (11,4%)	15 (5,8%)	2 (4,7%)	15 (13,9%)
I can't answer that	7 (5,0%)	6 (2,3%)	2 (4,7%)	2 (1,9%)
Are you satisfied with the "School for stroke patients and their relatives"?				
Yes	129 (92,1%)	254 (97,7%)	38 (90,6%)	100 (92,6%)
No	2 (1,4%)	2 (0,7%)	2 (4,7%)	5 (4,6%)
I can't answer that	9 (6,5%)	4 (1,6%)	2 (4,7%)	3 (2,8%)

In PCP #2, among those interviewed, 10 (2.5%) patients and 7 (4.7%) relatives were under the age of 30 years; 40 (10.0%) and 26 (17.3%) were aged 31-40 years, 62

(15.5%) and 35 (23.3%) were aged 41-50 years, 127 (31.8%) and 56 (37.3%) were aged 51-60 years, and 161 (40.3%) and 26 (17.3%) were aged over 60 years (Figure 35).



Patients **Relatives**

Figure 35 – Distribution of SIG No. 2 respondents by gender and age

Among the respondents, 207 (37.6%) were employed: 167 (41.8%) patients and 40 (26.7%) relatives, – 239 (43.5%) were retired: 180 (45.0%) patients and 59 (39.3%) relatives – and 104 (18.7%) were not employed: 53 (13.2%) patients and 51 (34.0%) relatives (Table 46) [110].

Table 46 – Social status of respondents of SIG No. 2

Status	Age, years									
	Up to 30	31-40	41-50	51-60	>60	Up to 30	31-40	41-50	51-60	>60
	Patients									
	Men (n=140)					Women (n=260)				
It's working	5 9,4%	9 17,0%	12 22,6%	14 26,4%	13 24,6%	5 4,4%	14 12,3%	33 28,9%	28 24,6%	34 29,8%
Pensioner	-	-	-	24 34,8%	45 65,2%	-	-	-	42 37,8%	69 62,2%
It's not working	-	3 16,7%	6 33,3%	9 50,0%	-	-	14 40,0%	11 31,4%	10 28,6%	-
	Relatives									
	Men (n=42)					Women (n=108)				
It's working	2 13,3%	6 40,0%	5 33,4%	-	2 13,3%	1 4,0%	5 20,0%	8 32,0%	6 24,0%	5 20,0%
Pensioner	-	-	-	9	6	-	-	-	31	13

				60,0%	40,0%				70,5%	29,5%
It's not working	-	2 16,7%	8 66,6%	2 16,7%	-	4 10,3%	13 33,3%	14 35,9%	8 20,5%	-

According to the results of the questionnaire survey conducted in PCP No. 2, all respondents answered positively to the question about the need to conduct schools for stroke patients and their relatives. To the question "Is the information you received at the training session sufficient?" 496 (90.2%) responded affirmatively: 364 (91.0%) patients and 132 (88.0%) relatives; 14 (2.5%) responded negatively: 10 (2.5%) patients and 4 (2.7%) relatives and 40 (7.3%) respondents found it difficult to answer: 26 (6.5%) patients and 14 (9.3%) relatives. Almost all respondents answered that the information during the sessions was delivered to them in an understandable manner: 532 (96.7%) people – 387 (96.7%) patients and 145 (96.7%) relatives; only 5 (0.9%) responded that the information was delivered inaccessibly – 2 (0.5%) patients and 3 (2.0%) relatives – and 13 (2.4%) found it difficult to answer this question – 11 (2.8%) patients and 2 (1.3%) relatives.

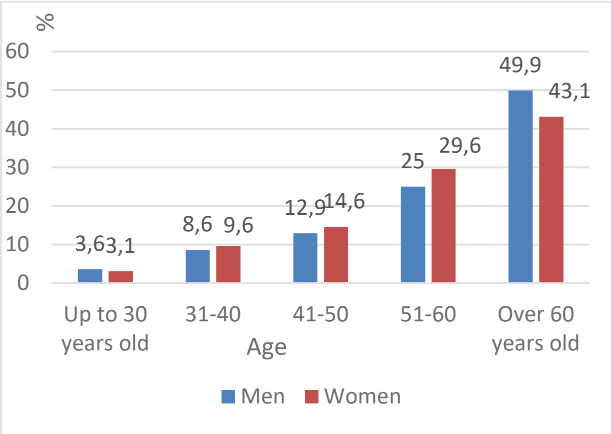
The majority of respondents reported that they had gained practical skills in patient care – 489 (88.9%) people: 361 (90.3%) patients and 128 (85.3%) relatives; 13 (2.4%) people answered this question negatively: 7 (1.8%) patients and 6 (4.0%) relatives – and 48 (8.7%) people had difficulty answering: 32 (7.9%) patients and 16 (10.7%) relatives. Only 9 (1.6%) people could not name stroke risk factors: 6 (1.5%) patients and 3 (2.0%) relatives – and 14 (2.5%) had difficulty answering this question, whereas 527 (95.8%) gave a positive answer: 385 (96.3%) patients and 142 (94.7%) relatives. At the same time, 100% of respondents knew the first signs of the disease. Almost all (535; 97.2%) respondents answered that they knew how to give first aid to a person who had a sudden stroke – 390 (97.6%) patients and 145 (96.6%) relatives; only 2 (0.4%) gave a negative answer to this question: 1 (0.3%) patient and 1 (0.7%) relative – and 13 (2.4%) found it difficult to answer this question: 9 (2.2%) patients and 4 (2.7%) relatives. 472 (85.8%) respondents reported that the handout distributed after each lecture was sufficient for them: 350 (87.5%) patients and 122 (81.4%) relatives; 48 (8.7%) would like more information material: 31 (7.8%) patients and 17 (11.3%) relatives – and 30 (5.5%) found it difficult to answer this question: 19 (4.7%) patients and 11 (7.3%) relatives. The majority of respondents (484; 88.0%) – 357 (89.2%) patients and 127 (84.7%) relatives – were completely satisfied with the school for stroke patients and their relatives; only 28 (5.1%) were dissatisfied with the sessions: 14 (3.5%) patients and 14 (9.3%) relatives – and 38 (6.9%) found it difficult to answer this question: 29 (7.3%) patients and 9 (6.0%) relatives (Table 47) [111].

Table 47 – Results of the questionnaire on the conducted schools for stroke patients and their relatives with PCO #2

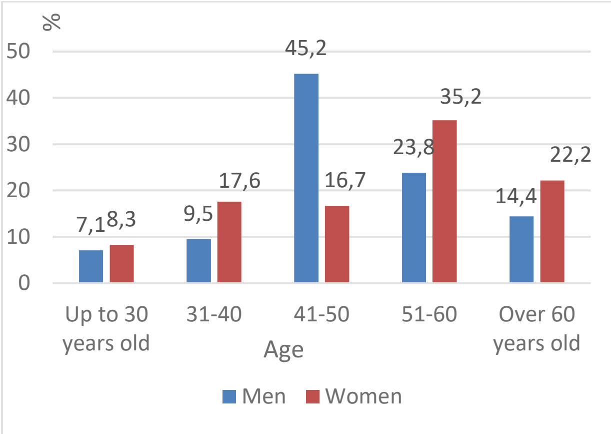
Answer options	Patients		Relatives	
	Men	Women	Men	Women
Was the information you received in class sufficient?				
Yes	124 (88,6%)	240 (92,3%)	37 (88,1%)	95 (88,0%)
No	5 (3,6%)	5 (1,9%)	1 (2,4%)	3 (2,8%)
I can't answer that	11 (7,8%)	15 (5,8%)	4 (9,5%)	10 (9,2%)
Is the information delivered to you in an accessible manner?				
Yes	136 (97,2%)	251 (96,5%)	42 (100%)	103 (95,3%)
No	1 (0,7%)	1 (0,4%)	-	3 (2,8%)
I can't answer that	3 (2,1%)	8 (3,1%)	-	2 (1,9%)
Did you gain practical nursing skills?				
Yes	116 (82,9%)	245 (94,2%)	35 (83,3%)	93 (86,1%)
No	4 (2,9%)	3 (1,1%)	1 (2,4%)	5 (4,6%)
I can't answer that	20 (14,2%)	12 (4,7%)	6 (14,3%)	10 (9,3%)
Do you know the risk factors for stroke?				
Yes	132 (94,3%)	253 (97,3%)	40 (95,2%)	102 (94,4%)
No	2 (1,4%)	4 (1,6%)	1 (2,4%)	2 (1,9%)
I can't answer that	6 (4,3%)	3 (1,1%)	1 (2,4%)	4 (3,7%)
Can you assist a person who has had a sudden stroke?				
Yes	137 (97,9%)	253 (97,3%)	42 (100%)	103 (95,4%)
No	-	1 (0,4%)	-	1 (0,9%)
I can't answer that	3 (2,1%)	6 (2,3%)	-	4 (3,7%)
Do you have enough handouts (booklets, leaflets, methodological recommendations)?				
Yes	116 (82,9%)	234 (90,0%)	34 (81,0%)	88 (81,5%)
No	15 (10,7%)	16 (6,2%)	3 (7,1%)	14 (13,0%)
I can't answer that	9 (6,4%)	10 (3,8%)	5 (11,9%)	6 (5,5%)
Are you satisfied with the "School for stroke patients and their relatives"?				
Yes	122 (87,1%)	235 (90,4%)	34 (81,0%)	93 (86,1%)
No	5 (3,6%)	9 (3,5%)	4 (9,5%)	10 (9,3%)
I can't answer that	13 (9,3%)	16 (6,1%)	4 (9,5%)	5 (4,6%)

In PCP No. 3 (Figure 36). among the respondents under 30 years of age there were 13 (3.3%) patients and 12 (8.0%) relatives; aged 31-40 years, 37 (9.3%) and 23 (15.3%)

patients, 41-50 years, 56 (14.0%) and 37 (24.7%) patients, 51-60 years, 112 (28.0%) and 48 (32.0%) patients and over 60 years, 182 (45.5%) and 30 (20.0%) patients and their relatives, respectively.



Patients



Relatives

Figure 36 – Distribution of SIG No. 3 respondents by gender and age

Among the respondents, 204 (37.1%) were employed: 147 (36.8%) patients and 57 (38.0%) relatives, – 245 (44.5%) were retired: 187 (46.8%) patients and 58 (38.7%) relatives – and 101 (18.4%) were not employed: 66 (16.4%) patients and 35 (23.3%) relatives (Table 48) [111].

Table 48 – Social status of respondents of SIG No. 3

	Age, years									
	Up to 30	31-40	41-50	51-60	>60	Up to 30	31-40	41-50	51-60	>60
	Patients									
	Men (n=140)					Women (n=260)				
It's working	4 8,3%	9 18,8%	10 20,8%	17 35,4%	8 16,7%	6 6,1%	7 7,1%	24 24,2%	28 28,3%	34 34,3%
Pensioner	-	-	-	12 16,2%	62 83,8%	-	-	-	35 31,0%	78 69,0%
It's not working	1 5,9%	3 17,6%	8 47,1%	5 29,4%	-	2 4,2%	18 37,4%	14 29,2%	14 29,2%	-
	Relatives									
	Men (n=42)					Women (n=108)				

It's working	3 16,7%	-	9 50,0%	6 33,3%	-	5 12,8%	12 30,8%	8 20,5%	6 15,4%	8 20,5%
Pensioner	-	-	-	4 40,0%	6 60,0%	-	-	-	32 66,7%	16 33,3%
It's not working	-	4 28,6%	10 71,4%	-	-	4 19,0%	7 33,3%	10 47,7%	-	-

Having analyzed the answers received as a result of the questionnaire, it was revealed that, similarly to other vascular centers, all respondents believed that holding schools for stroke patients and their relatives is a necessary element of preventive and educational activities for the population. To the question "Is the information you received at the classes sufficient?" 501 (91.1%) respondents answered in the affirmative: 370 (92.5%) patients and 131 (87.3%) relatives; – 10 (1.8%) answered in the negative: 4 (1.0%) patients and 6 (4.0%) relatives – and 39 (7.1%) found it difficult to answer this question: 26 (6.5%) and 13 (8.7%) patients and relatives, respectively [111].

The majority of respondents – 508 (92.4%) – gave a positive answer to the question "Is information available to you?": 378 (98.7%) patients and 130 (86.7%) relatives, – would like more information 3 (0.5%) people (relatives only) and 22 (4.0%) respondents found it difficult to answer this question: 5 (1.3%) patients and 17 (11.3%) relatives. Practical skills in patient care are a significant factor in the prevention of secondary complications of stroke; 496 (90.2%) respondents reported that they had acquired these skills as a result of the sessions and could use them: 364 (93.0%) patients and 132 (88.0%) relatives, – 9 (1.6%) responded negatively: 6 (1.5%) patients and 3 (2.0%) relatives – and 45 (8.2%) found it difficult to answer this question: 30 (5.5%) patients and 15 (10.0%) relatives [111].

The following three questions of the questionnaire: "Do you know the risk factors for stroke?", "Can you name the first signs of stroke?", "Can you help a person who has had a sudden stroke?" were answered by 100% of respondents (Table 49). – 100% of respondents answered in the affirmative (Table 49).

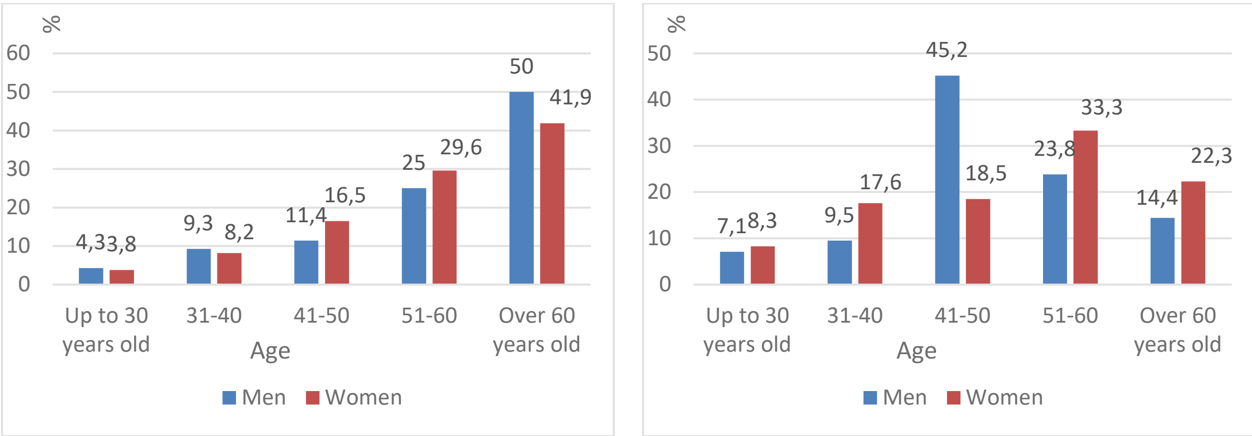
The materials distributed to the trainees contained information on the topics of the classes and in this vascular unit it was found that this material was sufficient for 488 (88.7%) respondents – 371 (92.7%) patients and 117 (78.0%) relatives, – 37 (6.7%) trainees did not know how to answer this question: 14 (3.5%) patients and 23 (15.3%)

relatives – and 25 (4.5%) respondents did not know how to answer this question: 15 (3.8%) patients and 10 (6.7%) relatives. The majority of respondents were satisfied with the quality and information content of the conducted sessions (508; 92.4%): 380 (95.0%) patients and 128 (85.3%) respondents – and the remaining 42 (7.6%) were not satisfied or found it difficult to answer this question: 20 (5.0%) patients and 22 (14.7%) relatives (Table 49).

Table 49 – Results of the questionnaire on the conducted schools for stroke patients and their relatives with PCO #3

Answer options	Patients		Relatives	
	Men	Women	Men	Women
Was the information you received in class sufficient?				
Yes	126 (90,1%)	244 (93,8%)	36 (85,7%)	95 (88,0%)
No	3 (2,1%)	1 (0,4%)	1 (2,4%)	5 (4,6%)
I can't answer that	11 (7,8%)	15 (5,8%)	5 (11,9%)	8 (7,4%)
Is the information delivered to you in an accessible manner?				
Yes	135 (96,4%)	243 (93,4%)	37 (88,1%)	93 (86,1%)
No	-	8 (3,1%)	-	3 (2,8%)
I can't answer that	5 (3,6%)	9 (3,5%)	5 (11,9%)	12 (11,1%)
Did you gain practical nursing skills?				
Yes	120 (85,7%)	244 (93,8%)	35 (83,3%)	97 (89,8%)
No	2 (1,4%)	4 (1,6%)	2 (4,8%)	1 (0,9%)
I can't answer that	18 (12,9%)	12 (4,6%)	5 (11,9%)	10 (9,3%)
Do you have enough handouts (booklets, leaflets, methodological recommendations)?				
Yes	124 (88,6%)	247 (95,0%)	25 (59,6%)	92 (76,1%)
No	8 (5,7%)	6 (2,3%)	9 (21,4%)	14 (13,0%)
I can't answer that	8 (5,7%)	7 (2,7%)	8 (19,0%)	2 (1,9%)
Are you satisfied with the "School for stroke patients and their relatives"?				
Yes	127 (90,8%)	253 (97,3%)	33 (78,5%)	95 (88,0%)
No	2 (1,4%)	2 (0,8%)	2 (4,8%)	5 (4,6%)
I can't answer that	11 (7,8%)	5 (1,9%)	7 (16,7%)	8 (7,4%)

In the RHCs, among those interviewed, 16 (4.0%) patients and 12 (8.0%) relatives were under 30 years of age; 36 (9%) and 23 (15.3%) were aged 31-40 years, 59 (14.8%) and 39 (26.0%) were aged 41-50 years, 112 (28.0%) and 46 (30.7%) were aged 51-60 years, and 179 (45.8%) and 30 (20.0%) patients and their relatives were aged over 60 years, respectively (Figure 37).



Patients **Relatives**

Figure 37 – Distribution of RCN respondents by gender and age

Among the respondents, 336 (61.1%) were employed: 228 (57.0%) patients and 108 (72.0%) relatives, – retired were 165 (30.0%): 138 (34.5%) patients and 27 (18.0%) relatives – and not employed were 48 (8.7%): 33 (8.3%) patients and 15 (10.0%) relatives; in addition, there was 1 (0.3%) student among the patients (Table 50) [111].

Table 50 – Social status of the respondents of the DMCs

Social status	Age, years									
	Up to 30	31-40	41-50	51-60	>60	Up to 30	31-40	41-50	51-60	>60
	Patients									
	Men (n=140)					Women (n=260)				
It's working	3 4,8%	10 16,1%	14 22,7%	25 40,3%	10 16,1%	6 3,6%	19 11,4%	33 19,9%	59 35,5%	49 29,6%
Pensioner	-	-	-	5 7,7%	60 92,3%	-	-	-	13 17,8%	60 82,2%
It's not working	2 16,7%	3 25,0%	2 16,7%	5 41,6%	-	2 9,5%	4 19,0%	10 47,6%	5 23,9%	-
Student	1 100%	-	-	-	-	-	-	-	-	-
	Relatives									
	Men (n=42)					Women (n=108)				

It's working	2 7,4%	4 14,8%	14 51,9%	6 22,2%	1 3,7%	7 8,6%	16 19,8%	16 19,8%	32 39,5%	10 12,3%
Pensioner	-	-	-	4 44,4%	5 55,6%	-	-	-	4 22,2%	14 77,8%
It's not working	1 16,7%	-	5 83,3%	-	-	2 22,2%	3 33,4%	4 44,4%	-	-

In RHCs, all respondents agreed that such schools should be held for both patients and relatives. 505 (91.8%) respondents were satisfied with the information received at the classes: 371 (92.7%) patients and 134 (89.4%) relatives, – 7 (1.3%) – not enough: 2 (0.5%) patients and 5 (3.3%) relatives – and 38 (6.9%) found it difficult to answer this question: 27 (6.8%) patients and 11 (7.3%) relatives, with 100% of respondents reporting that information on all topics covered was delivered to them in an accessible and understandable way [156].

Almost all trainees gave an affirmative answer to the question "Did you receive practical skills?" (507; 92.2%): 376 (94.0%) patients and 131 (92.6%) relatives, – 3 (0.5%) gave a negative answer: 2 (0.5%) patients and 1 (0.7%) relative – and 32 (5.8%) found it difficult to answer this question: 22 (5.5%) patients and 10 (6.7%) relatives. All respondents reported knowing the risk factors and first signs of stroke after the training sessions and being able to help a person who has a sudden stroke. In the RRC, the least number of respondents answered that they had enough handouts from the school – 478 (86.9%) people: 350 (87.6%) patients and 128 (85.4%) relatives – 32 (5.8%) people reported that the material was not enough: 18 (4.5%) patients and 14 (9.3%) relatives – and 40 (7.3%) found it difficult to answer: 32 (7.9%) patients and 8 (5.3%) relatives. The majority of trainees (516; 93.8%) were satisfied with the sessions: 377 (94.2%) patients and 139 (92.7%) relatives, – 9 (1.6%) people answered this question negatively: 5 (1.3%) patients and 4 (2.7%) relatives – and 25 (4.5%) found it difficult to answer this question: 18 (4.5%) patients and 7 (4.6%) relatives (Table 51) [110].

The main suggestions of the respondents to improve the schools were to increase the number of handouts, to teach the basics of physical therapy and massage, and to introduce a more personalized approach to healthy eating.

Based on the presented data, it can be concluded that the developed algorithm of educational activities is effective and in demand. No differences were found between the individual PCPs or between the RCCs, which can be explained by the fact that the staff who participate in these schools were trained using the same methodology, lectures and booklets were uniform for each department and center. This standardization also makes it possible to facilitate further interactions between the patient and the outpatient clinic doctor, as they were also trained in these schools together with inpatient staff.

Table 51 – Results of the questionnaire survey on the conducted schools for stroke patients and their relatives in RRCs

Answer options	Patients		Relatives	
	Men	Women	Men	Women
Was the information you received in class sufficient?				
Yes	130 (92,9%)	241 (92,7%)	38 (90,5%)	96 (88,9%)
No	-	2 (0,8%)	1 (2,4%)	4 (3,7%)
I can't answer that	10 (7,1%)	17 (6,5%)	3 (7,1%)	8 (7,4%)
Did you gain practical nursing skills?				
Yes	127 (90,7%)	249 (95,7%)	34 (80,9%)	97 (89,8%)
No	-	2 (0,8%)	2 (4,8%)	1 (0,9%)
I can't answer that	13 (9,3%)	9 (3,5%)	6 (14,3%)	10 (9,3%)
Do you have enough handouts (booklets, leaflets, methodological recommendations)?				
Yes	118 (84,3%)	232 (89,3%)	33 (78,6%)	95 (87,9%)
No	6 (4,3%)	12 (4,6%)	3 (7,1%)	11 (10,2%)
I can't answer that	16 (11,4%)	16 (6,1%)	6 (14,3%)	2 (1,9%)
Are you satisfied with the "School for stroke patients and their relatives"?				
Yes	129 (92,2%)	248 (95,4%)	40 (95,2%)	99 (91,7%)
No	2 (1,4%)	3 (1,1%)	-	4 (3,7%)
I can't answer that	9 (6,4%)	9 (3,5%)	2 (4,8%)	5 (4,6%)

4.4. Comparative characteristic of the results of the conducted schools among trainees and patients who did not receive training

When assessing the quality of the organization of the educational events held among the trainees of 4 schools (at the RRC and three PCPs), no differences were found either in the frequency of knowledge and skills acquired or in satisfaction with the quality of services provided. Therefore, the data received from all respondents were combined, and then a comparative study was conducted with patients and relatives who did not receive training but who filled in the sections of the questionnaire related to knowledge and practical skills about the disease.

Among respondents who did not attend schools for stroke patients and their relatives, there were 64 patients and 36 relatives. It was revealed that knowledge and practical skills in this category were significantly less than among those who had received training. For example, only 31 people (19 (30.0%) patients and 12 (33.3%) relatives; p<0.01 compared to the answers of school students) gave an affirmative answer to the question "Do you have practical skills in caring for stroke patients?". Forty-two respondents (26 (40.6%) patients and 16 (44.4%) relatives; p<0.01 compared with school students' answers) knew what first aid should be given to a person who had a sudden stroke. Risk factors for stroke were known by 53 people (30 (46.9%) patients and 23 (63.9%) relatives; p<0.01 compared with school trainees' responses) (Table 52) [111].

Table 52 – Results of the questionnaire survey on the conducted schools for stroke patients and their relatives in PCP and RCC

Answer options	School students		Control group	
	Patients (n=1600)	Relatives (n=600)	Patients (n=64)	Relatives (n=36)
Was the information you received in class sufficient?				
Yes	1481 (92,6%)	535 (89,2%)	-	-
No	18 (1,1%)	20 (3,3%)	-	-
I can't answer that	101 (6,3%)	45 (7,5%)	-	-
Was the information conveyed to you in an accessible manner?				
Yes	1565 (97,8%)	575 (95,8%)	-	-
No	10 (0,6%)	6 (1,0%)	-	-
I can't answer that	25 (1,6%)	19 (3,2%)	-	-
Do you have practical skills in caring for patients who have had a stroke? who have had a stroke?				
Yes	1468 (91,8%)	526 (87,7%)	19 (30,0%)*	12 (33,3%)#
No	19 (1,1%)	15 (2,5%)	41 (64,1%)*	21 (58,3%)#
I can't answer that	113 (7,1%)	59 (9,8%)	4 (5,9%)	3 (8,4%)
Can you assist a person who has had a sudden stroke?				
Yes	1582 (98,9%)	592 (98,7%)	26 (40,6%)*	16 (44,4%)#
No	1 (0,0%)	1 (0,1%)	33 (51,6%)*	18 (50,0%)#
I can't answer that	17 (1,1%)	7 (1,2%)	5 (7,8%)*	2 (5,6%)#

Answer options	School students		Control group	
	Patients (n=1600)	Relatives (n=600)	Patients (n=64)	Relatives (n=36)
Do you know the risk factors for stroke?				
Yes	1600 (100%)	600 (100%)	30 (46,9%)*	23 (63,9%)#
No	-	-	27 (42,2%)*	9 (25,0%)#
I can't answer that	-	-	7 (10,9%)	4 (11,1%)

Table 52 continued

Answer options	School students		Control group	
	Patients (n=1600)	Relatives (n=600)	Patients (n=64)	Relatives (n=36)
Do you have enough handouts?				
Yes	1427 (89,2%)	496 (82,7%)	-	-
No	94 (5,9%)	71 (11,8%)	-	-
I can't answer that	79 (4,9%)	33 (5,5%)	-	-
Are you satisfied with the "School for stroke patients and their relatives"?				
Yes	1497 (93,6%)	532 (88,7%)	-	-
No	27 (1,7%)	32 (5,3%)	-	-
I can't answer that	76 (4,8%)	36 (6,0%)	-	-
Note: * – p<0.01 – significant criteria between patients school students and control group; # – p<0.01 – significant criteria between relatives school students and control group.				

Thus, the conducted questionnaire survey among the school attendees revealed high interest and satisfaction of both patients and their relatives. The schools continue to be held in each vascular department and center, and appropriate adjustments are made based on the questionnaires.

Summary

The results of the study demonstrated that the implementation of the program to improve the provision of medical care to patients with STEMI in the Tyumen Oblast made it possible to improve the efficiency of medical care for this category of patients.

The developed and implemented educational programs contributed to increasing public awareness of stroke, which is also a significant aspect of prevention (both primary and secondary) of the disease.

CHAPTER 5. RESULTS OF MULTIDISCIPLINARY VISITING CREWS AND IMPLEMENTATION OF TELEMEDICINE TECHNOLOGIES (TMT)

Health protection of the rural population is of particular importance nowadays, as medical, social and legal problems of health care are most clearly manifested in rural areas. The tasks of the organization of medical care to the population at the present stage are to effectively and economically use the available health care resources, to increase accessibility and improve the quality of medical services.

The main documents determining the organization and development of the medical care system, including in rural areas, are:

– State Program "Development of Healthcare in the Russian Federation" for 2013-2020;
– Federal Law of 21.11.2011 No. 323-FZ "On the Fundamentals of Health Protection of Citizens in the Russian Federation";
– Federal Law of 29.11.2010 No. 326-FZ "On Compulsory Medical Insurance in the Russian Federation";
– Federal Target Program "Sustainable Development of Rural Territories of the Russian Federation for 2016 – 2019 and for the period up to 2020";
– Regional programs for the development of health care in the constituent entities of the Russian Federation.

At present, the heads of the executive authorities of the constituent entities of the Russian Federation in the sphere of health protection of citizens are recommended to introduce new forms of organization of medical assistance to the rural population, including mobile forms of work, telemedicine technologies and remote consultations.

This type of organization of medical care began to be actively implemented in the 1970s and demonstrated high efficiency for patients with oncological, ophthalmological, psychiatric and other diseases, as well as for certain population groups, for example, children (pediatric brigades) in various regions of the Russian Federation (Chelyabinsk Oblast, Sakha Republic, Far Eastern Federal District, etc.) [18, 48, 50, 55, 88, 136, 154].

For rural areas, the most optimal form of organizing medical care for rural residents is multidisciplinary visiting crews, the tasks of which are:

– bringing qualified medical care closer to the rural population;
– levelling the issue of deficit of doctors of narrow specialties;
– implementation of on-site visits not only to receive patients, but also to train specialists from rural municipalities;
– Ensuring continuity in the organization of medical care with further follow-up of patients at their place of residence and in regional medical organizations [107].

In accordance with Annex No. 2 to the Procedure for the provision of medical care to the adult population for diseases of the nervous system, approved by the order of the Ministry of Health of the Russian Federation of November 15, 2012, No. 926n, the recommended staff standards of the office of a neurologist are 1 per 15,000 of the attached adult population. In 2011, multidisciplinary visiting crews were organized in the TO (Order of the Ministry of Health of the TO No. 640 of 06.10.2009; Annex G, p. 329), due to the fact that specialized medical care was territorially available only for 49% of the rural population, for 42% it was difficult to access and for 9% it was inaccessible (Table 53).

Since 2016, there has been a reorganization of the State Budgetary Institution of Health Care of the Republic of Tatarstan: OB No. 6 and OB No. 16 were merged with OB No. 11 (Order No. 637-rp of April 30, 2015), OB No. 14 was merged with OB No. 17 (Order No. 638-rp of April 30, 2015), OB No. 12 was merged with OB No. 21 (Order No. 639-rp of April 30, 2015), OB No. 5, OB No. 10 and OB No. 18 were merged with OB No. 4 (Order No. 142-rp of February 16, 2015).

To assess the accessibility of medical organizations, we used the order of the Ministry of Health of the Russian Federation No. 132n of February 27, 2018 "On the requirements for the location of medical organizations of the state health care system and municipal health care system based on the needs of the population".

Table 53 – Availability of neurologists in medical organizations in the Tyumen Oblast in 2009-2022 (per 10,000 population)

Territory	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
OB #3	1,0	1,0	1,2	1,3	1,7	1,5	1,5	1,3	1,5	1,5	1,1	1,1	1,0	0,8
OB #4	0,8	0,8	0,9	1,3	1,4	1,3	1,4	1,3	1,3	1,2	1,3	1,2	1,1	0,9
OB #5	0,9	0,5	0,5	0,6	0,6	0,6	0,6	0,6	0,6	0,6	0,6	0,6	0,5	0,5
OB #6	0,8	0,8	0,9	0,9	0,9	0,9	0,9	0,9	0,9	1,0	1,0	0,0	0,0	0,0
OB #7	1,0	1,0	1,0	2,1	2,1	2,1	1,1	2,1	1,1	1,1	1,1	1,1	0,0	1,1
OB #8	0,8	0,9	0,9	0,9	0,9	0,9	0,9	0,9	0,9	0,9	0,9	1,0	0,0	0,0
OB #9	0,4	0,9	0,9	0,9	0,9	0,9	0,9	1,0	1,0	0,5	1,0	1,0	1,1	1,1
OB #10.	0,6	0,6	0,6	0,6	0,6	0,6	0,6	0,0	0,0	0,0	0,7	0,7	0,7	0,0
OB #11	0,7	0,8	0,8	1,1	1,1	1,1	1,2	1,2	1,2	1,2	1,2	1,2	1,3	1,3
OB #12.	0,9	0,9	0,9	0,9	0,7	0,6	0,9	0,9	0,9	0,6	0,9	1,1	0,8	1,1
OB #13	0,4	0,4	0,4	0,4	0,4	0,8	0,8	0,8	0,8	1,2	1,2	1,2	0,8	0,8
OB #14	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5
OB #15	0,4	0,4	0,4	0,4	0,4	0,4	0,0	0,4	0,5	0,9	0,9	0,9	0,7	0,7
OB #16	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,6	0,6	0,5	0,5
OB #17	0,0	0,0	0,0	0,0	0,9	0,9	0,9	0,9	1,0	0,0	0,0	0,0	0,0	0,9
OB #18	0,0	1,0	0,0	0,0	1,0	1,0	1,0	1,0	1,0	1,1	1,1	1,1	1,1	0,0
OB #19	0,6	0,8	0,9	1,2	1,2	1,0	0,8	0,8	0,7	0,6	0,8	0,8	0,8	0,9
OB #20.	0,5	0,5	0,5	0,5	0,5	0,5	0,5	1,0	1,0	1,0	1,0	0,5	0,5	0,5
OB #21	0,5	0,5	1,0	1,0	1,0	1,0	0,5	0,0	0,0	0,5	0,5	0,5	0,5	0,5
OB #22	0,0	0,8	0,8	0,9	0,0	0,0	0,0	0,0	0,0	0,9	0,9	0,9	0,9	0,9
OB #23	0,9	1,0	0,8	1,2	1,3	1,5	1,3	4,8	4,9	5,0	7,1	6,4	5,0	4,4
OB #24	0,4	0,4	0,4	0,4	0,9	1,3	1,3	1,3	0,9	0,9	0,9	1,3	0,9	0,9

According to the order of the Ministry of Health of the Russian Federation (developed in accordance with paragraph 2, part 2, article 14 of Federal Law No. 323-FZ

"On the Fundamentals of Health Protection of Citizens in the Russian Federation" and subparagraph 5.2.8 of the Regulations on the Ministry of Health of the Russian Federation), medical organizations that provide medical care in emergency form (except for ambulance stations, emergency departments of polyclinics (hospitals, emergency hospitals), are located taking into account transport accessibility, not exceeding 60 minutes.

Medical organizations providing medical care in emergency form are located taking into account transport accessibility not exceeding 120 minutes. There is a note in the Order, according to which the above parameters are reasonably adjusted taking into account transportation accessibility, as well as climatic and geographical peculiarities of the subjects of the Russian Federation. The location and service area of an emergency medical aid station, emergency medical aid department of a polyclinic (hospital, emergency medical aid hospital) shall be established taking into account the number and density of the population, features of the built-up area, the condition of transport highways, the intensity of motor traffic, the length of the settlement, taking into account 20-minute transport accessibility. Medical organizations providing primary health care in settlements with a population of more than 20 thousand people shall be located taking into account walking distance not exceeding 60 minutes.

In order to improve accessibility of specialized medical care to rural residents, to conduct consultations and preventive check-ups in the Tyumen Oblast, visiting crews have been organized in the following institutions:

– State Budgetary Institution of TO "Regional Clinical Hospital No. 1" – cardiologic dispensary;
– State Budgetary Institution of TO "Regional Clinical Hospital No. 2" – Traumatology Center;
– Regional Clinical Hospital for Rehabilitation Treatment";
– State Budgetary Institution of TO "Regional Oncological Dispensary";
– State Budgetary Institution of TO "Regional Ophthalmologic Dispensary";
– State Budgetary Institution of TO "Regional Clinical Psychiatric Hospital";
– State Budgetary Institution of TO "Regional Narcological Dispensary";

– Regional Medical and Physical Culture Dispensary;
– GBUZ TO "Perinatal Center".

In addition, field work was carried out by the staff of the Regional Hospital No. 3 (Tobolsk) (Tobolsk), Perinatal Center (Tobolsk), Regional Hospital No. 4 (Ishim). (Tobolsk), GBUZ TO "Regional Hospital No. 4" (Ishim), acting as inter-district centers, contributing to the improvement of medical services to the residents of the districts.103].

5.1. Results of the work of visiting multidisciplinary crew

The activity of visiting multidisciplinary medical crews of regional hospitals on the organization of consultative, organizational and methodological assistance to rural health care in remote and hard-to-reach areas of the Tyumen Oblast was analyzed.

Standard composition of the multidisciplinary visiting crew by position:

– neurologist;
– neurologist (with specialization in angioneurology);
– neurologist (specializing in extrapyramidal disorders);
– neurologist (epileptologist);
– neurologist (with specialization in child neurology);
– internist;
– cardiologist;
– ophthalmologist (with specialization in neuro-ophthalmology);
– an ultrasonographer (who can perform the following techniques: duplex scanning of extracranial arteries and transcranial duplex scanning);
– functional diagnostician (neurophysiologist) [107].

The main medical equipment that the crews are equipped with are portable devices Ultrasound device SonoAce R3 (Samsung, South Korea); Echoencephalograph portable "Sonomed" 315-R (CJSC "Spektromed", Moscow, Russia); Rheograph-polyalyzer RGPA-

6/12 "Rean-POLI" (LLC NKPF "Medikom MTD", Taganrog, Russia); Electroencephalograph-recorder "Encephalan – EEGR 19/26" (LLC NKPF "Medikom MTD", Taganrog, Russia); Electroencephalograph-recorder "Encephalan – EEGR 19/26" (LLC NKPF "Medikom MTD", Taganrog, Russia). Taganrog, Russia); Electroencephalograph-recorder "Encephalan – EEGR 19/26" (OOO NKPF "Medikom MTD", Taganrog, Russia); Analyzer ultrasound computer echo-signals of medium brain structures "ANGIODIN-ECHO" (NPF "BIOSS", Russia); as vehicles used motor transport [107].

Since the introduction of the mobile form of medical care in the Regional Treatment and Rehabilitation Center, specialists of the medical organization have made 50 visits to the following settlements:

Ishim 2

Zavodoukovsk 1

Yalutorovsk 7

Abatsky district 8

Berdyuzhsky district 2

Vikulovsky district 13

Isetsky district 1

N-Tavda district 4

Omutinsky district 3

Sorokinsky district 2

Uporovsky district 1

Yurginsky district 2

Yarkovsky district 4

The work of multidisciplinary visiting crew in remote rural areas in the period 2009-2020 resulted in the examination of 16425 people (Figure 38). The decline in the number of consulted patients in 2020 was due to the coronavirus pandemic and the transition to consultations using telemedicine technologies.

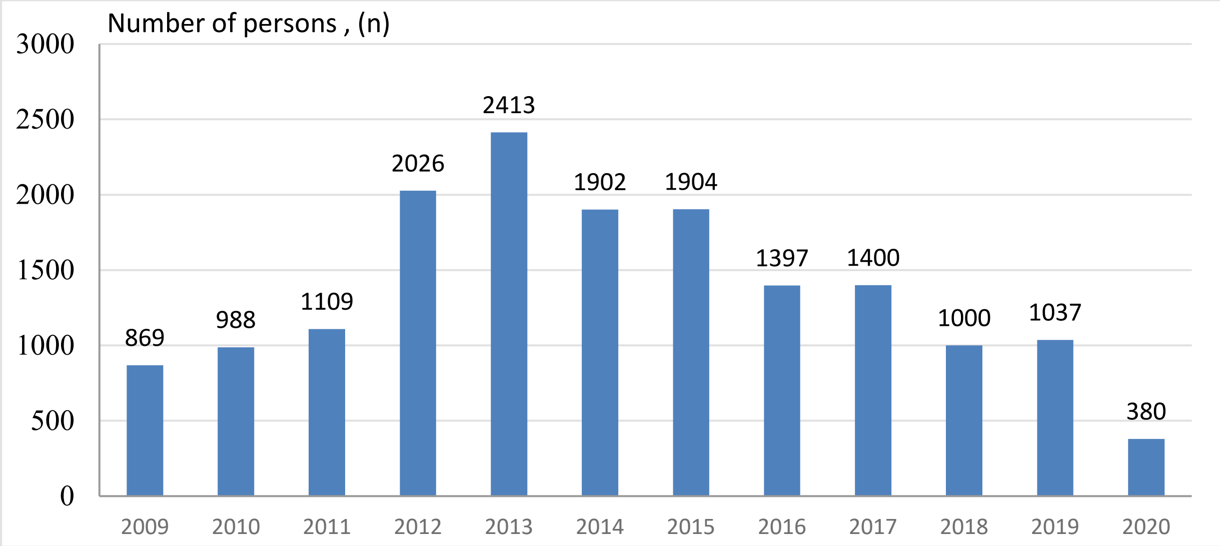


Figure 38 – Number of patients consulted by multidisciplinary visiting crews for 2009-2020

On average, in the period 2009-2020, among the consulted patients, CVD (I60-I69 Cerebrovascular diseases) was the most frequent diagnosis, which was diagnosed in 57.9% of patients (48.3% to 70.6%). Diseases of the musculoskeletal system and connective tissue (M42-M54; according to ICD-10) were detected on average in 1/5 of the examined patients. Episodic and paroxysmal disorders (G40-G47; according to ICD-10) and other diseases were detected in an average of 9.7%. Neoplasms (C00-D48; according to ICD-10) were detected least frequently in 0.9% of patients (Table 54).

Based on the results of the conducted examination and investigations in patients with CVD, an average of 35.8% of patients required a change in treatment tactics (from 28.4% in 2017 to 38.6% in 2018); a program of rehabilitation measures was developed and/or adjusted in 52.5% of patients (from 42.9% in 2010 to 52.3% in 2018); specialized examinations were conducted in an average of 80.9% of patients (from 61.1% in 2009 to 80.5% in 2015); 6.1% of patients were referred to regional MOBs for additional examination and treatment.); specialized examinations were performed in an average of 80.9% of patients (from 61.1% in 2009 to 80.5% in 2015); 6.1% of patients were referred to regional MIs for additional examination and treatment (from 3.7% in 2019 to 7.1% in 2010) (Table 55).

Table 54 – Diagnoses made by specialists of multidisciplinary visiting crews for 2009-2020

Year	WHC	New formations	Episodic and paroxysmal disorders	Diseases of the musculoskeletal system and connective tissue	Others
2009	566 (65,1%)	8 (0,9%)	110 (12,7%)	96 (11,1%)	89 (10,2%)
2010	581 (58,8%)	16 (1,6%)	124 (12,6%)	135 (13,7%)	132 (13,4%)
2011	726 (65,5%)	12 (1,1%)	140 (12,6%)	118 (10,6%)	112 (10,1%)
2012	999 (49,3%)	16 (0,8%)	168 (8,3%)	506 (25,0%)	327 (16,1%)
2013	1166 (48,3%)	21 (0,9%)	182 (7,5%)	746 (30,9%)	288 (11,9%)
2014	1187 (62,4%)	12 (0,6%)	152 (8,0%)	385 (20,2%)	146 (7,7%)
2015	1002 (52,6%)	1 (0,7%)	146 (7,7%)	382 (20,1%)	240 (17,7%)
2016	986 (70,6%)	12 (0,9%)	132 (9,4%)	178 (12,7%)	89 (6,4%)
2017	910 (66,0%)	11 (0,8%)	125 (8,9%)	247 (17,6%)	107 (7,6%)
2018	511 (51,1%)	10 (1,0%)	111 (11,1%)	252 (25,2%)	116 (11,6%)
2019	700 (67,5%)	13 (1,3%)	121 (11,7%)	222 (18,2%)	161 (15,5%)
2020	195 (51,2%)	7 (1,8%)	85 (22,3%)	89 (23,4%)	5 (1,3%)
TOTAL	9529 (57,9%)	152 (0,9%)	1596 (9,7%)	3356 (20,4%)	1812 (11,0%)

Table 55 – Indicators of therapeutic and consultative care by multidisciplinary visiting crews for patients with CVD in the region for 2009-2020

Year	Changing treatment tactics	Development and/or correction of rehabilitation programs	Conducting specialized surveys	Referral for follow-up examinations and treatment to regional MOBs
2009 (n=566)	215 (37,9%)	254 (44,9%)	346 (61,1%)	34 (6,0%)
2010 (n=581)	221 (38,0%)	249 (42,9%)	366 (62,9%)	41 (7,1%)
2011 (n=726)	256 (35,3%)	343 (47,2%)	467 (64,3%)	39 (5,4%)
2012 (n=999)	386 (38,6%)	689 (45,4%)	1113 (73,3%)	71 (4,7%)
2013 (n=1166)	417 (35,8%)	862 (51,1%)	1235 (73,2%)	84 (5,0%)
2014 (n=1187)	429 (36,1%)	728 (50,7%)	1056 (73,5%)	63 (4,4%)
2015 (n=1002)	372 (37,1%)	494 (49,3%)	1112 (80,5%)	88 (6,4%)
2016 (n=986)	298 (30,2%)	472 (52,2%)	663 (73,3%)	52 (5,8%)
2017 (n=910)	258 (28,4%)	481 (50,0%)	681 (70,8%)	46 (4,8%)
2018 (n=511)	197 (38,6%)	367 (52,3%)	593 (77,1%)	43 (5,6%)
2019 (n=700)	253 (36,1%)	173 (45,8%)	264 (69,8%)	14 (3,7%)
2020 (n=195)	72 (36,9%)	87 (44,6%)	134 (68,7%)	12 (6,2%)

The correlation analysis revealed a negative relationship of very high strength between the frequency of development and/or correction of rehabilitation programs by field team specialists and the reduction of CVD mortality in the supervised rural areas (r= -0.9; p<0.01). (Figure 39).

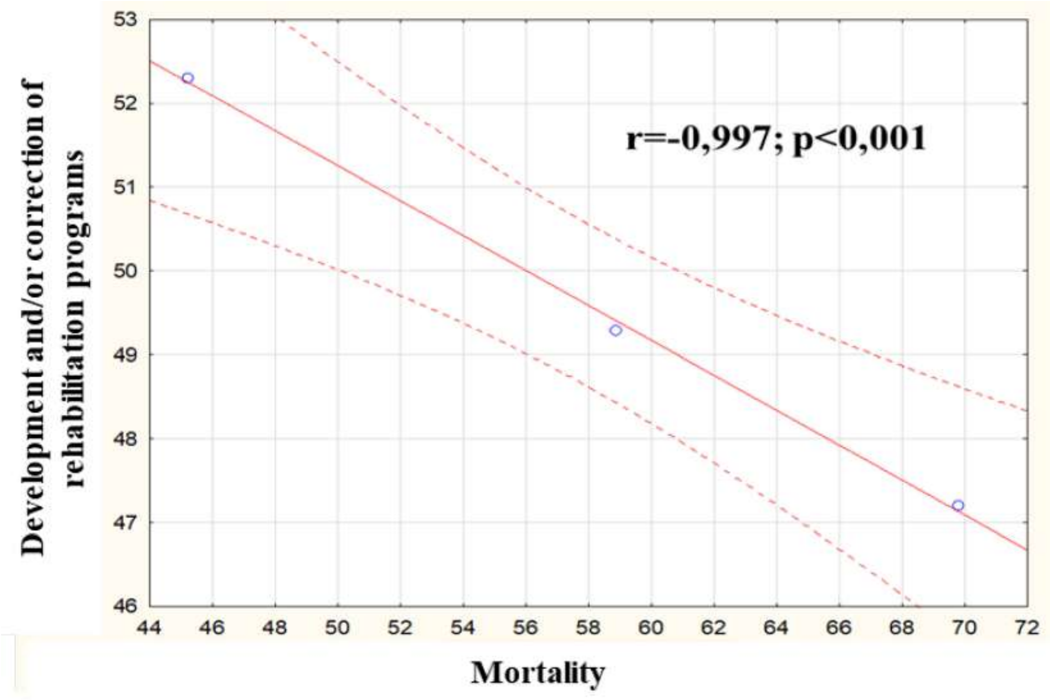


Figure 39 – Relationship between mortality from CVD of rural population and frequency of development and/or correction of rehabilitation programs by specialists of multidisciplinary visiting crews in the period 2009-2020

In addition, a negative high correlation of very high strength between mortality of rural population from CVD and change of treatment tactics developed by specialists of multidisciplinary visiting crews was revealed (r=-0.9; p<0.01), which indicates effective therapeutic and consultative work carried out by doctors of multidisciplinary visiting crews (Figure 40).

Thus, thanks to the fact that specialists of multidisciplinary visiting crew provide primary specialized medical and sanitary care, epidemiological indicators among the population living in rural areas are improving.

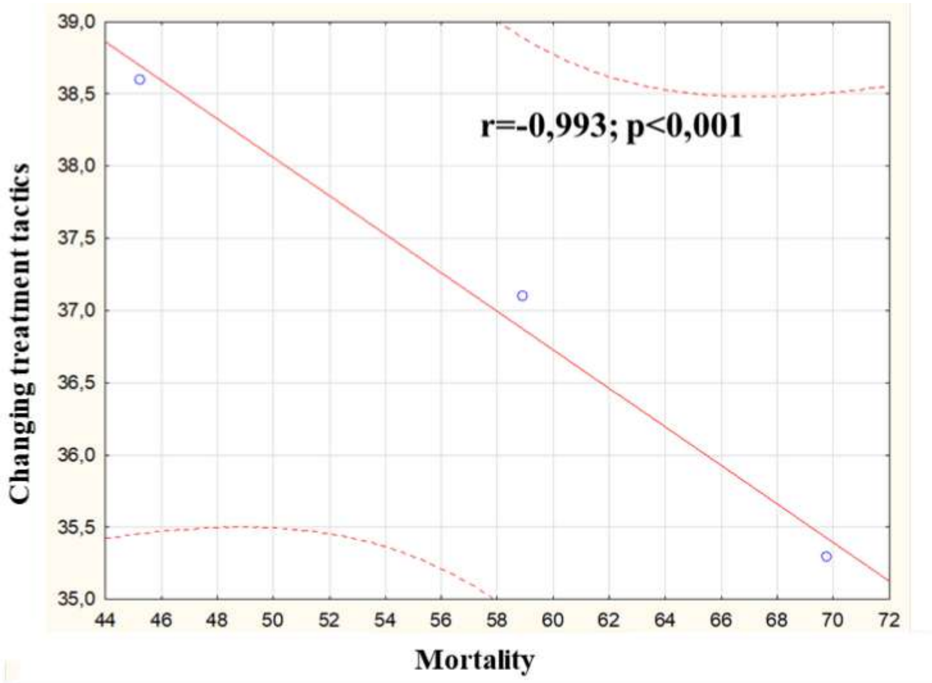


Figure 40 – Correlation of mortality from CVD of rural population and frequency of change of treatment tactics by specialists of multidisciplinary visiting crews in the period 2009-2020.

About 1/3 of patients with CVD underwent USG (assessment of the effective lumen of the precerebral arteries, the state of the intima-media complex, the presence of vessel deformities, tortuosities, bends, the presence of atherosclerotic plaques and thrombi), the results of which are presented in Table 56. Thus, on average, hemodynamically significant lesion of carotid arteries was detected in 29.4% of patients, and significant stenosis was detected on average in 9.7% of all patients who underwent the study. The presence of pathologic tortuosity, which was determined in the presence of local hemodynamic disturbances in the form of increasing linear blood flow velocity and pronounced blood flow turbulence, was detected on average in 19.7% of all patients who underwent the study (Table 56).

In order to improve the efficiency of the organization of the activities of state medical organizations in rural areas of the south of the Tyumen Oblast, to provide organizational, methodological and practical assistance, including on the issues of compliance with federal and regional legislation, the Tyumen Oblast Department of

Health issued Order No. 640 of October 6, 2009 "On Appointment of Supervisors of State Treatment and Preventive Medical Organizations of the Tyumen Oblast" (Annex G, p. 329) [107].

Table 56 – Results of USDG in patients with CVD by specialists of multidisciplinary visiting crews for 2009-2020

Year	Number of USDGs performed	Number of patients with significant pathology	Significant stenosis	Abnormal arterial tortuosity
2009 (n=566)	159 (28,1%)	46 (8,1%)	5 (0,9%)	38 (6,7%)
2010 (n=581)	192 (33,1%)	56 (9,6%)	12 (2,1%)	46 (7,9%)
2011 (n=726)	210 (29,0%)	59 (28,0%)	11 (5,0%)	48 (23,0%)
2012 (n=999)	299 (29,9%)	78 (26,0%)	18 (6,0%)	60 (20,0%)
2013 (n=1166)	361 (31,0%)	108 (30,0%)	33 (9,0%)	75 (20,8%)
2014 (n=1187)	380 (32,0%)	110 (29,0%)	37 (9,6%)	73 (19,2%)
2015 (n=1002)	291 (29,0%)	96 (33,0%)	31 (10,5%)	65 (22,3%)
2016 (n=986)	276 (28,0%)	75 (27,0%)	33 (12,0%)	42 (15,2%)
2017 (n=910)	288 (31,6%)	81 (28,0%)	33 (11,5%)	48 (16,7%)
2018 (n=511)	152 (29,7%)	47 (31,0%)	21 (14,0%)	26 (17,1%)
2019 (n=700)	203 (32,4%)	67 (33,0%)	20 (10,0%)	47 (23,2%)
2020 (n=195)	61 (21,3%)	18 (9,2%)	3 (1,5%)	14 (7,2%)

According to sociological surveys on the availability and quality of medical care, a number of shortcomings in the organization of medical care in the polyclinic of the State Budgetary Institution of TO "Regional Hospital No. 10 (Vikulovo village)" were identified. Respondents complained about the long waiting period for medical care, the low level of technical capabilities of the polyclinic for detailed examination of the patient's health. As suggestions for the organization of quality service in the provision of medical services, the majority of respondents suggested optimizing the flow of patients, strictly observe the rules of ethics and deontology when working with patients, pay attention to the appearance of staff, as well as improve the interior of the polyclinic premises [92].

In accordance with the order for the state MO TO "Regional Clinical Hospital for Restorative Treatment" for curation was allocated to the state MO TO "Regional Hospital No. 10" (Vikulovo village) [109].

In 2009, 2014, and 2019, 218, 243, and 267 patients were consulted by specialists of multidisciplinary visiting crews, respectively. USG of the brachiocephalic arteries was performed in 70, 77, and 84 patients, respectively, and hemodynamically significant stenoses were detected in 1/3 (Figure 41) [109].

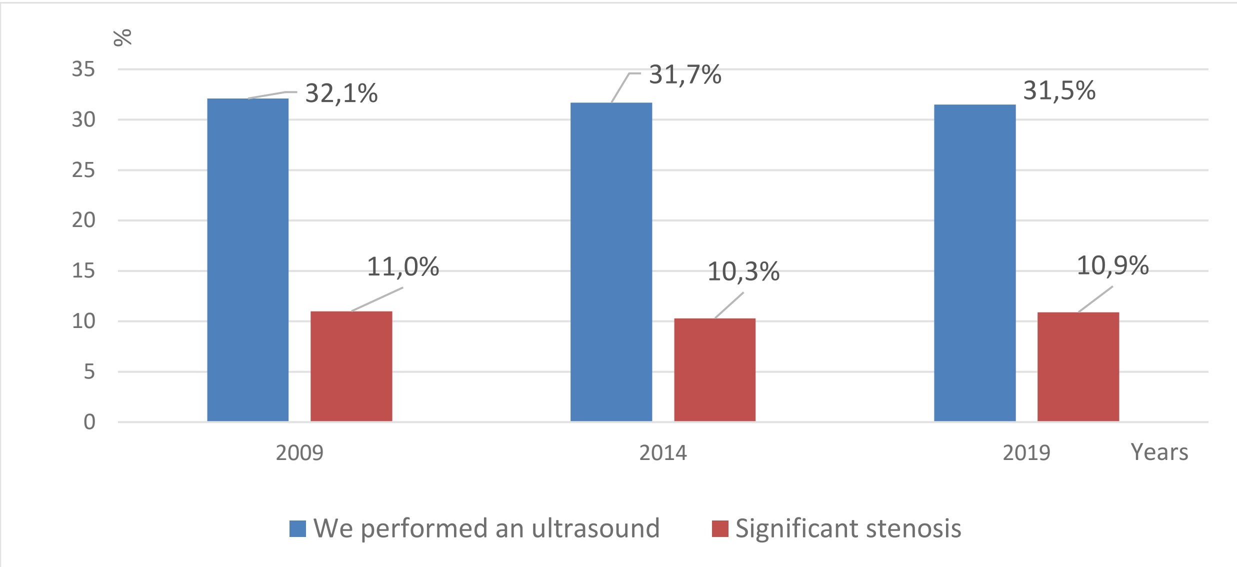


Figure 41 – Effectiveness of performed and detected hemodynamically significant stenoses in residents in Vikulovo village at USDG for 2009-2019.

These patients were referred to Tyumen for endovascular interventions (carotid endarterectomy or carotid angioplasty with stenting) to prevent STEMI [109].

Table 5.5 presents data on morbidity and morbidity in Vikulovo village from the time of multidisciplinary visiting crews' work until 2021. Decrease in morbidity,

morbidity, including morbidity with temporary disability per 100 employees* (in calendar days) in diseases of nervous and musculoskeletal systems for the entire period under evaluation is demonstrated. In CVD there was an improvement in these indicators by 2013, but by 2018 there was a slight increase [109].

The findings may be related to the effective work of multidisciplinary visiting crews, thanks to which patients at high risk of developing ONMCA were referred for surgical treatment (Table 57) [109].

Table 57 – Efficiency of multidisciplinary visiting crews in Vikulovo village in 2009-2021

Year	Soreness		
	Diseases of the nervous system	**WHC**	**Diseases of the musculoskeletal system**
2009	31,3	54,9	76,9
2010	32,7	58	76,5
2011	31,3	46,7	77
2012	33	44,7	78,7
2013	28,0	44,8	72,9
2014	25,9	44,8	73,6
2015	26,4	47,9	70,6
2016	33,5	46,3	67,9
2017	31,5	45,8	71,6
2018	36,7	22,3	74,8
2019	43,7	13,8	44,4
2020	32,6	26,5	59,9
2021	26,3	27,2	51,1
Average absolute growth t/ loss, %	-0,4	-2,3	-2,2
Average annual rate of growth/decline, %	-1,5	-5,7	-3,4
annual average, m ± SD	31,8 ± 4,8	40,3 ± 13,4	68,9 ± 10,7
95% CI	28,9-34,7	32,2-48,4	62,5-75,4
Incidence			
2009	21,4	15,2	33,4
2010	20,9	15,1	32,8
2011	20,6	14,9	32,3
2012	14,2	11,9	23,5
2013	13,5	10,9	21,4
2014	11,2	9,8	19,6
2015	10,6	8,7	15,2

2016	7,7	6,2	12,9
2017	5,9	6,5	9,9
2018	4,8	2,0	6,4

Table 57 continued

Year	Soreness		
	Diseases of the nervous system	**WHC**	**Diseases of the musculoskeletal system**
2019	5,2	8,9	5,2
2020	4,8	5,2	4,9
2021	5,1	5,7	3,9
Average absolute growth/decline, %	-1,4	-0,8	-2,5
Average annual rate of growth/decline, %	-11,3	-7,8	-16,2
annual average, m ± SD	11,2 ± 6,4	9,3 ± 4,2	17,0 ± 11,0
95% CI	7,3-15,1	6,8-11,9	10,4-23,7
Morbidity with temporary loss of disability per 100 employees (in calendar days) per 100 employees (in calendar days)			
2009	84,2	71,9	228,9
2010	79,3	70,5	227,7
2011	69,8	69,8	228,9
2012	56,1	68,7	211,3
2013	49,8	65,4	210,8
2014	29,3	62,7	210,7
2015	21,6	61,2	209,6
2016	17	60,7	205,9
2017	19,5	64,8	199,0
2018	22,5	102,4	217,3
2019	22,5	103,9	217,4
2020	17,7	68,9	182,5
2021	49,6	187,5	385,8
Average absolute growth/decline, %	-2,9	9,6	13,1
Average annual rate of growth/decline, %	-4,3	8,3	4,5
annual average, m ± SD	41,5 ± 24,7	81,4 ± 34,9	225,9 ± 49,7
95% CI	26,5-56,4	60,3-102,5	195,8-255,9

Correlation analysis revealed a negative correlation of medium strength between the percentage of detected hemodynamically significant stenoses in Vikulovo village and CVD morbidity (r= -0.61; p<0.01), which indicates that this diagnostic method is reasonable to improve the epidemiological situation on CVD (Figure 42).

In addition, there was a high negative correlation between the percentage of identified hemodynamically significant stenoses in Vikulovo village and the incidence of CVD (r= – 0.8; p<0.01), which also indicates the significance of this type of diagnostic intervention in stroke prevention (Figure 43).

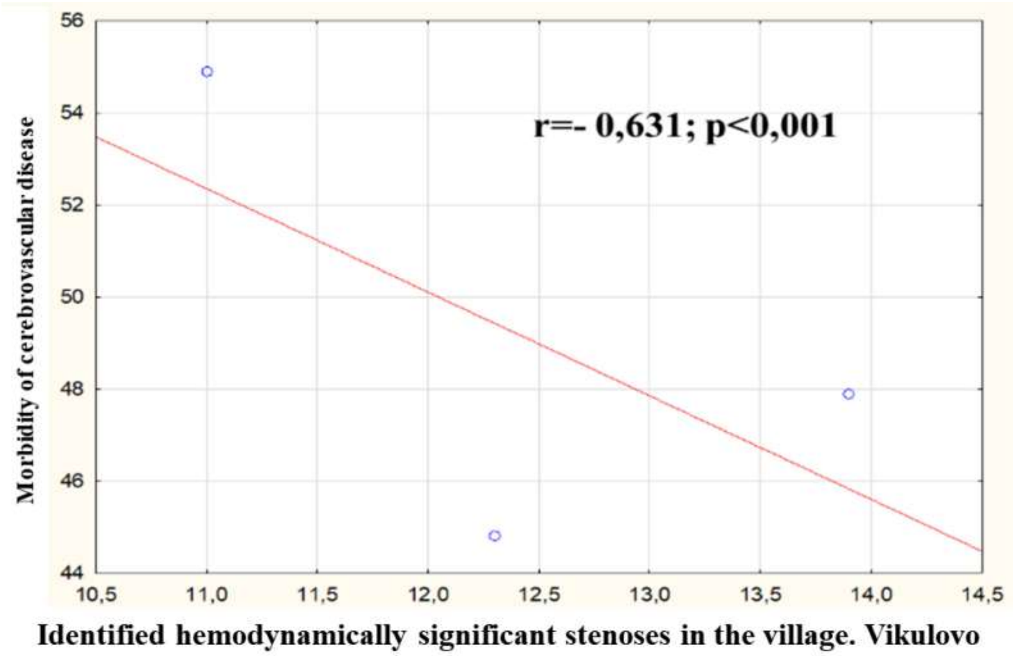


Figure 42 – Relationship between hemodynamically significant stenoses detected in Vikulovo village by specialists of multidisciplinary visiting crews and morbidity from CVD in the period 2009-2021

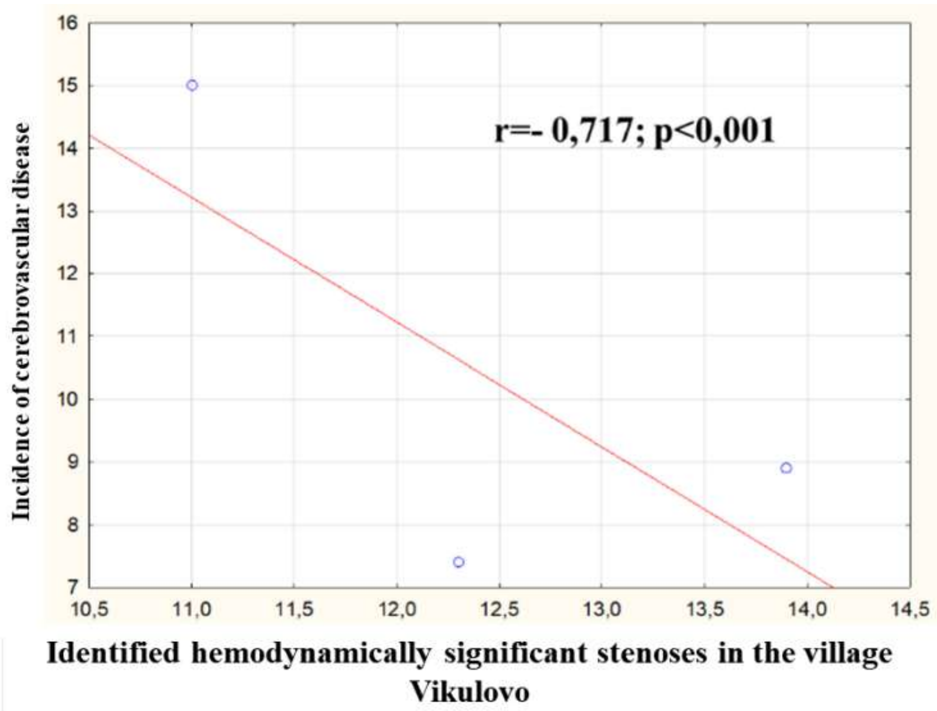


Figure 43 – Correlation between hemodynamically significant stenoses detected in Vikulovo village by specialists of multidisciplinary field crews and CVD morbidity in the period 2009-2020

Also, the frequency of hemodynamically significant stenoses detected in Vikulovo village with subsequent referral of patients for surgical intervention to correct them affected such indicator as morbidity with temporary disability: the higher was the detection rate, the lower was this indicator (r= – 0.9; p<0.01) (Figure 44).

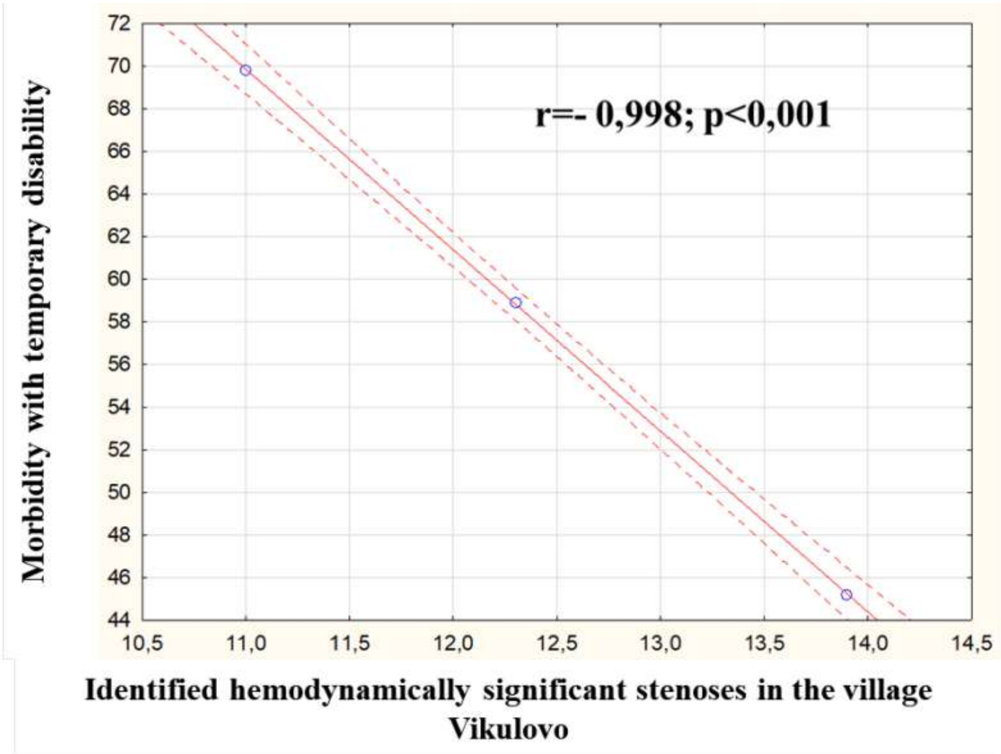


Figure 44 – Correlation of identified hemodynamically significant stenoses in the village of Vikulovo by specialists of visiting crews and morbidity with temporary disability due to CVD. The relationship between hemodynamically significant stenoses detected in Vikulovo village by specialists of field teams and morbidity with temporary disability due to CVD in the period 2009-2020

Thus, the effectiveness of multidisciplinary visiting crews was undoubtedly expressed in the form of improved diagnostic measures and subsequent treatment.

In Vikulovo village, which is a supervised area of the Regional Clinical Hospital for Rehabilitation Treatment, the effectiveness of the work of multidisciplinary visiting crews was manifested in the form of reduced morbidity and morbidity due to diseases of the nervous and musculoskeletal systems and CVD.

In addition to working with patients, specialists of multidisciplinary visiting crew provided training to specialists of rural municipalities, for which 10 presentations on the most topical issues were developed:

1. Regulatory framework used in the provision of primary health care (orders of care; clinical recommendations; standards of care).
2. Correct formulation of diagnoses and coding of diseases of the nervous system.
3. Primary prevention of acute cerebral circulatory disorders.
4. Secondary prevention of acute cerebral circulatory disorders.
5. Organization of medical care for patients with cerebral catastrophes, prehospital care.
6. Risk factors for brain catastrophes.
7. Nutrition and the brain.
8. Arterial hypertension and older age.
9. The role of the nurse in the organization of care for patients with acute cerebral circulatory failure.
10. Analysis of primary medical records [109].

5.1.1. Evaluation of the effectiveness of multidisciplinary visiting crews based on questionnaire data

To assess the satisfaction of the population with the quality of work of multidisciplinary visiting crews, 832 patients were surveyed using a questionnaire specially developed for this study (Questionnaire on the work of multidisciplinary visiting crews, Appendix E, p. 370): 306 (36.8%) men and 526 (63.2%) women. There were 56

(6.7%) respondents aged less than 20 years, 177 (21.3%) aged 20-30 years, 120 (14.4%) aged 31-40 years, 280 (33.7%) aged 41-50 years, 150 (18.0%) aged 51-60 years and 49 (5.9%) aged over 60 years [112]. Figure 45 shows the distribution of respondents by gender and age. Women on average were counseled more than men: under 20 years of age (1.9 times; $p<0.01$), 31-40 years (5.3 times; $p<0.01$), 41-50 years (1.9 times; $p<0.01$), 51-50 years (1.9 times; $p<0.01$), and over 60 years (2.5 times; $p<0,01$).

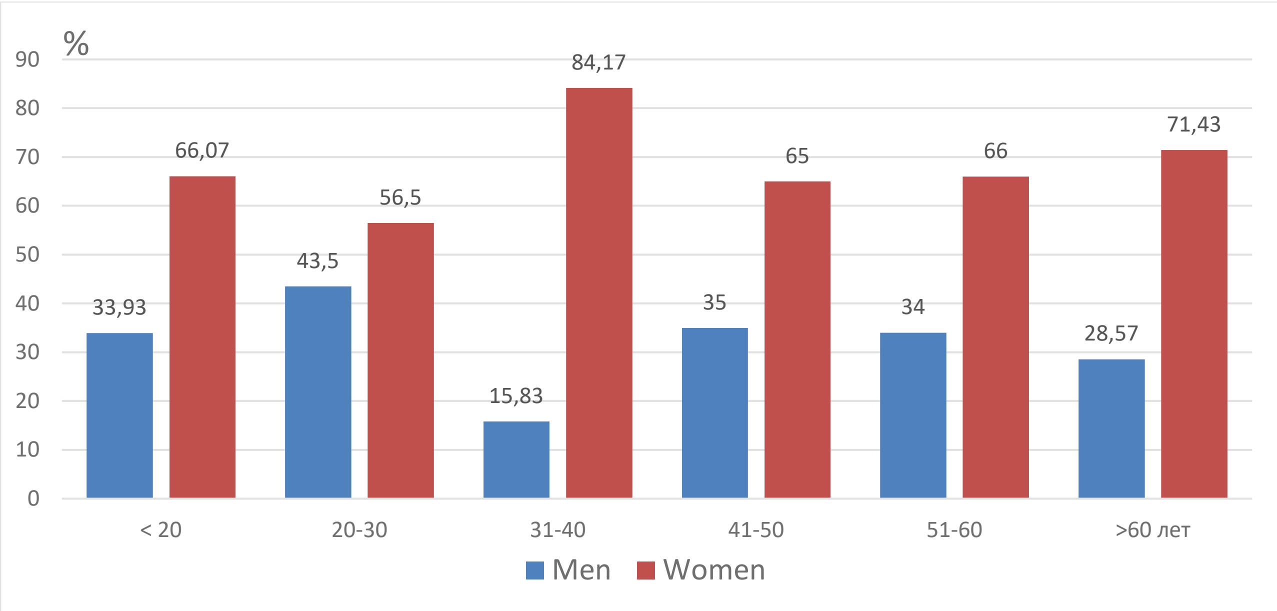


Figure 45 – Characterization of respondents by gender and age, %

The assessment of the respondents' social status revealed that they were most often employees of various state medical organizations (38.6%), less often workers (18.8%), unemployed (16.7%) and pensioners (13.2%). Students, pupils, entrepreneurs and managers were the least among this sample, at 6.4%, 2.2%, 3.4% and 0.8% respectively (Figure 46). It is important to note that among pensioners there were 2.1 times more women than men ($p<0.01$), which can be explained by the earlier age of retirement and longer life expectancy.

When assessing the social status according to the age of respondents, it was found that organization managers and entrepreneurs were most often aged 31-40 years (85.7% and 57.1%, respectively), while employees and workers were 41-50 years old (47.7% and 53.8%, respectively) [107]. Respondents aged 20-30 years were most likely to be unemployed (48.9%). In general, those below 20 years of age were dominated by students and students (66.1% and 26.8% respectively), 20-30 years of age by unemployed and employees (38.4% and 37.9% respectively), 31-40 years of age by employees (48.3%), 41-50 years of age by employees and workers (54.6% and 30.0% respectively), 51-60 years of age by pensioners, employees and workers (42.7%, 28.0% and 26.7% respectively) and above 60 years of age by pensioners (89.8%) (Table 58).

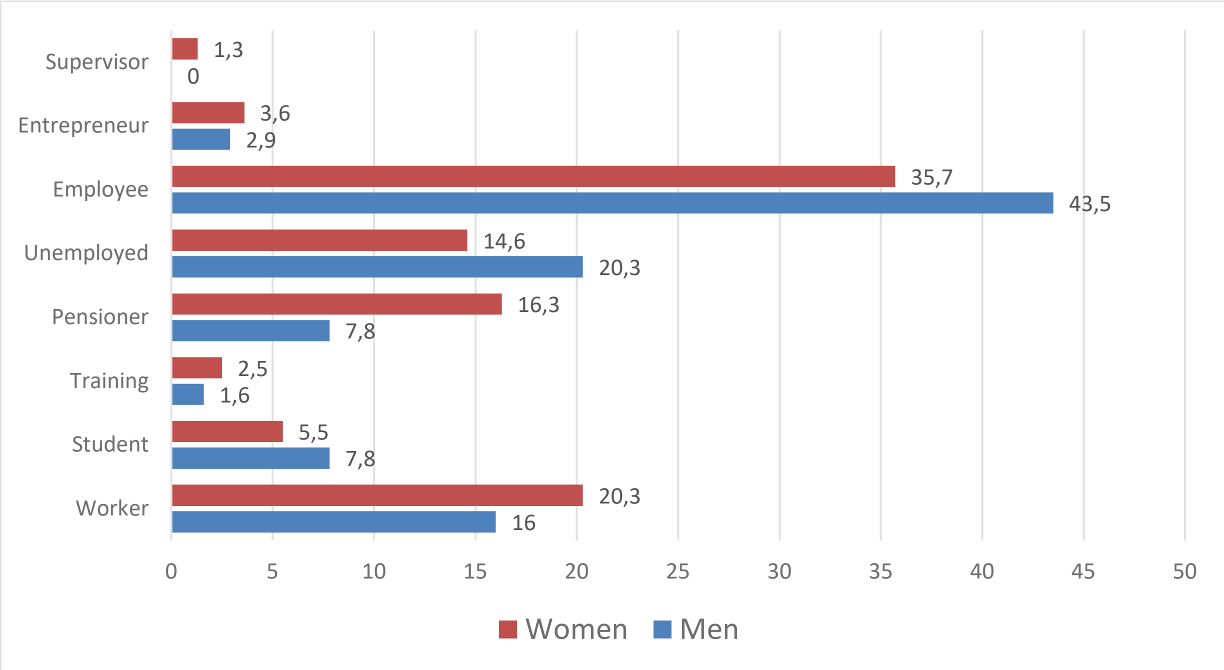


Figure 46 – Social status of respondents depending on gender, %

Table 58 – Social status of respondents depending on the age group by age group

Social status	Age, years						Total
	<20	20-30	31-40	41-50	51-60	>60	
Manager	-	1 0,6%	6 5,0%	-	-	-	7 0,8%
Entrepreneur	-	11 6,2%	16 13,3%	-	-	1 2,0%	28 3,4%
Employee	-	67 37,9%	58 48,3%	153 54,6%	42 28,0%	1 2,0%	321 38,6%
Unemployed	-	68 38,4%	24 20,0%	41 14,6%	4 2,7%	2 4,1%	139 16,7%
Pensioner	-	1 0,6%	1 0,8%	-	64 42,7%	44 89,8%	110 13,2%
Learner	15	-	-	2	-	1	18

	26,8%			0,7%		2,0%	2,2%
Student	37 66,1%	11 6,2%	5 4,2%	-	-	-	53 6,4%
Worker	4 7,1%	18 10,2%	10 8,3%	84 30,0%	40 26,6%	-	156 18,8%
Total	56 100%	117 100%	120 100%	280 100%	150 100%	49 100%	832 100%

The most frequent purpose of referral to specialists of the multidisciplinary visiting crew for both men and women was to consult a neurologist (470 out of 832 people – 56.5%). There were no differences by gender: only 183 (59.8%) men and 287 (54.6%) women wanted to be consulted by this specialist (p>0.1).

Angioneurologist consultation was needed for 141 (16.9%) respondents: 48 (15.7%) males and 93 (17.7%) females (p>0.1). Consultation with an epileptologist was needed by 225 (27.0%) respondents: 96 (31.4%) males and 129 (24.5%) females (p>0.1). Fifty-two (6.3%) respondents consulted a neurologist, of whom 2.4 times more women than men (42 (8.0%) and 10 (3.3%), respectively; p<0.01). About 1/3 of respondents (295 (35.5%) people) consulted a cardiologist: 97 (31.7%) men and 198 (37.6%) women (p>0.1). Half of the respondents required consultation of a neuro-ophthalmologist – 417 (50.1%) people, and there was a tendency for men to consult more than women: 177 (57.8%) and 240 (45.6%) respectively – but no significant differences were found (p>0.1). Parkinsonologist consultation was required by 38 (4.6%) respondents: 15 (4.9%) males and 23 (4.4%) females (p>0.1) (Figure 47).

The purpose of referral to specialists of the multidisciplinary visiting crew differed depending on the age of the respondents. Thus, patients under 20 years of age most often required a consultation with a pediatric neurologist, respondents aged 20-30 years more often consulted an epileptologist and a neuro-ophthalmologist, at the age of 31-40 years respondents consulted a neurologist, an angioneurologist, an epileptologist and a cardiologist with almost equal frequency. At the age of 41-50 the most demanded specialists were angioneurologist and cardiologist, at the age of 51-60 – neurologist, angioneurologist and parkinsonologist (Table 59).

Overall, the majority of respondents (603 – 72.5%) were counseled by more than 1 specialist: 412 (49.5%) were counseled by two, 162 (19.5%) by three and 29 (3.5%) by four specialists, with 2.4 times more men than women being counseled by four specialists (p<0.01) (Figure 48) [112].

Patients younger than 20 years of age were more likely to need counseling from 1 specialist, whereas all older than this age needed two or more (p<0.01).

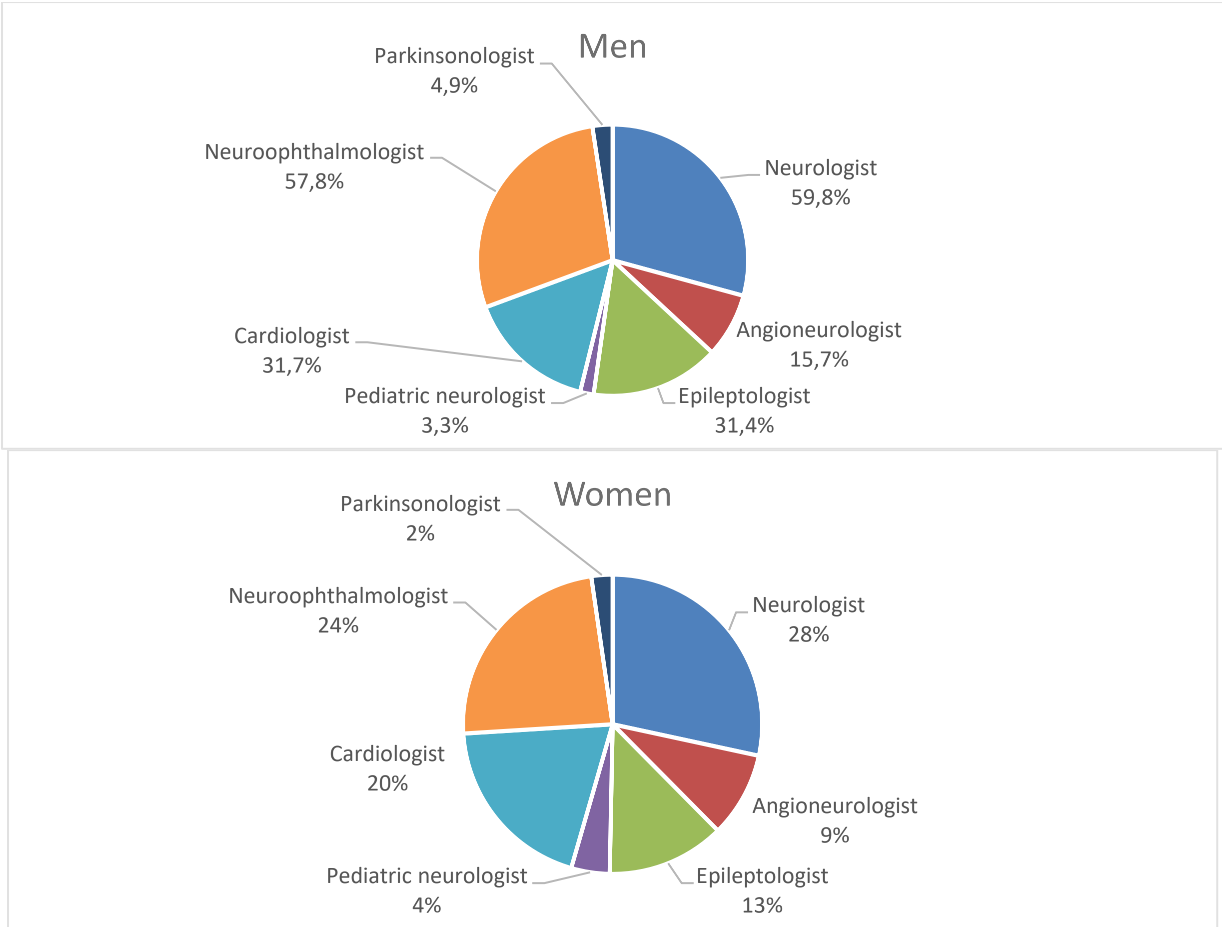


Figure 47 – Frequency of respondents' contact to specialists of multidisciplinary visiting crew depending on gender, %

Table 59 – Purpose of respondents' referral to specialists of multidisciplinary visiting crew depending on age group

Specialist advice	Age, years						Total
	<20	20-30	31-40	41-50	51-60	>60	
Neurologist	14 16,5%	97 24,9%	79 35,9%	142 25,7%	95 33,0%	43 42,2%	470 28,7%
Angioneurologist	-	-	21 9,6%	71 12,8%	32 11,1%	17 16,7%	141 8,6%
Epileptologist	19	83	39	58	20	6	225

	8,4%	36,9%	17,3%	25,8%	8,9%	2,7%	100%
Pediatric neurologist	33 38,8%	9 2,3%	5 2,3%	5 0,9%	-	-	52 3,2%
Cardiologist	-	42 10,8%	36 16,4%	151 27,3%	57 19,8%	9 8,8%	295 18,0%
Neuro-ophthalmologist	19 22,4%	159 40,8%	40 18,2%	126 22,8%	50 17,4%	23 22,6%	417 25,5%
Parkinsonologist	-	-	-	-	34 11,8%	4 3,9%	38 2,3%

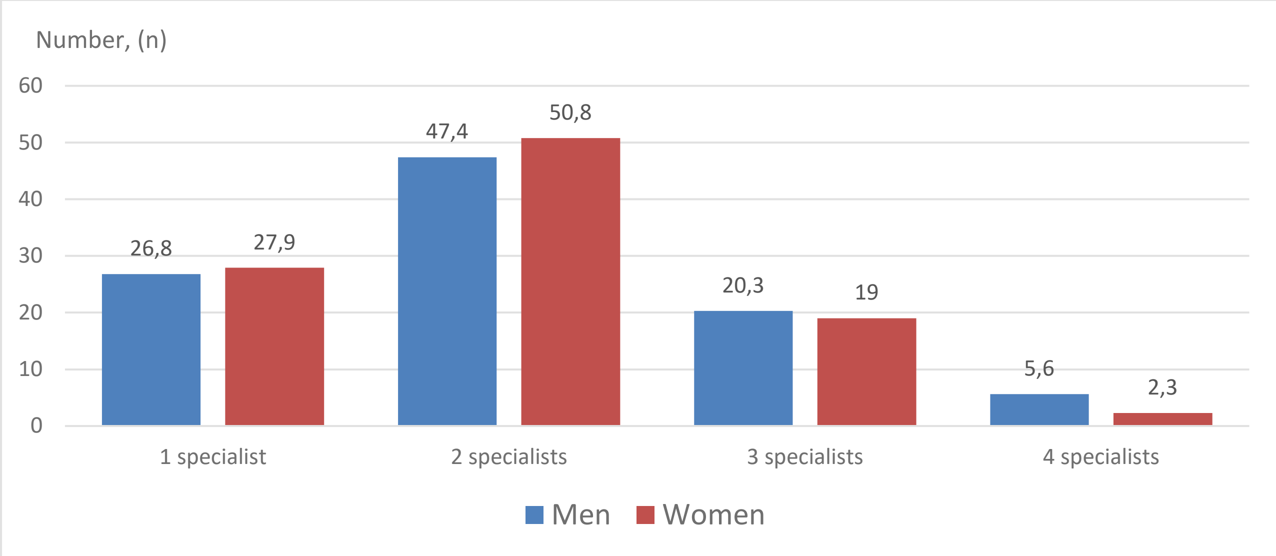


Figure 48 – Total number of consultations of specialists of the multidisciplinary visiting crew

Patients aged 20-60 years received consultation from two specialists in 1/4-1/3 of cases: aged 20-30 years – in 25.0% of cases, aged 31-40 years – in 18.7%, 41-50 years – in 32.3% and 51-60 years – in 14.8%. Three consultations were most often needed by patients aged 20-30 years (28.4%), 41-50 years (29.0%) and 51-60 years (24.7%). Four specialists were most often consulted by patients aged 41-50 years (65.5%) (Table 60).

Table 60 – Total number of consultations of multidisciplinary visiting crew specialists by age group

Number of consultations of 1 patient	Age, years						Total
	<20	20-30	31-40	41-50	51-60	>60	

1	37 66,1%	22 12,4%	30 25,0%	81 28,9%	49 32,7%	10 20,4%	229 27,5%
2	9 16,1%	103 58,2%	77 64,2%	133 47,5%	61 40,7%	29 59,2%	412 49,5%
3	10 17,9%	46 26,0%	13 10,8%	47 16,8%	40 26,7%	6 12,2%	162 19,5%
4	-	6 3,4%	-	19 6,8%	-	4 8,2%	29 3,5%

In addition to specialist consultations, multidisciplinary visiting crews performed instrumental examinations of patients. A total of 832 respondents underwent 2010 examinations (USDG, EEG, REG and ECHO-ES). There were no differences by gender and consultations performed (Figure 49).

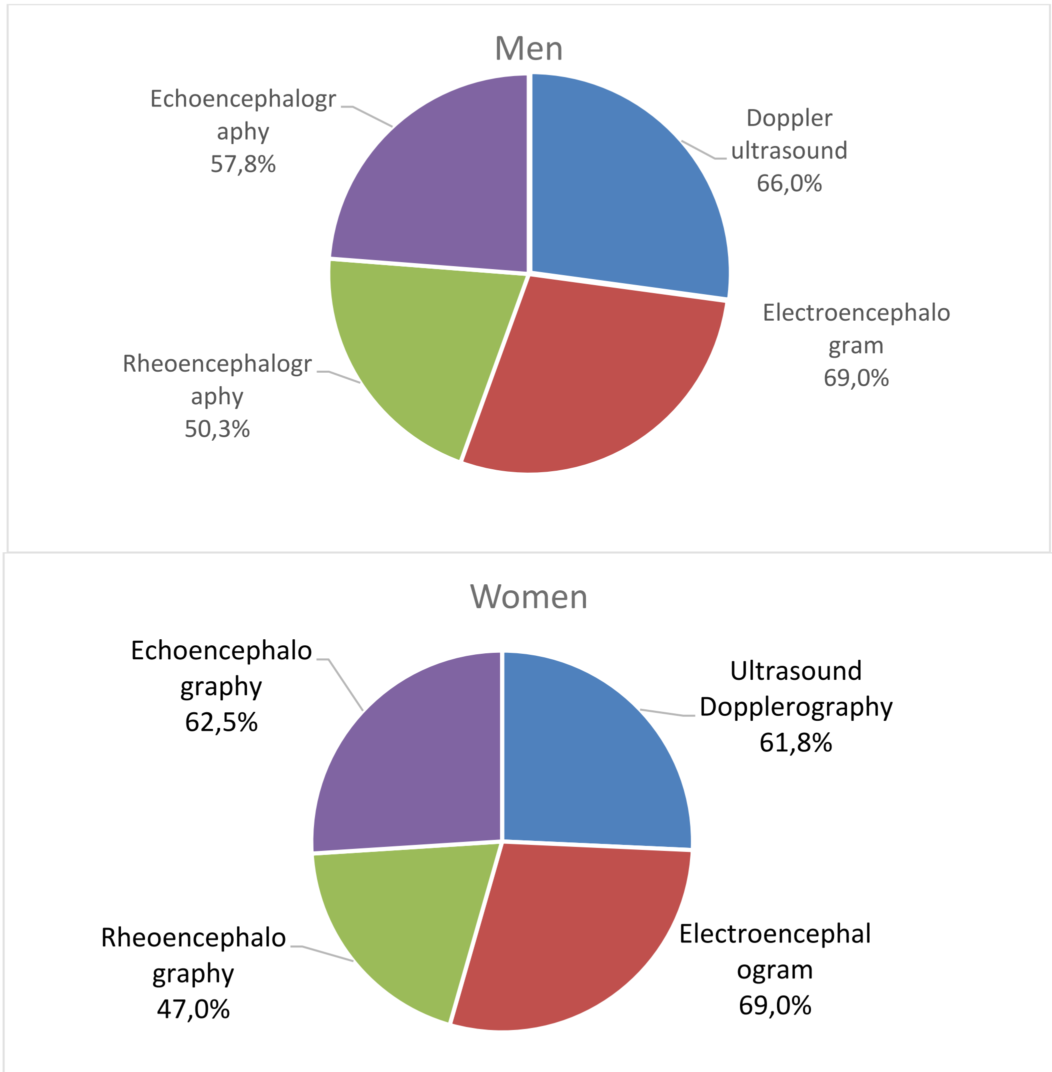


Figure 49 – Surveys conducted by specialists of the multidisciplinary visiting crews depending on gender, %

USDG was most commonly performed on patients over 40 years of age: 70.4% of patients aged 41-50 years, 80.0% of patients aged 51-60 years, and 89.8% of patients over 60 years. EEG was performed on all patients younger than 20 years of age: 93.8% of patients aged 20-30 years and 77.6% and 70.8% of patients aged over 60 years and 31-40 years, respectively [210]. REG was also performed in all patients under 20 years of age and 68.9% and 63.3% of patients aged 20-30 and 31-40 years, respectively. ECHO-ES was performed in 92.9% of patients <20 years of age, 89.8% of patients >60 years of age, and almost 2/3 of patients aged 20-30 and 31-40 years (66.7% and 67.5%, respectively) (Table 61).

Table 61 – Surveys conducted by specialists of the multidisciplinary visiting crew depending on the age group of respondents

Survey	Age, years						Total
	<20	20-30	31-40	41-50	51-60	>60	
USDG	-	104 19,7%	62 11,8%	197 37,4%	120 22,8%	44 8,3%	527 100%
EEG	56 9,8%	166 28,9%	85 14,8%	170 29,6%	59 10,3%	38 6,6%	574 100%
REG	56 14,0%	122 30,4%	76 19,0%	116 28,9%	31 7,7%	-	401 100%
ECHO-ES	52 10,3%	118 23,3%	81 16,0%	127 25,1%	84 16,6%	44 8,7%	506 100%

Most patients underwent more than 1 examination – 750 (90.1%). One examination was more often performed on respondents aged 41-50 and 51-60 years, 2 on respondents aged 41-50 years, 3 on respondents aged 20-30 and 41-50 years, and 4 on respondents aged 20-30 years (Table 62).

An important stage of the questionnaire was to assess the respondents' opinion about the organization of the multidisciplinary visiting crews.

Most of the patients surveyed in all age groups reported that they liked everything about the organization of the event.

At the same time, 1 examination was performed more often in men than in women, 2.1 times ($p<0.01$) (Figure 50).

Patients younger than 20 years old said that attention should be paid to the appearance of staff and the organization of medical care (n=11; 19.6%); patients aged 20-30 years old suggested paying attention to the culture of communication and the organization of medical care (n=46; 26.0%); at the age of 31-40, 41-50 and 51-60 years old, only 33 people (6.5%) also paid attention to the insufficiently effective organization of medical care for patients.

Table 62 – Total number of examinations conducted by multidisciplinary visiting crew specialists by age group

Number of consultations of 1 patient	Age, years						Total
	<20	20-30	31-40	41-50	51-60	>60	
1	-	-	-	45 54,9%	37 45,1%	-	82 100%
2	4 1,6%	36 14,2%	46 18,2%	102 40,3%	54 21,3%	11 4,3%	253 100%
3	52 11,7%	111 24,9%	69 15,5%	127 28,5%	49 11,0%	38 8,5%	446 100%
4	-	30 58,8%	5 9,8%	6 11,8%	10 19,6%	-	51 100%

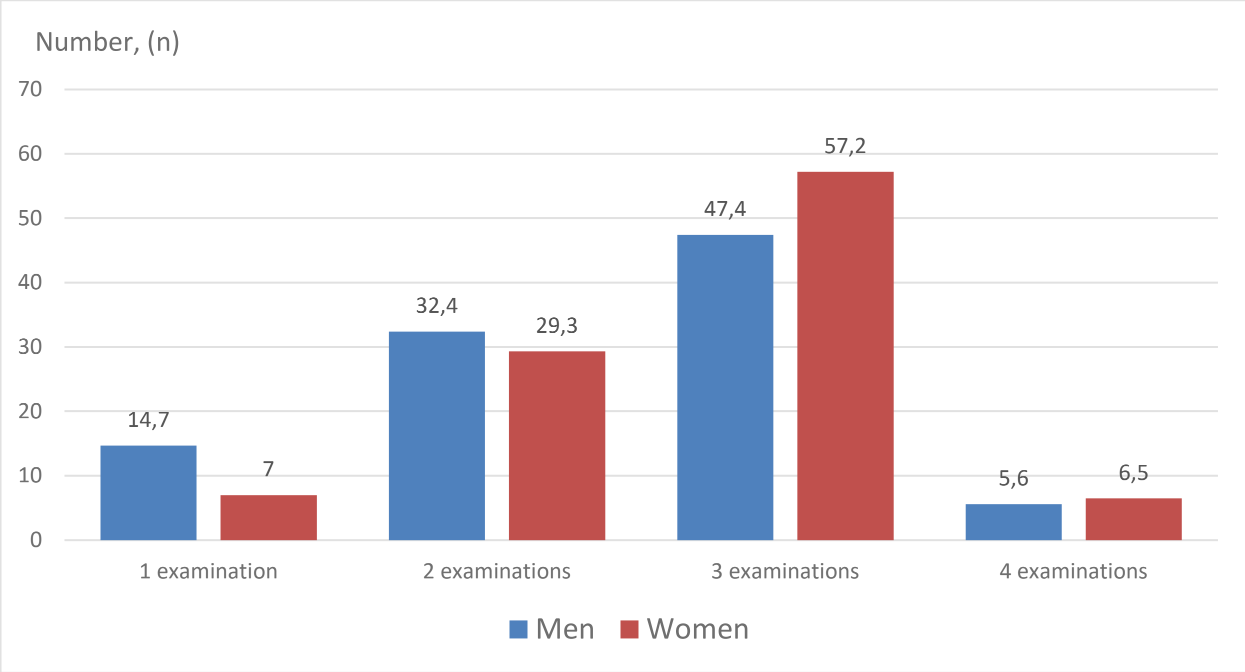


Figure 50 – Total number of specialist consultations multidisciplinary visiting crew

All patients over 60 years of age liked absolutely everything (Table 63).

Table 63 – Opinion on the organization of the multidisciplinary visiting crew by age group

Points to be noted	Age, years						Total
	<20	20-30	31-40	41-50	51-60	>60	
Culture of communication	-	18 10,2%	-	6 2,1%	-	-	24 2,9%
Appearance	6 10,7%	4 2,3%	-	-	-	-	10 1,2%
Organization of medical care	5 8,9%	28 15,8%	5 4,2%	23 8,2%	5 3,3%	-	66 7,9%
I liked it all	45 80,4%	127 71,8%	115 95,8%	251 89,6%	145 96,7%	49 100%	732 88,0%
Total	56 100%	177 100%	120 100%	280 100%	150 100%	49 100%	832 100%

There were no significant differences in opinion about the organization of the multidisciplinary visiting crew depending on gender (Figure 51).

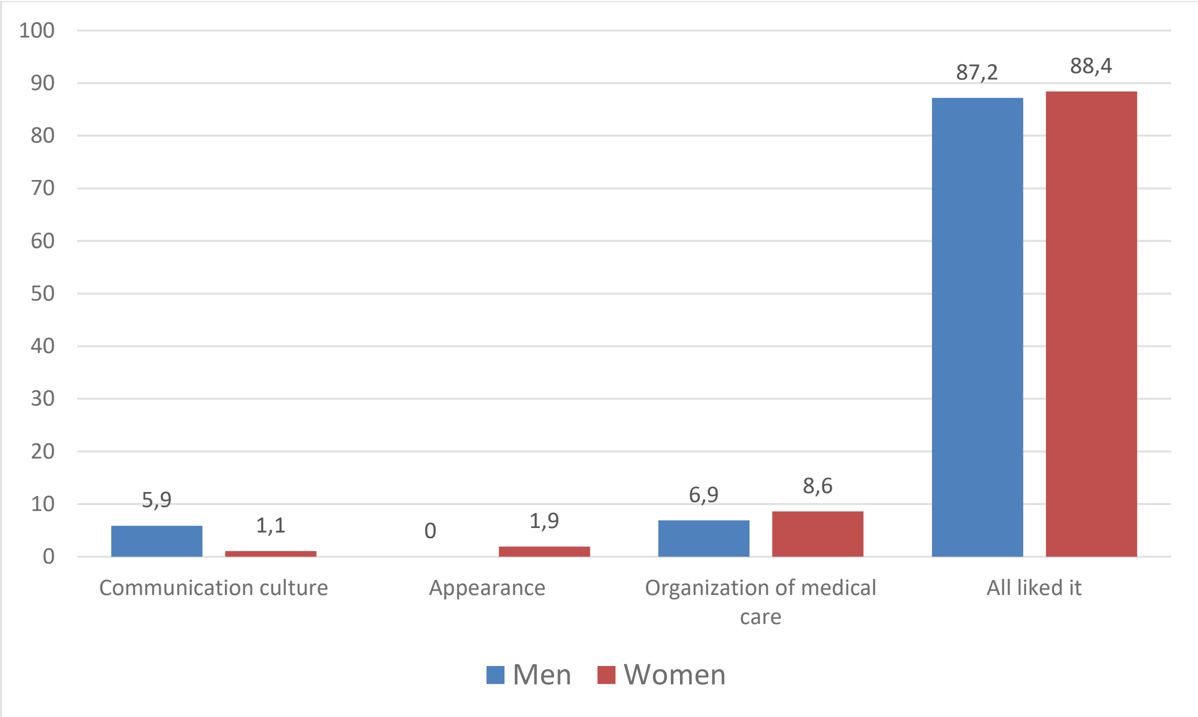


Figure 51 – Opinion about the organization of multidisciplinary team work of the visiting crew depending on the gender of the respondents, %

Men were 5.4 times less likely to be less satisfied with the culture of communication of medical personnel compared to women ($p<0.01$), while no men had any complaints about appearance. Dissatisfaction with the organization of medical care was insignificantly higher in women than in men, 1.3 times ($p>0.1$).

Respondents were also asked: "Do you plan to use our services again if necessary?". The majority answered that yes, as they liked everything (242 men and 402 women). Fifty-eight men and 106 women gave a positive answer, with the remark "for reasons beyond my control". When talking to these patients, they explained that this answer was due to the absence of necessary specialists in the medical organization at their place of residence, whom they should visit in connection with their disease, which necessitates a repeat visit to the specialists of the multidisciplinary visiting crew. 2.9% of respondents did not plan a repeat visit, women 1.7 times more often than men (Figure 52) [112].

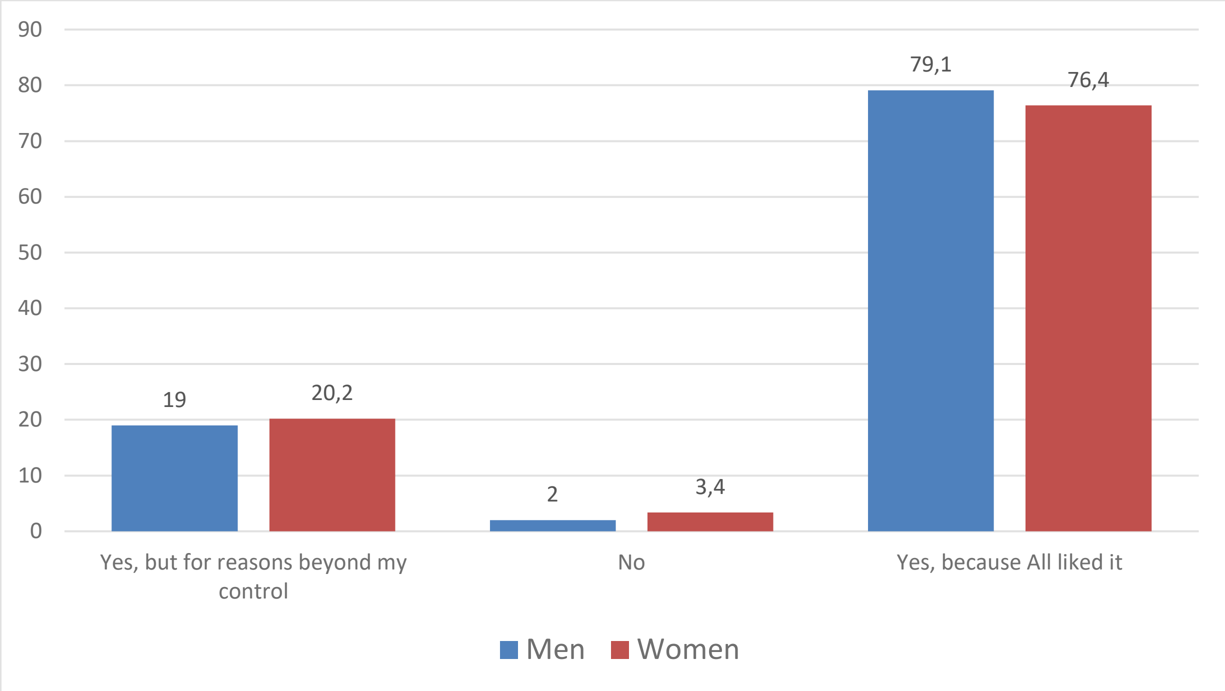


Figure 52 – Results of answers to the question: "Do you plan to use the services of a multidisciplinary visiting crew again, if necessary?", %

When evaluating the answers to this question depending on the age of respondents, it was revealed that patients aged less than 20 years and 41-50 years did not plan to re-visit the specialists of the multidisciplinary visiting crew. Respondents aged 51-60 years were more likely to plan a second visit for reasons beyond their control, 2.5 times more often than patients younger than 20 years ($p<0.01$), 1.7 times more often than patients aged 20-30 years ($p<0.01$), 9.5 times more often than patients aged 31-40 years, and 2.3 times more often than patients aged 41-50 years ($p<0.01$) (Table 64).

Table 64 – Results of answers to the question: "Do you plan to use the services of the multidisciplinary visiting crew again, if necessary?" depending on the age group of respondents

Answer options	Age, years						Total
	<20	20-30	31-40	41-50	51-60	>60	

Yes, but for reasons beyond my control.	9 16,1%	42 23,7%	5 4,2%	48 17,1%	60 40,0%	-	164 19,7%
No	6 10,7%	-	-	18 6,4%	-	-	24 2,9%
Yes, because I liked everything.	41 73,2%	135 76,3%	115 95,8%	214 76,4%	90 60,0%	49 100%	644 77,4%
Total	56 100%	177 100%	120 100%	280 100%	150 100%	49 100%	832 100%

When assessing the number of visits of each respondent to the specialists of the multidisciplinary visiting crew, the following differences were revealed: respondents aged 31-40 and 41-50 years were the most frequent first-time visitors. Thus, among the patients aged 31-40 years old, the first time they consulted the specialists of the multidisciplinary visiting crew was 4.8 times more often than among those aged <20 years old (p<0.01), 1.7 times more often than among those aged 20-30 years old (p<0.01) and 3.4 times more often than among those aged 51-60 years old (p<0.01).

The corresponding trend was observed among respondents aged 41-50 years, who 4.9, 1.7 and 3.5 times more often applied to this service for the first time compared to respondents aged under 20 years, 20-30 years and 51-60 years, respectively (p<0.01). Respondents younger than 20 years of age were the most likely to have had 1 experience of accessing the service: 1.4 times more likely than patients aged 20-30 years (p<0.01), 1.8 times more likely than respondents aged 31-40 years, 2.2 times more likely than respondents aged 41-50 years (p<0.01), 2.8 times more likely than respondents aged 51-60 years, and 2.3 times more likely than respondents aged over 60 years (p<0.01). Among respondents aged 51-60 years, a mean number of 2-4 referrals was most frequently observed: 3.0 times more frequently than among respondents younger than 20 years (p<0.01), 2.5 times more frequently than among those aged 20-30 years (p<0.01), 3.0 times more frequently than among those aged 31-40 years (p<0.01), and 2.2 times more frequently than among those aged 41-50 years (p<0.01). Among patients over 60 years of age, there were no respondents who accessed the service 2-4 times, which is partly due to the fact that this age group was more likely to access the service 5 or more times: 6.0

times more often than patients younger than 20 years of age (p<0.01), 4.2 times more often than patients 20-30 years of age (p<0.01), 5.2 times more often than patients 31-40 years of age (p<0.01), 5.0 times more often than patients 41-50 years of age (p<0.01), and 6.4 times more often than patients 51-60 years of age (p<0.01) (Table 65).

Table 65 – Number of visits of 1 respondent to multidisciplinary visiting crews

Number of requests	Age, years						Total
	<20	20-30	31-40	41-50	51-60	>60	
For the first time.	4 7,1%	36 20,3%	41 34,2%	97 34,6%	15 10,0%	14 28,6%	207 24,9%
1 time	37 66,1%	81 45,8%	45 37,5%	84 30,0%	36 24,0%	14 28,6%	297 35,7%
2-4 times	11 19,6%	42 23,7%	24 20,0%	75 26,8%	89 59,3%	-	241 29,0%
More than 5 times	4 7,1%	18 10,2%	10 8,3%	24 8,6%	10 6,7%	21 42,9%	87 10,5%
Total	56 100%	177 100%	120 100%	280 100%	150 100%	49 100%	832 100%

There were no differences by gender and number of visits (Figure 53). For the first time multidisciplinary visiting crew, men were 1.2 times more likely to be referred to specialists than women (p>0.1), men had 1.0 times more experience per visit than women (p>0.1), while women were more likely to be referred 2-4 times 1.1 times (p>0.1) and 5 or more times 1.4 times (p>0.1) (Figure 53).

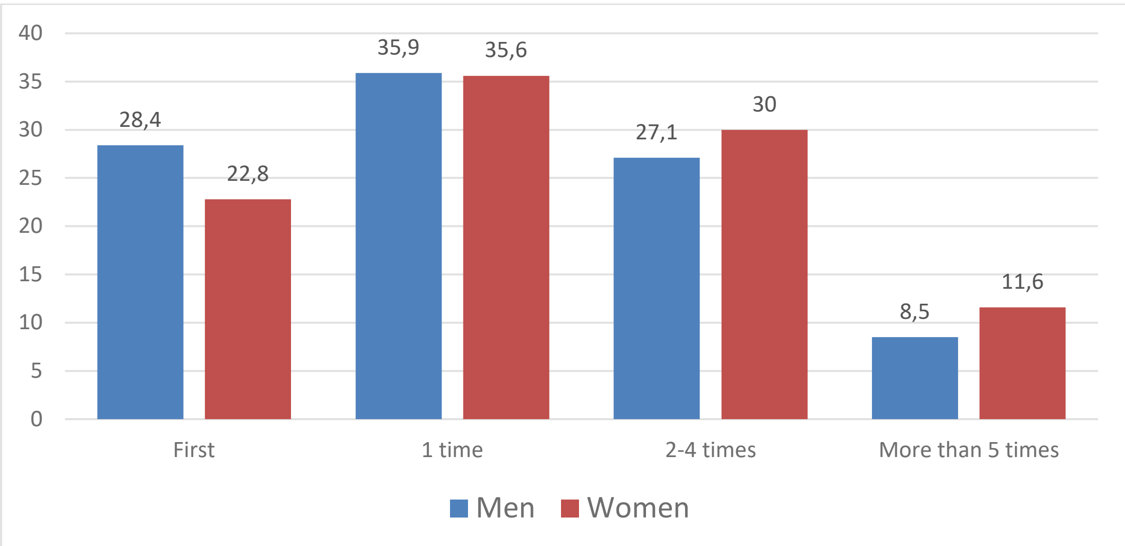


Figure 53 – Number of visits of 1 respondent to multidisciplinary visiting crews, %

To the question "Would you recommend the services of the multidisciplinary visiting crew to your acquaintances?" 796 (95.7%) respondents gave an affirmative answer: men were 1.0 times more likely than women (p>0.1) (Figure 54) [114].

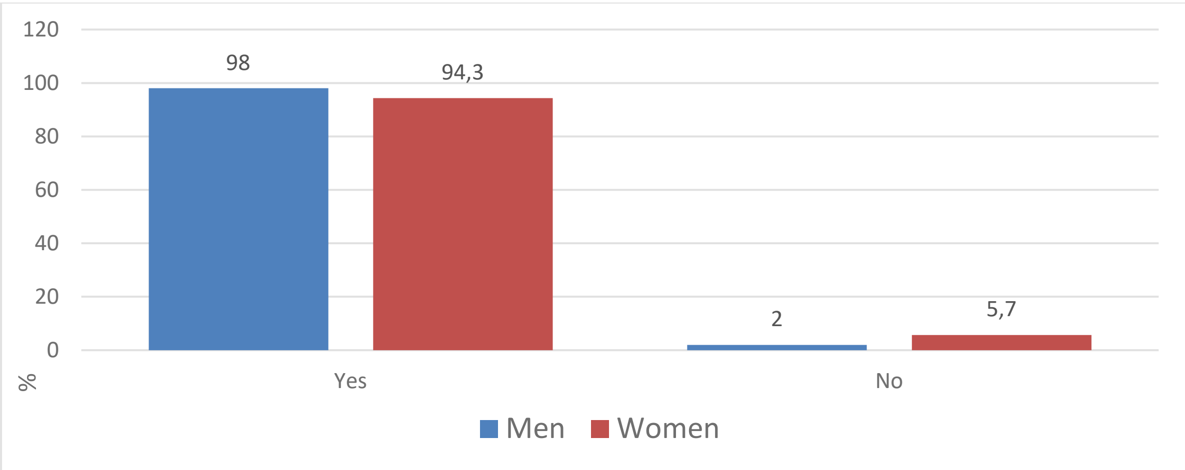


Figure 54 – Results of answers to the question: "Would you recommend the services of the multidisciplinary visiting crew to your acquaintances?", %

There were no negative answers to this question among patients aged 31-40, 51-60 and over 60 years. However, the most frequent negative answer was given by respondents under 20 years of age 1.6 times more often than by respondents aged 20-30 years of age, and 1.7 times more often than those aged 41-50 years (Table 66).

Table 66 – Results of answering the question: "Would you recommend the services of the multidisciplinary visiting crew to your acquaintances?"

Response	Age, years						Total
	<20	20-30	31-40	41-50	51-60	>60	
Yes	50 89,3%	165 93,2%	120 100%	262 93,6%	150 100%	49 100%	796 95,7%

No	6 10,7%	12 6,8%	-	18 6,4%	-	-	36 4,3%
Total	56 100%	177 100%	120 100%	280 100%	150 100%	49 100%	832 100%

The main negative moments in the work of multidisciplinary visiting crews indicated by respondents were rudeness of the staff (2.9%), with men paying attention to this aspect more often than women (1.7 times; p<0.01) (1.7 times; p<0.01).

In addition, 0.7% of respondents had the impression that staff were inattentive, and all respondents who noticed this were male (Figure 55) [114].

It is important to note that 802 (96.4%) respondents reported that there were no negative moments in the work of specialists of the multidisciplinary visiting crew [114].

The presence of negative moments that occurred to respondents when they contacted the multidisciplinary visiting crew physicians was observed only among 20-30 and 41-50 year olds.

At the same time, rudeness was more frequently complained about among respondents aged 20-30 years 4.9 times more often (p<0.01), and inattention was complained about only in this age group (Table 67).

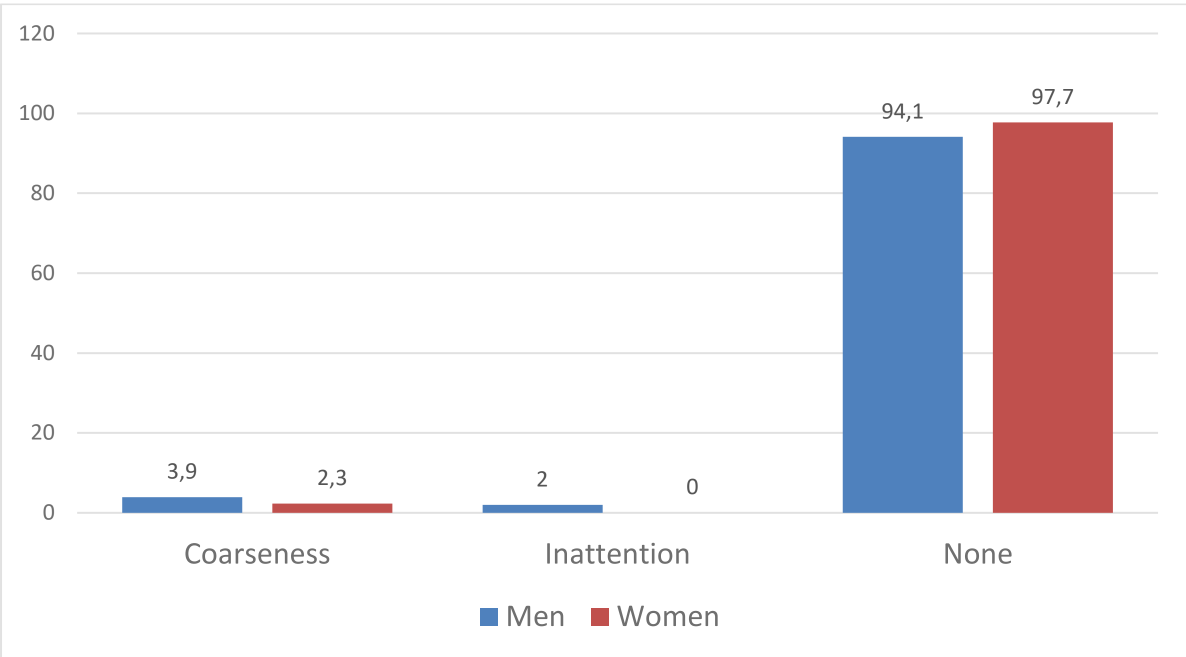


Figure 55 – Results of answering the question: "Specify the negative moments that occurred to you when contacting the doctors of the multidisciplinary visiting crew"%

Table 67 – Results of answering the question: "Specify the negative moments that occurred to you when contacting the doctors of the multidisciplinary visiting crew"

Response	Age, years						Total
	<20	20-30	31-40	41-50	51-60	>60	
rudeness	-	18 10,2%	-	6 2,1%	-	-	24 2,9%
Inattention	-	6 3,4%	-	-	-	-	6 0,7%
Absent	56 100%	153 86,4%	120 100%	274 97,9%	150 100%	49 100%	802 96,4%
Total	56 100%	177 100%	120 100%	280 100%	150 100%	49 100%	832 100%

As a result of the survey, the majority of respondents (698; 83.9%) concluded that multidisciplinary visiting crews are needed in the Tyumen Oblast (women 1.1 times more often than men; p>0.1), 15 (1.8%) respondents would like additional specialists to be included in the team (Figure 56).

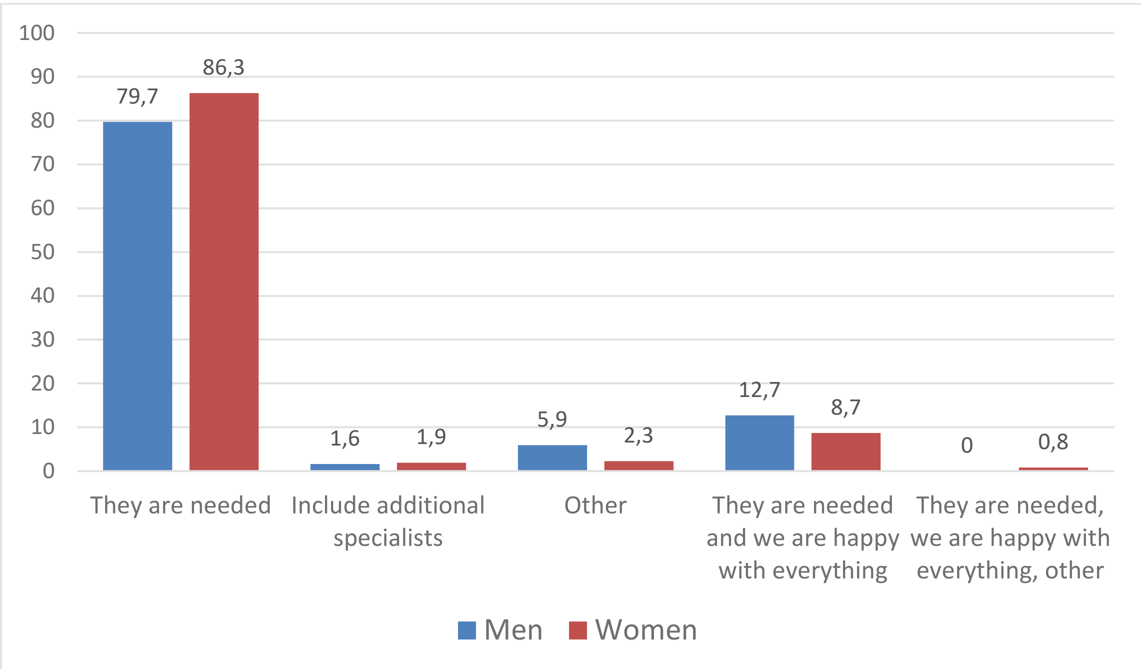


Figure 56 – Results of answers to the question: "How do you feel about multidisciplinary visiting crews", %

The need to include additional professionals was in the groups of respondents aged 20-30 and 41-50 years (Table 68).

Table 68 – Results of answers to the question: "What is your attitude to multidisciplinary visiting crews? "

Response	Age, years						Total
	<20	20-30	31-40	41-50	51-60	>60	
They're needed	51 91,1%	144 81,4%	105 87,5%	249 88,9%	116 77,3%	33 67,3%	698 83,9%
Include additional specialists	-	5 2,8%	-	10 3,6%	-	-	15 1,8%
Other	-	24 13,6%	-	6 2,1%	-	-	30 3,6%
We need them and we're fine with it	5 8,9%	-	15 12,5%	15 5,4%	34 22,7%	16 32,7%	85 10,2%
We need them, we're fine with them, the other thing is.	-	4 2,3%	-	-	-	-	4 0,5%
Total	56 100%	177 100%	120 100%	280 100%	150 100%	49 100%	832 100%

5.2. Results of implementation of telemedicine technologies for diagnostics and treatment of patients with neurological diseases
and treatment of patients with neurological diseases

Telemedicine in neurology has developed with the advent of technologies that have made it possible to transfer knowledge and exchange information. The use of telemedicine technology provides the opportunity to monitor the health of patients, train specialists, and develop research. Telemedicine allows for the provision of medical services at a distance using communication technologies, including telephone and the Internet, and may include teleconsultation, teleconferencing, or even telelearning.

Contact can be initiated by health professionals or patients, and can be synchronous (real-time) or asynchronous (save and forward).

In the last two decades, teleneurology has evolved through the expansion of technological resources. The COVID-19 pandemic has intensified this process and allowed for greater use of teleneurology for patient care and case discussions between physicians at different levels of healthcare. The last three years have certainly made digital health a necessity rather than an exception. Technological advances that seemed like distant possibilities and futuristic concepts have come to fruition in a short period of time due to the needs brought about by the pandemic. The advances made by teleneurology during this period facilitated technological innovations and healthcare processes that opened up opportunities to improve the care provided, including for individuals living in remote areas. The results of the implementation of teleconsultation in the work of the neurological service of TO for the period 2020-2022 are presented below.

All doctors performing telemedicine consultations were trained on the program "Skills of organization and provision of medical care using the centralized subsystem of telemedicine consultations on the Medved.Telemed platform" [97].

This course included the following areas:

Part I. BASICS OF TELEMEDIC TECHNOLOGIES APPLICATION IN MEDICAL ASSISTANCE

1.1. The concept of telemedicine, its purpose and the history of the emergence of technology of remote medical care.
1.2. Overview of types and forms of health care delivery using telemedicine
1.3. Telemedical consultations between a physician and a patient or his/her legal representative.
1.4. Remote interaction of physicians with each other
1.5. Remote monitoring of the patient's health status
1.6. Other practical options for the use of telemedicine technologies, directions of telemedicine development

Part II. ORGANIZATION OF TELEMEDICINE

2.1. Regulatory and legal acts regulating the use of telemedicine technologies.
2.2. Roles and distribution of responsibilities of the participants of the process of providing medical care with the use of telemedicine technologies.
2.3. Methodological training (medical part).

Part III. APPLICATION PART. SUBSYSTEM ON THE BEAR.TELEMED PLATFORM

General description of system functions

Part IV. PRACTICES IN THE USE OF TELEMEDICINE TECHNOLOGIES

4.1. Obstetrics and gynecology: management of patients in early/late stage of pregnancy
4.2. Organization of telemedicine consultations in primary outpatient and polyclinic care (district therapist)
4.3. Endocrinology: risk identification and remote monitoring of patients on dispensary care
4.4. Remote monitoring of patients with epilepsy to adjust medication prescriptions
4.5. Questionnaires and remote methods of surveying to determine the risk of diseases at enterprises working on a rotational basis
4.6. Conclusion on the practice of application

Part V. Online seminar "pros and cons of telemedicine technologies" [97].

A total of 3336 patients with conditions such as epilepsy, Parkinson's disease and ONMC were consulted during the analysis period, with the number of consultations in 2021 being 1.5 times higher than in 2020 and in 2022 being 2.4 and 1.6 times higher than in 2020 and 2021, respectively ($p<0.01$). The increase in the number of consultations was predominantly due to repeat consultations, the frequency of which increased 2.6 times in 2021 compared to 2020 and 3.6 and 1.4 times in 2022 compared to 2020 and 2021, respectively ($p<0.01$). The number of initial consultations increased significantly by 2022 and was 1.9 times greater than in 2020 and 2.2 times greater than in 2021 [Table 69].

Table 69 – Frequency of remote consultations of patients with neurological diseases in the period 2020-2022 (physician-patient)

Types of counseling	Years						p 2020-2021	p 2021-2022	p 2020-2022
	2020		2021		2022				
	n	%	n	%	n	%			
Primary	360	31	307	30	671	41	0,7	<0,01	<0,01
Repeated	210	53	550	54	753	46	0,8	<0,01	0,06
Remote patient monitoring	109	16	163	16	213	13	1,00	0,2	0,2
Counseled total	679	100	1020	100	1637	100			

The number of patients under remote monitoring also increased, but no statistically significant differences were observed (p>005).

Remote consultations of doctors have also started to be actively carried out. In total, 388 primary consultations, 134 repeated consultations, 63 medical consultations were held during the 3 analyzed years. There were no differences by year in the frequency of different types of consultations (p>005) [Table 70].

The most frequent age group among patients who received video consultations was children under 18 years of age with a diagnosis of Epilepsy. Telemedicine consultations of these children took place in the presence of parents. Also in 2020, about 1/3 of the patients consulted using telemedicine technologies were aged 18-35 years, but the number decreased thereafter, due to an increase in consulted children and those aged over 60 years, resulting in 19.0% of consultations in this age group in 2022. The number of patients aged 60 years and older counseled in 2022 increased 1.7 and 1.5 times compared to 2020 and 2021, respectively (p<0.01) [Table 71].

Table 70 – Frequency of remote consultations of physicians providing medical care to patients with neurological diseases in the period 2020-2022 (physician-physician)

Types of counseling	Years					
	2020		2021		2022	
	n	%	n	%	n	%
Primary	124	68	142	66	122	64
Repeated	40	23	45	21	49	26

Medical consultation	16	9	28	13	19	10
Counseled total	180	100	215	100	190	100

Table 71 – Age distribution of counseled patients

Age (years)	Years						p 2020-2021	p 2021-2022	p 2020-2022
	2020		2021		2022				
	n	%	n	%	n	%			
up to 18 years old.	319	47,0	550	53,9	900	55,0			
18-35 years old	210	30,9	245	24,0	311	19,0	0,21	<0,01	0,02
36-59 years old	102	15,0	143	14,0	229	14,0	0,51	0,33	0,9
60 and over	48	7,1	82	8,1	197	12,0	0,4	<0,01	<0,01
Total	679	100	1020	100	1637	100			
Note: * – children diagnosed with Epilepsy									

Patients diagnosed with epilepsy were the most demanded for videoconferences; they were also conducted for patients with Parkinson's disease and STEMI. There were no differences in the frequency of consultations depending on the diagnosis by year (p<0.01) [Table 72].

Table 72 – Diagnoses of patients consulted using telemedicine technologies between 2020 and 2022.

Diagnosis	Years					
	2020		2021		2022	
	n	%	n	%	n	%
Patients diagnosed with epilepsy	462	68	704	69	704	67
Patients diagnosed with Parkinson's disease	96	14	132	13	132	12
Patients who have had an STEMI	121	18	184	18	184	21

Table 73 shows the distribution of patients over 18 years of age, consulted using telemedicine technologies, diagnosed with Epilepsy by sex and age. There were no statistically significant differences by sex in the different age groups (p>0.1).

Table 73 – Distribution of patients over 18 years of age diagnosed with Epilepsy by sex and age

Patient groups	Years														
	2020					2021					2022				
	male		female		p	male		female		p	male		female		p
	n	%	n	%		n	%	n	%		n	%	n	%	
18-35 years old	24	45	44	49	0,6	26	44	47	49	0,6	26	34	51	42	0,3
36-59 years old	18	34	24	27	0,5	21	36	27	28	0,4	29	37	38	32	0,5
60 and over	11	21	22	24	0,7	12	20	21	23	0,7	22	29	31	26	0,6
Total	53	37	90	63		59	38	95	62		77	39	120	61	

The majority of patients diagnosed with Parkinson's disease were aged 60 years or older, but there were no statistically significant differences in either age or gender among the counseled patients with this diagnosis (p>0.1) [Table 74].

Analysis of the age-sex structure of patients who had suffered a STEMI and required telemedicine consultations revealed that in 2020 there were statistically significantly more men (p<0.01) among patients aged 36-59 years and women (p<0.01) among patients aged 60 years and older (p<0.01).

Table 74 – Distribution of patients over 18 years of age diagnosed with Parkinson's disease by sex and age

Patient groups	Years														
	2020					2021					2022				
	male		female		p	male		female		p	male		female		p
	n	%	n	%		n	%	n	%		n	%	n	%	
36-59 years old	23	41	11	28		34	43	14	27		50	42	22	29	
60 and over	33	59	29	72	0,2	45	57	39	73	0,1	70	58	55	71	0,2
Total	56	58	40	42		79	60	53	40		120	61	77	39	

However, in subsequent years, these differences were not present and telemedicine consultations were provided equally to both men and women in different age groups (Table 75).

The main purpose of telemedicine consultations (TMC) in the analyzed period was recommendations on patient management (100% of cases; 3336 consultations): clarification of diagnosis (1338 consultations), determination of treatment tactics (3085 consultations, determination of indications for face-to-face consultation (120 consultations), recommendations on the need for diagnostics (2641 consultations), and recommendations for hospitalization (93 consultations) [Table 76].

Table 75 – Distribution of patients over 18 years of age diagnosed with ONMK by sex and age

Patient groups	Years														
	2020					2021					2022				
	male		female		p	male		female		p	male		female		p
	n	%	n	%		n	%	n	%		n	%	n	%	
18-35 years old	3	6	6	9	0,52	8	10	15	15	0,3	11	8	17	8	1,00
36-59 years old	32	63	27	39	0,09	43	51	41	41	0,3	66	50	91	43	0,3
60 and over	16	31	37	52	0,0	33	39	44	44	0,5	55	42	103	49	0,3
Total	51	42	70	58		84	46	100	54		132	38	211	62	

Table 76 – Key TMC goals for the period 2020-2022 (physician-patient)

Types of counseling	Years						p 2020-2021	p 2021-2022	p 2020-2022
	2020		2021		2022				
	n	%	n	%	n	%			
Clarification of diagnosis	360	53,0	307	30,1	671	40,9	<0,01	<0,01	<0,01
Determination of treatment tactics	634	93,4	989	96,9	1462	89,3	0,02	0,07	<0,01
Determination of indications for a face-to-face consultation	19	2,8	37	3,6	64	3,9	0,4	0,2	0,7
Recommendations on the need for diagnosis	450	66,3	870	85,3	1321	80,7	<0,01	<0,01	0,08
Hospitalization recommended	10	1,5	31	3,0	52	3,2	0,2	0,1	0,80
Recommendations for patient management	679	100,0	1020	100,0	1637	100,0			

The main goals of TQM of patients with epilepsy throughout the study period were recommendations on patient management (100% of cases), which included determination of treatment tactics and recommendations on the need for necessary diagnostic procedures. In the period 2020-2022 as well as 2021-2022, there was a statistically significant increase in the number of patients whose TMC goal was to clarify the diagnosis, determine treatment tactics, and recommend the need for diagnostic procedures ($p<0.01$). There were less than 5% of cases when patients were recommended to have a face-to-face consultation or hospitalization (Table 77).

Table 77 – Key targets for TMC of patients with epilepsy in the period 2020-2022

Types of counseling	Years						p 2020-2022	p 2021-2022	p 2020-2021
	2020		2021		2022				
	n	%	n	%	n	%			
Clarification of diagnosis	231	50,0	352	50,0	674	61,4	<0,01	<0,01	1,00
Determination of treatment tactics	459	99,4	698	99,2	1060	96,6	0,06	0,02	0,7

Determination of indications for a face-to-face consultation	14	3,0	21	2,9	25	2,3	0,5	0,5	0,91
Recommendations on the need for diagnosis	401	86,8	695	98,7	996	90,8	0,1	<0,01	<0,01
Hospitalization recommended	2	0,4	9	1,3	12	1,1	0,3	0,7	0,1
Recommendations for patient management	462	100,0	704	100,0	1097	100,0			

For the majority of patients with Parkinson's disease, also the main purpose of TMC was to recommend management tactics, namely drug therapy. In this cohort of patients, the need for face-to-face consultation and hospitalization was noted in 11.5%, 22.7%, and 29.4% of cases in 2020, 2021, and 2022, respectively, the main reasons for which were examination of neurological status, orthostatic testing, increased akinetic syndrome, and hallucinations on medication. Between 2020 and 2022, there was a statistically significant increase in the number of patients whose purpose of TMC was to determine treatment tactics and for whom hospitalization was recommended (p<0.01) [Table 78].

The main goal of TMC for patients with ONMC during the analyzed 3 years was to determine the treatment tactics. Face-to-face consultation and hospitalization were required in 2020. 20.7% of patients, in 2021 – 23.4% and in 2022 – 19.2%, the main reasons for which were control of neurological status and rehabilitation using a multidisciplinary approach. There were no statistically significant differences in TMC goals for patients with ONMC between 2020 and 2022 (p>0.1) [Table 79].

Table 78 – Key targets for TMC of patients with Parkinson's disease in the period 2020-2022

Types of counseling	Years						p 2020-2022	p 2020-2021	p 2021-2022
	2020		2021		2022				
	n	%	n	%	n	%			
Clarification of diagnosis	52	54,2	63	47,7	98	49,8	0,6	0,4	0,8
Determination of treatment tactics	88	91,7	111	84,1	158	80,2	0,1	0,3	0,4

Determination of indications for a face-to-face consultation	3	3,1	9	6,8	19	9,6	0,1	0,3	0,5
Recommendations on the need for diagnosis	23	23,9	41	31,1	74	37,6	0,1	0,3	0,3
Hospitalization recommended	8	8,3	21	15,9	39	19,8	0,1	0,3	0,4
Recommendations for patient management	96	100,0	132	100,0	197	100,0			

Table 79 – Key targets for TMC of patients with ONMC in the period 2020-2022

Types of counseling	Years					
	2020		2021		2022	
	n	%	n	%	n	%
Clarification of diagnosis	13	10,7	17	9,2	24	7,0
Determining treatment tactics	114	94,2	169	91,9	321	93,6
Determination of indications for a face-to-face consultation	7	5,8	14	7,6	18	5,3
Recommendations on the need for diagnosis	19	15,7	23	12,5	35	10,2
Hospitalization recommended	18	14,9	29	15,8	48	13,9
Recommendations for patient management	121	100,0	184	100,0	343	100,0

Among both patients and physicians, attitudes toward telemedicine were mostly positive, with 20% more patients reporting positive attitudes and 22% more physicians reporting positive attitudes by 2022. Between 2020 and 2021, there was a statistically significant improvement in attitudes toward TMC among both physicians and patients, due to a decrease in the number of individuals who had difficulty giving an answer and an increase in respondents who gave positive feedback (Table 80).

Table 80 – Patient and physician attitudes toward telemedicine in the period 2020-2022

Types of consultations	Years									p 2020-2021		p 2021-2022		p 2020-2022	
	2020			2021			2022								
	П	В	p	П	В	p	П	В	p	П	В	П	В	П	В
positive	58	62	0,6	69	71	0,9	78	84	0,3	0,07	0,02	0,4	0,5	0,5	0,1
negative	24	19	0,5	21	13	0,12	18	9	0,1	0,20	0,2	0,7	0,71	0,6	0,5
Hard to answer	18	19	0,9	10	16	0,3	4	7	0,4	0,05	0,1	0,4	0,7	0,2	0,2
Total	100	100		100	100		100	100							
Note: P – patients; D – physicians															

The majority of doctors positively answered the questions "Can teleconsultations be trusted?" and "Do TMCs increase the availability of specialized medical services?". However, 1/5 of physicians expressed the opinion that TQMs do not increase the availability of specialized medical services, motivated by the fact that not all patients living in rural areas of the TO have the technical capabilities to conduct them, as well as due to the lack of "live contact" with the patient (Table 81).

The following responses were received to the question "For which patient groups are TMCs most in demand?":

– parents of children – 105 (87.5%);
– patients, regardless of age – 115 (95.8%).

When asked "What TM services do patients want?" physicians responded as follows:

– consultation of narrow specialists – 100 (83.3%);
– medical consultation – 49 (40.8%);
– nutrition and care counseling – 52 (43.3%);
– remote monitoring, control and correction of therapy – 120 (100%);
– educational work – 104 (86.7%).

Table 81 – Questionnaire survey of physicians on the importance of TMC

Questions	Yes	No	I don't know.
Can telecounseling be trusted?	90 75,0%	15 12,5%	15 12,5%
Do TMCs improve access to specialized medical care?	75 62,5%	25 20,8%	20 16,7%

Thus, according to doctors' opinion, the most demanded services for patients receiving TMC are remote monitoring, control and correction of therapy; educational work, as well as consultation of narrow specialists.

We also conducted a questionnaire survey of 120 patients with various neurological diseases about their attitude to TMC. Most patients answered positively to the questions "Can teleconsultation be trusted?", "Are you satisfied with the results of the consultation?", "Did you get answers to all your questions?", and "Do you plan to re-apply for TMC?" (Table 82).

All patients expressed the opinion that TMC should be performed on all patients, regardless of age.

Thus, starting from 2020, telemedicine technologies started to be actively used in TOs. Video consultations are conducted for patients suffering from epilepsy, Parkinson's disease and consequences of STEMI and their attending physicians, the frequency of which increased 2.4 times from 2020 to 2022. Video counseling was most in demand for children under 18 years of age diagnosed with Epilepsy. There were no differences by gender, age (among persons over 18 years old) in the demand for video consultations for the three analyzed diagnoses (epilepsy, Parkinson's disease and CNMI). The main goals of video consultations, regardless of the neurological diagnosis, were to determine treatment tactics, recommend diagnostic methods of examination, and the need for a face-to-face consultation and/or hospitalization.

Table 82 – Questionnaire survey of patients' attitudes towards TMC

Questions	Yes	No	I don't know.
Can telecounseling be trusted?	86 71,7%	23 19,2%	11 9,1%
Are you satisfied with the results of the consultation?	91 75,8%	19 15,8%	10 8,4%
Did you get answers to all your questions?	88 73,3%	18 15,0%	14 11,7%
Do you plan to reapply for TMC?	96 80,0%	8 6,7%	16 13,3%

During the questionnaire survey, both doctors and patients mostly demonstrated a positive attitude to the introduction of telemedicine technologies. Among physicians, the majority trusted the quality of teleconsultations and agreed with the thesis that TMCs increase the availability of medical services. Among patients, the majority also reported that they trusted this method of medical service delivery, and that they were satisfied with the results of the consultation and received answers to all the answers they were interested in.

Summary

Thus, the conducted survey has demonstrated the effective work of multidisciplinary visiting crew, the majority of respondents have positive feedback about the organization and work of specialists (88.0%), are ready to come for repeated consultations (77.4%) and recommend to their friends in case of need to use the services of specialists of multidisciplinary visiting crews (95.7%) [112]. There were no significant differences depending on the gender of respondents.

CHAPTER 6. RESULTS OF OPTIMIZATION OF CARE FOR THE POPULATION OF TYUMEN REGION SUFFERING FROM EPILEPSY

Epilepsy is a polyethiologic, highly comorbid pathology [93], which represents one of the most common diseases of the nervous system and ranks 3rd in the structure of these diseases [260].

The International Antiepileptic League has formulated a definition of epilepsy (2017), according to which it must meet the following criteria [229]:

– history of at least 2 reflex (unprovoked) epileptic seizures with an interval of at least 24 hours;
– a history of 1 reflex (unprovoked) epileptic seizure and a recurrence probability approaching the overall risk of recurrence (greater than 60%) after 2 spontaneous seizures in the next ten years;
– an established diagnosis of epilepsy syndrome.

The prevalence and incidence of epilepsy differs by demographic characteristics-age, gender, race, and socioeconomic status-and averages 0.5% of the population [61, 187, 188]. The incidence rate differs significantly between age groups, with high rates in early childhood, lower rates in young adulthood, and a second peak after age 65 years [87]. At present in the Russian Federation there are no unified statistical data on the epidemiology of epilepsy in connection with the referral of patients to various medical organizations [34]. Thus, according to P. M. Ponomareva (2017), the prevalence of epilepsy in the Komi Republic amounted to 3.9 per 1000 population, primary morbidity – 24.7 per 100000 population. In the Russian Federation, the prevalence in 2018 was 2.9 per 1,000 population, and the TO was 3.3 per 1,000 population [149].

The problem of helping both pediatric and adult patients requires special attention due to the need to consider appropriate treatment strategies and tactics for each patient individually. In addition, the importance of the problem is also related to the fact that patients have to take antiepileptic drugs for a long period of time, and sometimes for life, usually with some serious side effects, as well as interactions with other drugs.

Timeliness of diagnosis, as well as adequate treatment and management tactics have a significant impact on the outcome of the disease [12]. All this necessitates the organization of a specialized antiepileptic service for children and adults.

The experience of both Russian and foreign researchers has demonstrated that an epileptology center established in a particular administrative territory or locality makes it possible to organize the most effective process of treatment and rehabilitation of this category of patients. The epileptology center allows solving the issues of diagnosis and treatment, differential diagnosis, and expertise of patients with epilepsy [3, 214].

The Epileptology Center coordinates scientific research and provides highly specialized medical care. One of the center's tasks is also to identify patients with epilepsy, perform differential diagnosis and treatment [120].

Due to the high rates of epilepsy morbidity in the rural population in TO, which exceed the urban population, the oblast initiated a system of improving the system of organizing the provision of medical care to this category of patients (Figure 57).

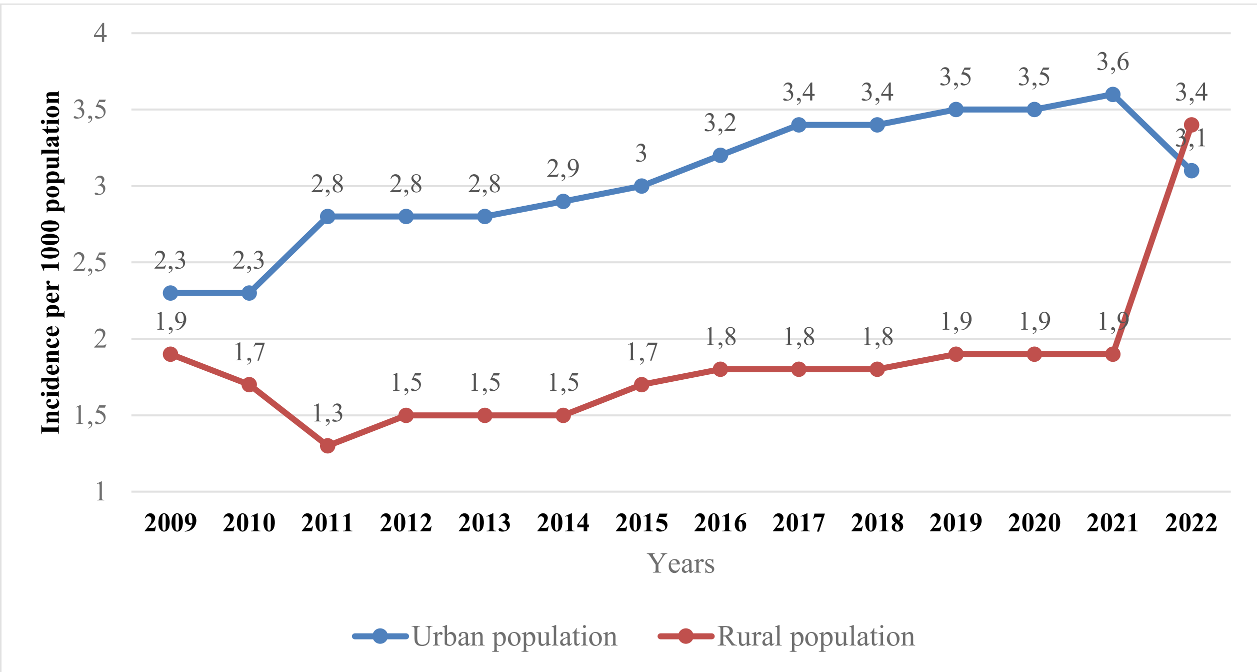


Figure 57 – Epilepsy incidence in urban and rural populations

in the Tyumen Oblast in 2009-2022 (per 1000 population)

In the Tyumen Oblast, specialized medical care for patients with epilepsy was organized based on the order of the Tyumen Oblast Department of Health Care No. 486 dated April 21, 2015. This order officially recognized the existence of the Tyumen Regional Epileptology Center, which also included a children's service in its structure [118].

In addition, a significant aspect of the order was the need to allocate a group of neurologists to receive patients with epilepsy in the so-called inter-territorial offices. Thus, in the Tyumen Oblast, not just a center/cabinet for receiving patients with epilepsy was formed, but a system of specialized care for this category of patients was developed, including accessibility for the rural population [158].

In accordance with the Order of the Ministry of Health of TO No. 486 of 21.04.2015 (Annex I, p. 331), the Regional Epileptology Center was opened in the State Autonomous Institution of TO "Regional Treatment and Rehabilitation Center", and inter-territorial epileptology rooms (ITEC) were opened in the State Budgetary Institution of TO "Regional Hospital No. 3", State Budgetary Institution of TO "Regional Hospital No. 4" and State Budgetary Institution of TO "Regional Hospital No. 23".

The cabinet's tasks included:

- Creation of a register of patients and a computerized database on the use of anticonvulsants for the purpose of their rational use;
- providing qualified consultative diagnostic assistance to the population using effective medical technologies through comprehensive examination and treatment of patients with epilepsy and paroxysmal disorders, as well as dynamic monitoring of this contingent of patients and implementation of medical, social and rehabilitation measures;
- Development and implementation of diagnostic algorithms for epileptic patients with paroxysmal conditions in order to obtain complete and reliable information in minimum time during consultative appointments;

- implementation of dynamic monitoring of patients with epilepsy and paroxysmal conditions in order to timely and adequate control over the effectiveness of treatment and identification of possible side effects;
- analyzing the effectiveness of rehabilitation measures and dispensary monitoring of epilepsy patients;
- Providing advisory and methodological assistance to various LPU [101].

Neurologists from these offices have undergone training in epileptology and functional diagnostics at the Tyumen Epileptology Center and at federal-level clinics. The developed routing of patients (adults and children) diagnosed with epilepsy for consultative appointments, diagnostic examination and, if necessary, inpatient treatment under compulsory medical insurance (CMI) is carried out as follows: the patient applies to the territorial polyclinic or directly to the inter-territorial office and then, if necessary, is referred to the Tyumen regional epileptology center [158].

The territories of the Tyumen Oblast are distributed and attached by offices and the Center (Figure 58).

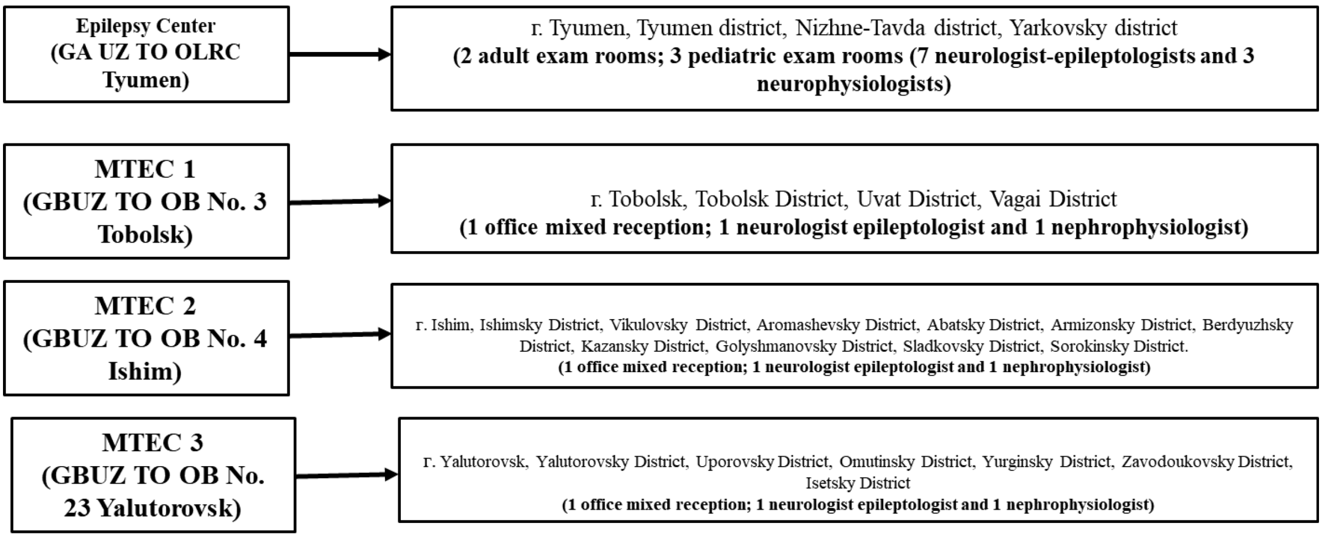


Figure 58 – Routing of patients with epilepsy in the Tyumen Oblast

According to the joint order of the Tyumen Oblast Department of Healthcare, the Tyumen City Administration Healthcare Department and the Tyumen Oblast Territorial Mandatory Medical Insurance Fund dated 11.09.2015 № 598os/26-34-42015/73od "On keeping regional registers of adults subject to dispensary observation", in the program module of RS EGISZ "Doctor's Workplace", patients suffering from epilepsy (ICD-10 code G40-G41) are included in the regional register of patients suffering from diseases of the nervous system and are under dispensary observation in the medical organization at the place of attachment (Figure 59) [107].

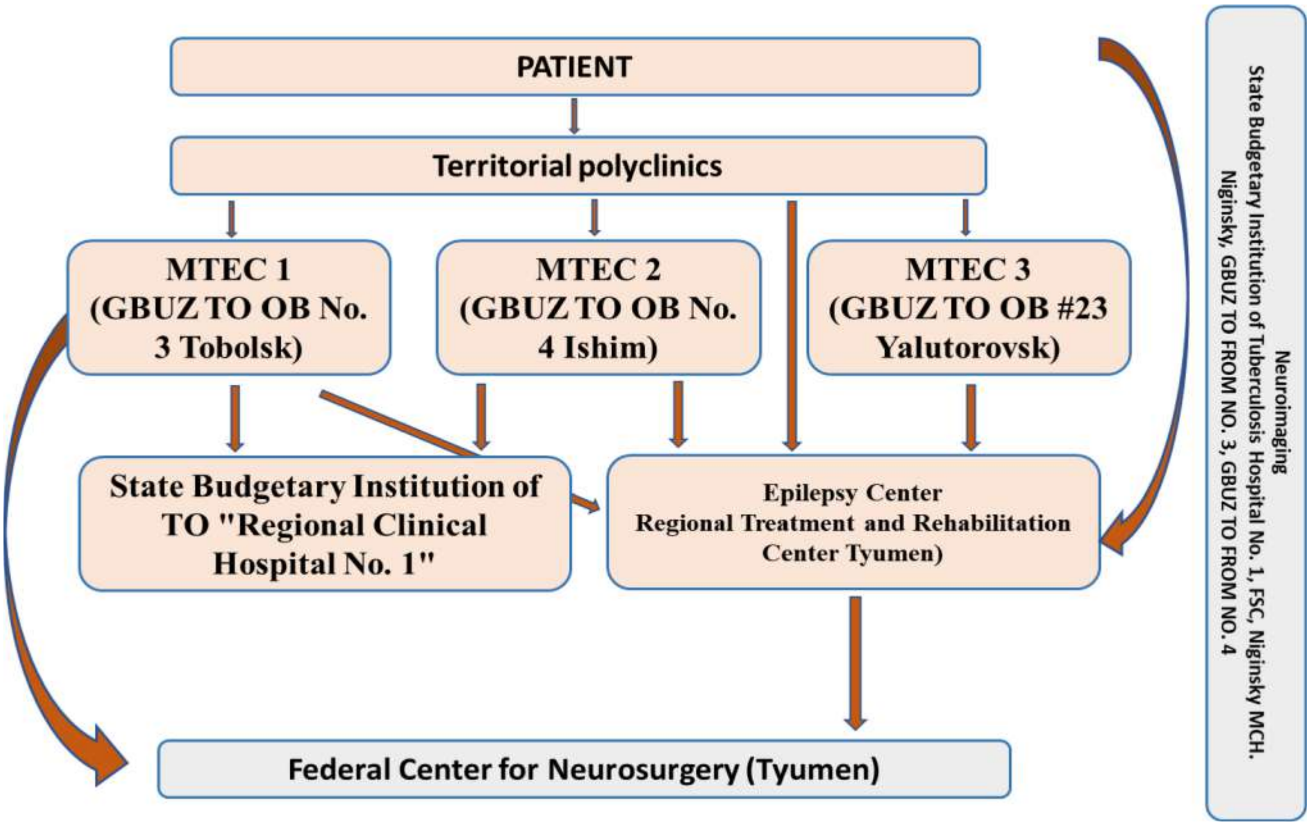


Figure 59 – Staging of medical care for patients with epilepsy in the Tyumen Oblast with epilepsy in the Tyumen Oblast

We analyzed the total and primary incidence of epilepsy in the context of the territories of the Tyumen region for 2008-2019 (per 1000 population) in the period from 2009 to 2022 (Table 83).

The analysis revealed that in the Tyumen Oblast (without AD) in the period 2020-2022, the mean absolute increase/decline (0.1% and 0.1%), mean annual rate of attrition (2.6% and 3.6%), and mean annual rate of total epilepsy morbidity (2.8 ± 0.3 95% CI 2.6-3.1 and 0 ± 0.1 95% CI 3.2-3.8) were statistically significantly higher than in the period 2009-2019 (p=0.03).

Table 83 – Total and primary incidence of epilepsy by territories of the Tyumen Oblast for 2009-2017 (per 1000 population)

Territories	Morbidity	2009	2010	2011	2012	2013	2014	2015	2016	2017
Tyumen Oblast.	OZ	2,6	2,5	2,5	2,6	2,6	2,7	2,9	3,1	3,2
	PZ	0,3	0,2	0,3	0,3	0,2	0,2	0,2	0,3	0,3
Tyumen	OZ	2,8	2,9	2,7	2,8	2,7	2,8	2,9	3,1	3,2
	PZ	0,3	0,3	0,3	0,2	0,2	0,2	0,2	0,3	0,2
Ishim and Ishim district	OZ	3,4	1,6	1,4	1,8	1,8	1,9	1,9	2,5	3,0
	PZ	0,3	0,1	0,1	0,3	0,2	0,1	0,1	0,7	0,6
Tobolsk	OZ	1,7	2,2	2,8	2,5	2,5	2,7	2,9	2,9	3
	PZ	0,1	0,1	0,3	0,2	0,2	0,3	0,3	0,2	0,2
Abatsky district	OZ	1,9	2,3	2,4	2,7	2,9	3,1	3,4	3,5	3,0
	PZ	0,5	0,2	0,1	0,4	0,3	0,3	0,2	0,2	0,2
Armizon district	OZ	4,2	4,2	3,7	3,8	3,5	3,5	3,2	4,8	5,4
	PZ	0,5	0,4	0,3	0,2	0,1	0,3	0,4	1,3	1,3
Aromashevsky district	OZ	3,4	4,0	4,1	4,3	4,5	5,1	5,5	5,7	6,4
	PZ	0,8	0,3	-	0,1	0,4	0,5	0,5	0,5	0,8
Berdyuzhsky district	OZ	3,4	3,4	3,6	3,8	3,7	3,8	3,9	4,1	4,3
	PZ	0,8	0,3	0,5	0,5	0,3	0,6	0,2	0,3	0,2
Vagayskiy district	OZ	3,0	1,9	2,0	2,6	2,9	3,4	3,6	3,5	3,6
	PZ	0,1	0	0,4	0,3	0,4	0,5	0,4	0,1	0,1
Vikulovsky district	OZ	2,7	2,6	2,9	3,3	3,3	3,7	5,4	3,7	4,1
	PZ	0,2	0,1	0,4	0,4	0,1	0,5	0,6	0,6	0,4
Golyshmanovsky district	OZ	2,9	2,8	3,6	3,0	2,7	3,1	5,3	5,5	5,5
	PZ	0	0,1	0,9	0,3	0,2	0,2	0,2	0,4	0,2
Zavodoukovsky district	OZ	2,1	2,2	2,3	2,7	2,8	2,7	2,9	3,0	2,7
	PZ	0,4	0,3	0,2	0,4	0,2	0,2	0,2	0,1	0,1
Isetsky district	OZ	2,7	2,3	2,4	2,5	2,4	2,3	2,4	2,6	2,4
	PZ	0,3	0,1	0,1	0,2	0,1	0,3	0,1	0,2	0,2
Kazan district	OZ	2,3	2,4	2,4	2,7	2,6	2,8	2,6	2,9	3,1
	PZ	0,1	0,1	0,2	0,3	0,1	0,2	0,2	0,3	0,5
Nizhnetavda district	OZ	2,2	2,4	2,6	2,3	1,8	1,6	1,9	1,3	1,4
	PZ	0,1	0,1	0,2	0,1	0,2	0,1	0,1	0,1	0,1
Omutinsky district	OZ	3,5	3,6	3,8	4,2	4,1	4,3	4,8	4,3	3,9
	PZ	0,5	0,4	0,3	0,6	0,4	0,3	0,3	0,4	0,7
Sladkovsky district	OZ	1,7	1,6	1,7	2,1	1,6	2,1	1,8	1,8	2,1
	PZ	0	0,2	0	0,3	0,1	0,5	0,2	0	0,5
Sorokinsky district	OZ	1,6	1,9	1,9	2,2	2,8	2,9	3,3	3,8	3,5
	PZ	0,2	0	0,1	0,3	0,6	0,5	0,3	0,5	0,1
Tyumen district	OZ	1,7	1,6	1,7	1,9	2,3	2,4	2,7	3,4	3,4
	PZ	0,2	0,2	0,2	0,3	0,4	0,3	0,3	0,3	0,5
Tobolsk district	OZ	2,1	2,0	1,9	1,9	2,3	2,2	2,3	2,1	2,2
	PZ	0,4	0,3	0,3	0,2	0,4	0,3	0,2	0,1	0,1
Uvat district	OZ	2,9	2,9	2,6	2,5	2,6	2,7	2,9	2,9	3,1
	PZ	0,2	0,2	0	0	0,1	0,1	0,2	0,1	0,2

Uporovsky district	OZ	2,7	2,1	2,0	2,1	2,3	2,4	2,6	2,6	2,8
	PZ	0,2	0,1	0,2	0,3	0,3	0,3	0,2	0,1	0,2
Yurginsky district	OZ	1,5	1,4	1,4	1,4	1,6	1,9	2,0	1,8	2
	PZ	0	0	0,1	0,2	0,2	0,4	0,2	0	0,3
Yarkovsky district	OZ	4,2	3,9	3,9	3,9	4,2	3,9	4,3	4,9	5,1
	PZ	0,5	0,1	0,2	0	0,4	0	0,4	0,7	0,5
Yalutorovsky district	OZ	1,9	2,3	2,4	2,7	2,9	3,1	3,4	3,5	3,0
	PZ	0,5	0,2	0,1	0,4	0,3	0,3	0,2	0,2	0,2
Note: GI – total morbidity; PI – primary morbidity										

In Yalutorovsk city, the mean absolute increase/decline (0.1% and -0.0%), mean annual rate of attrition (5.1% and -0.7%) decreased significantly between 2020 and 2022, and the mean annual rate of total epilepsy incidence (1.6 ± 0.3 95% CI 1.3-1.8 and 2.3 ± 0.0 95% CI 2.2-2.4) increased compared to 2009-2019 (p=0.0). In Tobolsk, there was a decrease in the mean absolute increase/decline (0.2% and 0.1%) and mean annual rate of loss (6.4% and 3.3%) between 2020 and 2022, while the mean annual rate of total epilepsy incidence (2.7 ± 0.5 95% CI 2.4-3.0 and 4.3 ± 0.1 95% CI 3.9-4.6) increased compared to 2009-2019 (p=0.0). In Tyumen city there was an increase in all analyzed indicators of total epilepsy incidence in the period 2020-2022 compared to 2009-2019: for the mean absolute increase/decline from 0.1% to 0.1%, the mean annual rate of increase in attrition from 1.7% to 3.9% and for the mean annual rate of total epilepsy incidence from 2.9 ± 0.2 95% CI 2.8-3.1 to 3.4 ± 0.1 95% CI 3.0-3.8(p=0.0). In Yarkovsky district, these rates increased from 0.1% to 0.1%, from 1.9% to 2.5% and from 4.4 ± 0.5 95% CI 4.1-4.8 to 5.2 ± 0.1 95% CI 4.9-5.5 between 2009 and 2019 compared to 2020-2022, respectively (p=0.1). In Yurginsky district, they increased from 0.1% to 0.6%, from 4.6% to 21.8% and from 1.8 ± 0.4 95% CI 1.6-2.0 to 3.1 ± 0.6 95% CI 1.6-4.6 between 2009 and 2019 compared to 2020-2022, respectively (p=0.0). In Uporovsky district, mean absolute increase/decline, mean annual rate of increase in attrition and mean annual rate of total epilepsy incidence increased from 0.0% to 0.3%, from 1.4% to 8.1% and from 2.5 ± 0.4 95% CI 2.3-2.7 to 3.6 ± 0.3 95% CI 2.9-4.3 from 2009 to 2019 compared to 2020-2022, respectively (p=0.0). The same trend was observed in Uvat district, where these rates increased from 0.1% to 0.2%, from 3.4% to 4.4% and from 2.9 ± 0.4 95% CI 2.6-3.2 to 4.6 ± 0.3 95% CI 4.0-5.3 between 2009 and 2019 compared to 2020-2022, respectively (p=0.0). In Tobolsk district, these rates increased from 0.1% to 0.7%, from 3.6% to 19.7% and from 2.3 ± 0.3 95% CI 2.0-2.5 to 3.9 ± 0.7 95% CI

2.2-5.6 between 2009 and 2019 compared to 2020-2022, respectively (p=0.0). In Tyumen district, they increased from 0.2% to 0.3%, from 7.9% to 7.9% and from 2.6 ± 0.8 95% CI 2.0-3.1 to 4.0 ± 0.3 95% CI 3.3-4.8 between 2009 and 2019 compared to 2020-2022, respectively (p=0.0). In Vagayskiy district, the mean absolute increase/decline (0.1% and -0.1%), mean annual rate of increase in attrition (1.8% and -1.8%) decreased significantly between 2020 and 2022, and the mean annual rate of total epilepsy incidence (3.1 ± 0.6 95% CI 2.7-3.5 and 3.9 ± 0.3 95% CI 3.2-4.8) increased compared to 2009-2019 (p=0.0) (Table 84).

Table 84 – Total and primary incidence of epilepsy by territories of the Tyumen Oblast for 2018-2022 (per 1000 population)

Territories	Morbidity	2018	2019	2020	2021	2022	Average absolute increase/decrease	Average annual growth/decline rate	Average annual level/ average annual level, Me [25Q; 75Q]	95% CI
Tyumen Oblast.	OZ	3,3	3,3	3,4	3,5	3,6	0,1	2,8	2,9 ± 0,4	1,5-1,9
	PZ	0,2	0,2	0,2	0,2	0,3			0,3 ± 0,0	
Tyumen	OZ	3,2	3,2	3,3	3,3	3,6	0,1	2,0	3,0 ± 0,3	2,9-3,2
	PZ	0,2	0,2	0,2	0,2	0,3			0,3 ± 0,1	
Ishim and Ishim district	OZ	3,5	3,1	2,7	2,7	2,8	-0,1	-1,5	2,5 ± 0,7	2,1-2,8
	PZ	0,3	0,2	0,1	0,2	0,2			0,2 ± 0,2	
Tobolsk	OZ	3,3	3,2	4,1	4,3	4,4	0,2	7,5	3,1 ± 0,8	2,6-3,5
	PZ	0,2	0,1	0,2	0,2	0,5			0,2 ± 0,1	
Abatsky district	OZ	3,2	2,9	2,7	2,4	2,6	0,1	2,4	2,8 ± 0,5	2,5-3,1
	PZ	0,2	0,2	0,4	0,3	0,2			0,2 ± 0,1	
Armizon district	OZ	5,5	5,8	5,2	5,2	5,6	0,1	2,2	4,5 ± 0,9	4,0-5,1
	PZ	0,9	1,1	0,3	0,3	0,7			0,6 ± 0,4	
Aromashevsky district	OZ	5,9	5,9	5,8	6,2	6,1	0,2	4,5	5,2 ± 0,9	4,7-5,8
	PZ	0,7	0,8	0,8	0,7	0,4			0,6 ± 0,2	
Berdyuzhsky district	OZ	4,5	5,3	4,5	4,7	5,2	0,1	3,3	4,1 ± 0,6	3,8-4,5
	PZ	0,8	1,0	0,7	0,6	0,6			0,5 ± 0,3	
Vagayskiy district	OZ	3,5	3,6	3,9	4,3	3,7	0,1	1,6	3,3 ± 0,7	2,9-3,7
	PZ	0,2	0,2	0,3	0,6	0,2			0,3 ± 0,2	

Territories	Morbidity	2018	2019	2020	2021	2022	Average absolute increase/decrease	Average annual growth/decline rate	Average annual level/ average annual level, Me [25Q; 75Q]	95% CI
Vikulovsky district	OZ	3,9	4,0	4,2	4,2	3,9	0,1	3,1	3,7 ± 0,7	3,3-4,1
	PZ	0,1	0,2	0,1	0,1	0,9			0,3 [0,1; 0,5]	
Golyshmanovsky district	OZ	5,7	5,9	5,6	5,8	5,7	0,2	5,2	4,5 ± 1,4	3,8-5,3
	PZ	0,3	0,3	-	0,2	0,1			0,2 ± 0,2	
Zavodoukovsky district	OZ	2,4	2,7	2,3	2,6	2,2	0,1	1,9	2,6 ± 0,3	2,1-2,8
	PZ	0,1	0,4	0,3	0,3	0,2			0,2 ± 0,1	

Table 84 continued

Territories	Morbidity	2018	2019	2020	2021	2022	Average absolute increase/decrease	Average annual growth/decline rate	Average annual level/ average annual level, Me [25Q; 75Q]	95% CI
Isetsky district	OZ	3,2	3,0	3,0	3,1	2,9	-0,0	-1,6	2,5 ± 0,2	2,4-2,5
	PZ	-	-	0,1	-	0,1			0,2 ± 0,1	
Kazan district	OZ	1,7	2,4	2,6	2,4	2,5	0,1	1,8	2,8 ± 0,3	2,6-2,9
	PZ	0,3	0,8	0,5	0,2	0,3			0,2 ± 0,1	
Nizhnetavda district	OZ	4,5	4,1	4,4	4,3	4,4	0,0	0,9	2,1 ± 0,5	1,8-2,3
	PZ	0,5	0,3	0,3	0,1	0,2			0,2 [0,1; 0,3]	
Omutinsky district	OZ	2,4	2,2	2,2	1,8	1,9	0,1	1,9	4,2 ± 0,4	3,9-4,4
	PZ	0,2	0,2	0,3	-	0,1			0,4 ± 0,2	
Sladkovsky district	OZ	3,4	3,2	3	2,9	3,2	0,0	0,7	1,9 ± 0,3	1,8-2,1
	PZ	-	0,1	-	-	0,2			0,2 ± 0,2	
Sorokinsky district	OZ	3,4	3,6	3,7	4,1	4,3	0,1	5,3	2,8 ± 0,7	2,4-3,2
	PZ	0,2	0,4	0,3	0,4	0,3			0,3 ± 0,2	
Tyumen district	OZ	2,7	3,0	3,2	3,9	4,6	0,2	7,6	2,9 ± 0,9	2,3-3,4
	PZ	0,1	0,1	0,1	0,5	0,2			0,3 ± 0,1	
Tobolsk district	OZ	3,1	4	4,4	4,8	4,7	0,2	6,1	2,6 ± 0,8	2,2-3,1
	PZ	0,1	0,5	0,4	0,5	0,3			0,2 ± 0,2	
Uvat district	OZ	2,9	3,0	3,3	3,6	3,8	0,1	3,9	3,3 ± 0,8	2,8-3,8
	PZ	0,3	0,2	0,3	0,4	0,4			0,2 ± 0,2	
Uporovsky district	OZ	2,3	2,3	2,5	3,1	3,7	0,1	2,9	2,7 ± 0,6	2,4-3,1

	PZ	0,3	0,2	0,4	0,7	0,5			0,3 ± 0,1	
Yurginsky district	OZ	5,2	5,1	5,1	5,2	5,3	0,2	7,4	2,1 ± 0,7	1,7-2,5
	PZ	0,5	0,2	0,2	0,4	0,3			0,3 ± 0,2	
Yarkovsky district	OZ	3,2	2,9	2,7	2,4	2,6	0,1	1,8	4,6 ± 0,6	4,2-4,9
	PZ	0,2	0,2	0,4	0,3	0,2			0,3 ± 0,2	
Yalutorovsky district	OZ	5,5	5,8	5,2	5,2	5,6	0,1	4,5	1,7 ± 0,4	1,5-1,9
	PZ	0,9	1,1	0,3	0,3	0,7			0,2 ± 0,1	
Note: GI – total morbidity; PI – primary morbidity										

Analysis of the dynamics of primary epilepsy incidence revealed that its average annual level (Me [25Q; 75Q] or m ± SD) significantly increased in the period from 2009-2019 compared to 2020-2022 in Nizhnetavdinsky (from 0.1% [0.1; 0.2] to 0.3% [0.2; 0.5]; p=0.1), Uvatsky (from 0.2 ± 0.1 to 0.4 ± 0.1; p=0.0), Uporovsky (from 0.2 ± 0.1 to 0.3 ± 0.1; p=0.1) (from 0.2 ± 0.1 to 0.3 ± 0.1; p=0.1), Yurginsky (from 0.2 ± 0.1 to 0.5 ± 0.2; p=0.0) districts and decreased in Zavodoukovsky (from 0.2 ± 0.1 to 0.0 ± 0.0; p=0.0). No statistically significant differences were found in other districts.

Improvements in diagnosis have been accompanied by increases in indicators such as morbidity and morbidity.

The analysis of epilepsy morbidity in the population revealed an increase in the mean absolute increase/decline rate from 2009-2019 to 2020-2022 among children 0-17 years old from 0.1% to 0.2%, among adults from 0.1 to 0.1 and a decrease in the total population from 0.1% to 0.1%. Also among children 0-17 years and adults, an increase in the average annual rate of increase/decrease in population morbidity from 2009-2019 to 2020-2022 was found from 1.7% to 3.1% and from 2.8% to 3.3%, respectively, and a decrease among the total population from 2.4% to 1.5%. The mean annual morbidity rate increased between 2009-2019 and 2020-2022 among children 0-17 years of age from 4.1 ± 0.4 95% CI 3.8-4.4 to 4.9 ± 0.2 95% CI 4.5-5.3 (p=0,0), among adults from 2.5 ± 0.3 95% CI 2.3-2.7 to 3.1 ± 0.1 95% CI 2.9-3.4 (p=0.0), and among the total population from 2.8 ± 0.3 95% CI 2.6-3.1 to 3.5 ± 0.1 95% CI 3.3-3.6 (p=0.0).

The analysis of epilepsy morbidity (including status epilepticus) revealed an increase in the average absolute growth/decline rate between 2009-2019 and 2020-2022 among children 0-17 years old from -0.1% to 0.1% and in the total population from -0.0% to 0.1%, with no change in the adult population (0.0% and 0.0%, respectively). There was also an increase in the average annual rate of increase/decline from 2009-2019 to 2020-2022 among children 0-17 years old from -9.3% to 11.8% and in the total population from -3.9% to 22.5%, with no trend in the adult population (0.0% and 0.0%, respectively). Regarding the mean annual incidence of epilepsy (including status epilepticus) in the population, both among children 0-17 years (from 0.5 ± 0.1 95% CI 0.4-0.6 to 0.5 ± 0.1 95% CI 0.3-0.6) and in the whole population (from 0.3 ± 0.1 95% CI 0.2-0.3 to 0.2 ± 0.1 95% CI 0.1-0.4) there was a decrease in this indicator (Table 85).

Table 86 shows the incidence and morbidity of epilepsy by age groups in Tyumen for 2012-2019 (per 1000 population). It was revealed that in children 0-17 years old there was no dynamics in the average absolute increase/decrease of epilepsy morbidity in the period 2009-2019 and 2020-2022, in both periods this indicator was 0.1, while in adults and the whole population there was an increase from 0.1 to 0.2 and from 0.0 to 0.2, respectively.

Table 85 – Incidence and morbidity of epilepsy (including epileptic status) by age groups in the Tyumen Oblast in 2009-2022 (per 1000 population)

Year	Age category	Registered patients with the disease abs. data		Soreness	Morbidity
		total	including diagnosed for the first time diagnosed for the first time in life	rate per 1,000 us.	
2009	children 0-17 years	1081	206	3,9	0,8
	adults	2342	173	2,2	0,2
	entire population	3423	379	2,6	0,3
2010	children 0-17 years	1049	144	3,9	0,5
	adults	2244	177	2,1	0,2
	entire population	3293	321	2,5	0,2
2011	children 0-17 years	971	122	3,6	0,4

	adults	2364	218	2,2	0,2
	entire population	3335	340	2,5	0,3
2012	children 0-17 years	1046	137	3,7	0,5
	adults	2489	209	2,3	0,2
	entire population	3535	346	2,6	0,3
2013	children 0-17 years	1083	123	3,7	0,4
	adults	2532	191	2,3	0,2
	entire population	3615	314	2,6	0,2
2014	children 0-17 years	1170	141	3,9	0,5
	adults	2657	172	2,4	0,2
	entire population	3827	313	2,7	0,2
2015	children 0-17 years	1364	164	4,3	0,5
	adults	2847	173	2,6	0,2
	entire population	4211	337	2,9	0,2

Table 85 continued

Year	Age category	Registered patients with the disease abs. data		Soreness	Morbidity
		total	including diagnosed for the first time diagnosed for the first time in life	rate per 1,000 us.	
2016	children 0-17 years	1493	191	4,6	0,6
	adults	3054	218	2,7	0,2
	entire population	4547	409	3,1	0,3
2017	children 0-17 years	1525	172	4,4	0,5
	adults	3244	261	2,8	0,2
	entire population	4769	433	3,2	0,3
2018	children 0-17 years	1575	141	4,5	0,4
	adults	3323	207	2,9	0,2
	entire population	4898	348	3,2	0,2
2019	children 0-17 years	1644	122	4,6	0,3
	adults	3411	212	2,9	0,2
	entire population	5055	334	3,3	0,2
2020	children 0-17 years	1753	161	4,7	0,4
	adults	3472	172	3	0,2
	entire population	5225	333	3,4	0,2
2021	children 0-17 years	1815	171	4,9	0,5
	adults	3576	176	3,1	0,2
	entire population	5391	347	3,5	0,2

2022	children 0-17 years	1867	188	5	0,5
	adults	3772	284	3,2	0,2
	entire population	5639	472	3,5	0,3
Average absolute growth/loss	children 0-17 years	-	-	0,1	-0,0
	adults	-	-	0,1	0,0
	entire population	-	-	0,1	0,0
Average annual rate of increase/decrease	children 0-17 years	-	-	1,9	-3,6
	adults	-	-	2,9	0,0
	entire population	-	-	2,3	0,0
Average annual level	children 0-17 years	-	-	4,3 ± 0,5	0,5 ± 0,1
	adults	-	-	2,6 ± 0,4	0,2
	entire population	-	-	2,9 ± 0,4	0,2 ± 0,1
95% CI	children 0-17 years	-	-	3,9-4,5	0,4-0,6
	adults	-	-	2,4-2,8	
	entire population	-	-	2,8-3,2	0,2-0,3

Table 86 – Incidence and morbidity of epilepsy by age groups in Tyumen for 2009-2022 (per 1000 population)

Year	Age category	Registered patients with the disease abs. data		Soreness	Incidence
		total	including those diagnosed for the first time in their lives	rate per 1,000 us.	
2009	children 0-17 years	439	94	3,6	0,7
	adults	1221	109	2,5	0,2
	entire population	1660	203	2,8	0,3
2010	children 0-17 years	483	83	3,9	0,7
	adults	1238	124	2,6	0,3
	entire population	1721	207	2,9	0,3
2011	children 0-17 years	386	52	3,1	0,4
	adults	1270	136	2,6	0,3
	entire population	1656	188	2,7	0,3
2012	children 0-17 years	458	52	3,5	0,4
	adults	1335	105	2,6	0,2
	entire population	1793	157	2,8	0,2
2013	children 0-17 years	470	39	3,5	0,3

	adults	1337	93	2,5	0,2
	entire population	1807	132	2,7	0,2
2014	children 0-17 years	529	45	3,7	0,3
	adults	1419	74	2,6	0,1
	entire population	1948	119	2,8	0,2
2015	children 0-17 years	629	71	4,2	0,5
	adults	1487	85	2,7	0,2
	entire population	2116	156	3	0,2
2016	children 0-17 years	704	57	4,4	0,4
	adults	1594	125	2,8	0,2
	entire population	2298	182	3,1	0,3
2017	children 0-17 years	708	55	4,2	0,3
	adults	1739	125	3	0,2
	entire population	2447	180	3,2	0,2

Table 86 continued

Year	Age category	Registered patients with the disease abs. data		Soreness	Incidence
		total	including those diagnosed for the first time in their lives	rate per 1,000 us.	
2018	children 0-17 years	718	59	4	0,3
	adults	1759	122	2,9	0,2
	entire population	2477	181	3,2	0,2
2019	children 0-17 years	762	44	4,1	0,2
	adults	1821	103	3	0,2
	entire population	2583	147	3,2	0,2
2020	children 0-17 years	844	85	4,4	0,4
	adults	1839	82	3	0,1
	entire population	2683	167	3,3	0,2
2021	children 0-17 years	739	81	3,6	0,4
	adults	1844	88	3	0,1
	entire population	2583	169	3,1	0,2
2022	children 0-17 years	922	92	4,5	0,5
	adults	2010	175	3,3	0,3

	entire population	2932	267	3,6	0,3
average absolute growth/loss, %	children 0-17 years			0,1	-0,0
	adults			0,1	0,0
	entire population			0,1	0,0
average annual growth/loss rate, %	children 0-17 years			1,7	-2,6
	adults			2,2	3,2
	entire population			1,9	0,0
annual average	children 0-17 years			3,9 ± 0,4	0,4 ± 0,2
	adults			2,8 ± 0,2	0,2 ± 0,1
	entire population			3,0 ± 0,3	0,2 ± 0,1
95% CI	children 0-17 years			3,7-4,2	0,3-0,5
	adults			2,7-2,9	0,2-0,2
	entire population			2,9-3,2	0,2-0,3

The average annual rate of increase/decrease in epilepsy morbidity in children 0-17 years of age between 2009-2019 and 2020-2022 decreased from 1.3 to 1.1, in adults increased from 1.8 to 4.9, and in the total population also increased from 1.3 to 4.5. The mean annual epilepsy morbidity rate from 2009-2019 to 2020-2022 increased in all subgroups analyzed: In children 0-17 years from 3.8 ± 0.4 95% CI 3.6-4.1 to 4.2 ± 0.5 95% CI 2.9-5.4, in adults from 2.7 ± 0.2 95% CI 2.6-2.8 to 3.1 ± 0.2 95% CI 2.7-3.5 (p=0.0) and in the whole population from 2.9 ± 0.2 95% CI 2.8-3.1 to 3.3 ± 0.3 95% CI 2.7-3.9 (p=0.01).

Analysis of epilepsy incidence rates revealed that the average absolute growth/decline rate between 2009-2019 and 2020-2022 increased in all subgroups analyzed: in children 0-17 years from -0.1% to 0.1%, in adults from 0.0% to 0.1%, and in the entire population from -0.0% to 0.1%. The average annual rate of increase/decline in epilepsy incidence from 2009-2019 to 2020-2022 also increased in all age subgroups: in children 0-17 years from -11.8% to 11.8%, in adults from 0% to 73.2%, and in the entire population from -3.9% to 22.5%. Meanwhile, the mean annual incidence of epilepsy between 2009-2019 and 2020-2022 increased in children 0-17 years from 0.4 ± 0.2 95% CI 0.3-0.5 to 0,4 ± 0.1 95% CI 0.3-0.6 and decreased among adults from

0.2 ± 0.1 95% CI 0.2-0.3 to 0.2 ± 0.1 95% CI 0.0-0.5 and the general population from 0.2 ± 0.1 95% CI 0.2-0.3 to 0.2 ± 0.1 95% CI 0.1-0.4.

In Tyumen, there are opportunities, including within the framework of MHI, to perform practically all studies necessary for epilepsy: video-EEG monitoring (including invasive), magnetic resonance imaging (MRI) of the brain (1.5-3 T), tractography, magnetic resonance reconstruction, magnetic resonance spectroscopy, functional MRI, single-photon emission computed tomography, positron emission/computed tomography [111].

Some of these studies are used in the routine practice of an epileptologist, and some are performed thanks to the Federal Center for Neurosurgery located in the city as part of the pre – and intraoperative preparation of pharmacoresistant patients [158].

If it is necessary to perform these diagnostic tests, doctors of epileptology offices in Tyumen Oblast refer patients to Tyumen.

The subdivisions of the Tyumen Oblast were provided with electroencephalographs, including those with EEG. The table presents data for 2011-2022 (Table 87).

Table 87 – Provision of Tyumen Oblast subdivisions with electroencephalographs

Institution	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Total												
Electroencephalographs	**31**	**37**	**36**	**39**	**35**	**45**	**54**	**58**	**59**	**67**	**71**	**78**
Regional Clinical Hospital No. 1												
Electroencephalographs	3	3	3	6	6	8	8	7	6	9	8	8
Regional Clinical Hospital No. 2												
Electroencephalographs	4	4	4	4	1	7	7	7	7	9	9	8
Regional treatment and rehabilitation center												
Electroencephalographs	6	6	6	6	6	4	4	5	5	5	5	6
Regional Hospital No. 3 (Tobolsk)												
Electroencephalographs			1	1	2	2	3	3	3	4	3	3
City Polyclinic (Tobolsk)												
Electroencephalographs	1	1	1	1							1	1
Regional Hospital No. 4 (Ishim)												
Electroencephalographs	2	2	2	2	2	2	2	2	2	2	2	3
Regional Hospital No. 12 (Zavodoukovsk)												
Electroencephalographs	1	1	1	1	1	1	1	1	1	1	2	2
Regional Hospital No. 23 (Yalutorovsk)												
Electroencephalographs	1	1	1	1	1	1	1	1	1	2	2	2

Due to the provision of electroencephalographs in the Tyumen Oblast, patients underwent EEG examinations, the number of which for the period 2015-2022 is presented in Table 88.

Table 88 – Number of EEG studies in the Tyumen Oblast

Institution	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Total for all institutions												
Number of EEG studies	**24 332**	**22 113**	**25 377**	**23 774**	**29 744**	**31 123**	**41 698**	**49 743**	**55 947**	**43 368**	**46 956**	**44 760**
Regional Clinical Hospital No. 1												
Number of EEG studies	3 981	2 760	1 837	1 837	2 565	1 904	3 289	5 975	6 387	2 572	4 680	3 604
Regional Clinical Hospital No. 2												
Number of EEG studies	2 188	1 251	1 747	1 466	1 196	1 103	1 332	1 172	1 215	581	1 019	1 289

Table 88 continued

Institution	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Regional treatment and rehabilitation center												
Number of EEG studies	10 901	10 459	12 456	12 914	14 901	14 810	16 420	18 831	20 255	14 960	15 213	15 502
Regional Hospital No. 3 (Tobolsk)												
Number of EEG studies					426	777	2 401	2 685	2 276	2 027	2 132	316
City Polyclinic (Tobolsk)												
Number of EEG studies	1 007	628	1 217	526								1 041
Regional Hospital No. 4 (Ishim)												
Number of EEG studies	883	1 125	1 710	1 080	1 059	2 189	2 732	2 841	3 081	2 519	3 877	3 346
Regional Hospital No. 12 (Zavodoukovsk)												
Number of EEG studies	97	285	235		3 797	319	715	1 285	1 329	1 386	1 329	1 386
Regional Hospital No. 23 (Yalutorovsk)												
Number of EEG studies						1 547	1 809	1 837	2 720	1 456	1 739	1 451

Table 89 presents the unit burden for each health facility to which encephalographs were installed.

Table 89 – Load per unit of equipment (electroencephalographs)

Institution	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Total for all institutions												
Load per unit of equipment	**785**	**598**	**705**	**610**	**850**	**692**	**772**	**858**	**948**	**647**	**661**	**574**
Regional Clinical Hospital No. 1												
Load per unit of equipment	1 327	920	612	306	428	238	411	854	1 065	286	585	451
Regional Clinical Hospital No. 2												
Load per unit of equipment	547	313	437	367	1 196	158	190	167	174	65	113	161
Regional treatment and rehabilitation center												
Load per unit of equipment	1 817	1 743	2 076	2 152	2 484	3 703	4 105	3 766	4 051	2 992	3 043	2 584
Regional Hospital No. 3 (Tobolsk)												
Load per unit of equipment					213	389	800	895	759	507	711	105
City Polyclinic (Tobolsk)												
Load per unit of equipment	1 007	628	1 217	526								1 041

Table 89 continued

Institution	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Regional Hospital No. 4 (Ishim)												
Load per unit of equipment	442	563	855	540	530	1 095	1 366	1 421	1 541	1 260	1 939	1 115
Regional Hospital No. 12 (Zavodoukovsk)												
Load per unit of equipment	97	285	235		3 797	319	715	1 285	1 329	1 386	665	693
Regional Hospital No. 23 (Yalutorovsk)												
Load per unit of equipment						1 547	1 809	1 837	2 720	728	870	726

6.1. Results of schools for epileptic patients and their relatives

An important stage in the work of the offices was the organization of schools for epileptic patients and their relatives, which were held regularly. The topics and responsible persons were developed. The purpose of these schools was to raise awareness of the disease and the algorithm of action in case of its occurrence in case of its occurrence. The schools have been held since 2015. 1 every 2 months [111].

The topics that were conducted at the epilepsy center and inter-territorial offices were:

No. 1 – "Epilepsy. General information. Help in different types of seizures. Seizure provocateurs. Adherence to drug therapy and keeping a seizure diary";

No. 2 – "Epilepsy and pregnancy. Whether it is possible to marry and have a healthy child. Methods of contraception and anti-epileptic drugs. Regime of observation of pregnant women by an epileptologist";

No. 3 – "Epilepsy and career choices. Choice of sports activities. Professional prospects. Discrimination in employment";

No. 4 – "Epilepsy in a child. Features of the course. Prognosis. Choice of therapy. Sports activities, daily regimen, provocateurs of seizures. How to bring up a child with epilepsy";

No. 5 – "Epilepsy of the elderly. Peculiarities of course. Comorbidity. Social aspects. Peculiarities of therapy"

No. 6 – "Epilepsy. Myth and Reality." [111].

Table 90 shows the number of schools held between 2015 and 2022.

Table 90 – Schools for epileptic patients and their relatives for 2015-2022 in the epilepsy center

Topic number	2015	2016	2017	2018	2019	2015-2019	2020	2021	2022	2020-2022
Epilepsy Center										
№ 1.	24 15,9%	27 14,7%	28 11,0%	32 11,9%	44 15,5%	**155 13,6%**	12 23,5%	-	6 13,6%	**18 18,9%**
№ 2.	16 10,6%	19 10,3%	35 13,7%	26 9,7%	36 12,7%	**132 11,6%**	6 11,8%	-	4 9,1%	**10 10,5%**
№ 3.	20 13,2%	32 17,4%	46 18,0%	44 16,4%	38 13,4%	**180 15,8%**	9 17,6%	-	7 5,9%	**16 16,8%**
№ 4.	23 15,2%	26 14,1%	38 14,9%	42 15,6%	54 19,1%	**183 16,0%**	11 21,6%	-	9 20,5%	**20 21,1%**
№ 5.	32	41	56	60	49	**238**	7	-	8	**15**

	21,2%	22,3%	22,0%	22,3%	17,3%	**20,8%**	13,7%		18,2%	**15,8%**
№ 6.	36 23,8%	39 21,2%	52 20,4%	65 24,2%	62 21,9%	**254** **22,2%**	6 11,8%	-	10 22,7%	**16** **16,8%**
Inter-territorial offices										
№ 1.	12 16,0%	15 14,4%	20 12,0%	23 14,7%	26 15,1%	**96** **14,2%**	7 20,0%	-	8 14,8%	**15** **16,9%**
№ 2.	8 10,7%	11 10,6%	22 13,2%	17 10,9%	24 14,0%	**82** **12,2%**	6 17,1%	-	6 11,1%	**12** **13,5%**
№ 3.	9 12,0%	19 18,3%	35 21,0%	32 20,5%	36 20,9%	**131** **19,4%**	7 20,0%	-	9 16,7%	**16** **18,0%**
№ 4.	14 18,7%	17 16,4%	24 14,4%	22 14,1%	23 13,4%	**100** **14,8%**	5 14,3%	-	11 20,4%	**16** **18,0%**
№ 5.	13 17,3%	21 20,2%	32 19,2%	30 19,2%	31 18,0%	**127** **18,8%**	6 17,1%	-	11 20,4%	**17** **19,1%**
№ 6.	19 25,3%	21 20,2%	34 20,4%	32 20,5%	32 18,6%	**138** **20,5%**	4 11,4%	-	9 16,7%	**13** **14,6%**
TOTAL	151 100%	184 100%	255 100%	269 100%	283 100%	**155** 100%	51 100%	-	44 100%	**95** 100%

In MTEC #1, topic #1 was visited by 85 (20.5%) patients and 63 (16.6%) relatives between 2015-2019, which was comparable to the period 2020-2022, where 14 (13.3%) and 20 (19.1%) patients and relatives, respectively, visited this topic (p=0.1 and p=0.7). Topic #2 was visited by 57 (13.8%) patients and 37 (9.8%) relatives between 2015-2019 and 11 (10.5%) patients and 8 (7.6%) relatives between 2020-2022 (p=0.4 and p=0.5, respectively). Patients who visited topic #3 between 2015-2019 and 2020-2022 were 86 (20.8%) and 19 (18.1%), respectively (p=0.53), and relatives were 49 (12.9%) and 13 (12.4%), respectively (p=0.9) (Table 91).

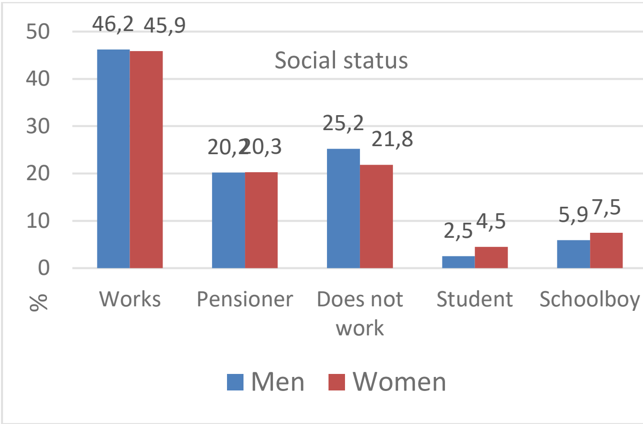
Table 91 – Schools for epilepsy patients and their relatives in MTEC #1 for 2015-2022

SCHOOL-LA №	CONTINUOUS GENT.	2015	2016	2017	2018	2019	2020	2021	2022	TOTAL patz.
1	patient	12 (24,0%)	10 (19,6%)	20 (18,9%)	23 (21,9%)	20 (19,6%)	6 (13,6%)	-	8 (13,1%)	99 (19,1%)
	relatives	9 (17,7%)	13 (22,4%)	11 (13,9%)	12 (13,2%)	18 (18,0%)	6 (15,4%)	-	14 (21,2%)	83 (17,2%)
2	patient	8 (16,0%)	8 (15,7%)	15 (14,2%)	12 (11,4%)	14 (13,7%)	5 (11,4%)	-	6 (9,8%)	68 (13,1%)
	relatives	4 (7,8%)	5 (8,6%)	10 (12,7%)	10 (11,0%)	8 (8,0%)	4 (10,3%)	-	4 (6,1%)	45 (9,3%)
3	patient	7 (14,0%)	9 (17,7%)	26 (24,5%)	24 (22,9%)	20 (19,6%)	7 (15,9%)	-	12 (19,7%)	105 (20,2%)

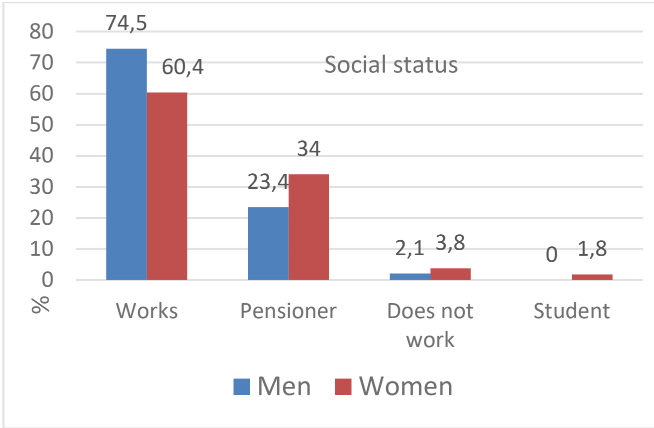
	relatives	8 (15,7%)	3 (5,2%)	10 (12,7%)	13 (14,2%)	15 (15,0%)	6 (15,4%)	-	7 (10,6%)	62 (12,8%)
4	patient	6 (12,0%)	8 (15,7%)	13 (12,3%)	15 (14,3%)	12 (11,8%)	9 (20,5%)	-	8 (13,1%)	71 (13,7%)
	relatives	9 (17,7%)	15 (25,9%)	25 (31,6%)	28 (30,8%)	30 (30,0%)	14 (35,9%)	-	20 (30,3%)	141 (29,1%)
5	patient	9 (18,0%)	7 (13,7%)	12 (11,2%)	11 (10,5%)	15 (14,7%)	8 (18,2%)	-	13 (21,3%)	75 (14,5%)
	relatives	10 (19,6%)	10 (17,2%)	8 (10,1%)	10 (11,0%)	12 (12,0%)	3 (7,7%)	-	10 (15,2%)	63 (13,0%)
6	patient	8 (16,0%)	9 (17,7%)	20 (18,9%)	20 (19,0%)	21 (20,6%)	9 (20,5%)	-	14 (23,0%)	101 (19,5%)
	relatives	11 (21,6%)	12 (20,7%)	15 (19,0%)	18 (19,8%)	17 (17,0%)	6 (15,4%)	-	11 (16,7%)	90 (18,6%)
TOTAL	patient	50 (100%)	51 (100%)	106 (100%)	105 (100%)	102 (100%)	44 (100%)	-	61 (100%)	519 (100%)
	relatives	51 (100%)	58 (100%)	79 (100%)	91 (100%)	100 (100%)	39 (100%)	-	66 (100%)	484 (100%)

Theme #4 was visited by 54 (13.0%) patients and 107 (28.2%) relatives between 2015-2019 and 2020-2022, and 17 (16.2%) patients and 34 (32.4%) relatives between 2020-2022 (p=0.4 and p=0.5, respectively). Patients who attended topic #5 between 2015-2019 and 2020-2022 were 54 (13.0%) and 21 (20.0%), respectively (p=0.1), and relatives were 50 (13.2%) and 13 (12.4%), respectively (p=0.9). Topic 6 was listened to by 78 (18.8%) patients and 73 (19.3%) relatives between 2015-2019 and between 2020-2022. – 23 (21.9%) and 17 (16.2%) patients and relatives, respectively (p=0.6 and p=0.5, respectively) (Table 91).

After completing the course of lectures, the students were surveyed using a questionnaire that we had specially developed (Questionnaire for school students – patients with epilepsy and their relatives, Appendix E, p. 369). 333), which assessed their satisfaction with the quality of the schools. We analyzed 352 questionnaires, of which 252 (71.6%) were patients and 100 (28.4%) relatives. Among the respondents, 183 (52.0%) were employed (116 (46.0%) patients and 67 (67.0%) relatives); 80 (22.7%) were retired (51 (20.2%) patients and 29 (29.0%) relatives); non-working – 62 (17.6%) people (59 (23.4%) patients and 3 (3.0%) relatives); students – 10 (2.9%) people (9 (3.7%) patients and 1 (1.0%) relative) and 17 (4.8%) schoolchildren, who were all patients of MTEC #1 (6.7%) (Figure 60) [111].



Patients



Relatives

Figure 60 – Social status of MTEC No. 1 respondents, %

In addition, as a comparison group, we screened 70 individuals (47 (67.1%) patients and 23 (32.9%) relatives) who were unable or unwilling to attend these schools in order to assess the effectiveness of the educational interventions [111].

Based on the results of the questionnaire, 100% of respondents answered in the affirmative to the question "Do you think it is necessary to hold schools for epilepsy patients and their relatives?" and "Was the information at the conducted school accessible to you?". The majority of respondents (344; 97.7%) answered that they received enough information at the classes, and only 8 (2.3%) reported that they would like the lectures to be expanded (3 (1.2%) patients and 5 (5.0%) relatives). 330 (93.8%) respondents (245 (97.2%) patients and 85 (85.0%) relatives) were able to name factors that provoke epileptic seizures; 18 (5.1%) individuals (6 (2.4%) patients and 12 (12.0%) relatives) were unable to name these factors and 4 (1.1%) had difficulty answering this question. 331 (94.0%) respondents (242 (96.0%) patients and 89 (89.0%) relatives) knew the manifestations of epilepsy after the cycle of sessions; the remaining 21 (6.0%) could not or had difficulty answering this question (10 (4.0%) patients and 11 (11.0%) relatives) [111] (Table 91).

To the question "Can you help a person who has had a sudden epilepsy attack?" 319 (90.6%) respondents answered in the affirmative (232 (92.1%) patients and 87 (87.0%) relatives), 13 (3.7%) responded in the negative (8 (3.2%) patients and 5 (5.0%)

relatives), and 20 (5.7%) had difficulty answering (12 (3.4%) patients and 8 (8.0%) relatives) [111].

Most of the respondents (347; 98.6%) had enough handouts (booklets, leaflets, guidelines) and all of them (347; 98.6%) were satisfied with the school (251 (99.6%) patients and 96 (96.0%) relatives), while 5 (1.4%) did not have enough material and gave a negative answer or found it difficult to answer the question "Are you satisfied with the school..." (among these respondents were those who reported in previous answers that the information at the schools was insufficient). (among these respondents were those who reported in previous responses that there was not enough information on the schools held). No statistically significant differences were found between men and women who participated in the study (Table 92).

Thus, the questionnaire survey conducted at MTEC #1 demonstrated the high efficiency and quality of the educational activities carried out for patients and their relatives [111].

Table 92 – Results of questionnaire survey on schools conducted for patients with epilepsy and their relatives in MTEC No. 1

Answer options	Patients		Relatives	
	Men	Women	Men	Women
Was the information you received in class sufficient?				
Yes	117 (98,3%)	132 (99,2%)	45 (95,7%)	50 (94,3%)
No	2 (1,7%)	1 (0,8%)	2 (4,3%)	3 (5,7%)
I can't answer that	-	-	-	-
Do you know the triggers for the development of epilepsy?				
Yes	115 (96,6%)	130 (97,7%)	40 (85,1%)	45 (84,9%)
No	3 (2,3%)	3 (2,3%)	6 (12,8%)	6 (11,3%)
I can't answer that	1 (1,1%)	-	1 (2,1%)	2 (3,8%)
Do you know the manifestations of epilepsy?				
Yes	117 (98,3%)	125 (94,0%)	40 (85,1%)	49 (92,5%)
No	2 (1,7%)	6 (4,5%)	2 (4,3%)	1 (1,8%)
I can't answer that	-	2 (1,5%)	5 (10,6%)	3 (5,7%)
Can you help a person who suddenly has an epileptic seizure? an epileptic seizure?				
Yes	111 (93,2%)	121 (91,0%)	40 (85,1%)	47 (88,7%)

No	4 (3,4%)	4 (3,0%)	3 (6,4%)	2 (3,8%)
I can't answer that	4 (3,4%)	8 (6,0%)	4 (8,5%)	4 (7,5%)
Do you have enough handouts (booklets, leaflets, methodological recommendations)?				
Yes	118 (98,9%)	130 (97,7%)	46 (97,9%)	53 (100%)
No	1 (1,1%)	2 (1,5%)	-	-
I can't answer that	-	1 (0,8%)	1 (2,1%)	-
Are you satisfied with the "School for stroke patients, and their relatives"?				
Yes	118 (98,9%)	133 (100%)	47 (100%)	52 (98,2%)
No	1 (1,1%)	-	-	1 (1,8%)
I can't answer that	-	-	-	-

In the period 2015-2019 in MTEC #2, topic #1 was attended by 74 (19.5%) patients and 66 (18.3%) relatives, which was comparable to the period 2020-2022, where this topic was attended by 15 (15.9%) and 20 (19.2%) patients and relatives, respectively (p=0.5 and p=0.82). Topic #2 was attended by 57 (15.0%) patients and 37 (10.4%) relatives between 2015-2019 and 11 (11.7%) patients and 6 (5.8%) relatives between 2020-2022 (p=0.4 and p=0.2, respectively). Patients who visited topic #3 between 2015-2019 and 2020-2022 were 70 (18.4%) and 18 (19.2%), respectively (p=0.9), and relatives were 43 (12.1%) and 17 (16.4%), respectively (p=0.4). Theme #4 was visited by 59 (15.5%) patients and 88 (24.8%) relatives between 2015-2019, and 15 (15.9%) patients and 29 (27.9%) relatives between 2020-2022 (p=0.9 and p=0.6, respectively). Patients who attended topic #5 between 2015-2019 and 2020-2022 were 51 (13.4%) and 15 (15.9%), respectively (p=0.5), and relatives were 49 (13.8%) and 9 (8.7%), respectively (p=0.2). Topic 6 was listened to by 69 (18.2%) patients and 73 (20.6%) relatives between 2015-2019 and between 2020-2022. – 20 (21.3%) and 23 (22.1%) patients and relatives, respectively (p=0.6 and p=0.71, respectively) [0] (Table 93).

370 questionnaires were analyzed, of which 260 (70.3%) were completed by patients and 110 (29.7%) by relatives. In assessing the social status of respondents, it was determined that 172 (46.5%) respondents were employed (113 (43.5%) patients and 59 (53.6%) relatives); 83 (22.4%) were pensioners (46 (17.7%) patients and 37 (33.6%) relatives); 105 (28.4%) were not working (91 (35.0%) patients and 14 (12.8%) relatives);

1 (0.3%) patient was a student and 9 (2.4%) respondents were high school students (all patients 3.5%) (Figure 61) [111].

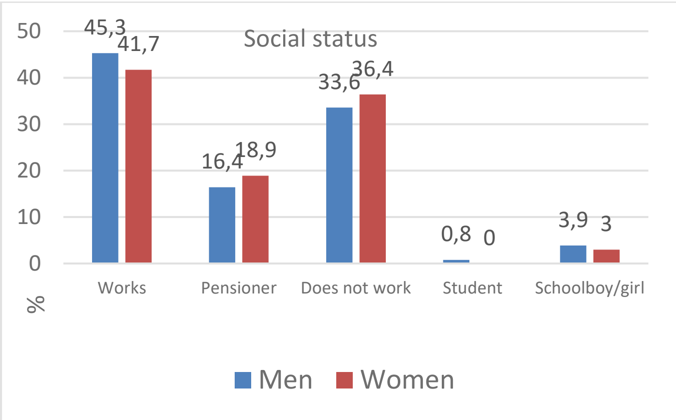
Only 3 (0.8%) respondents (all patients – 1.2%) found it difficult to answer the question "Is it necessary to conduct such schools for patients and their relatives?", while the remaining 99.2% of respondents gave a positive answer to this question. The provoking factors of epilepsy and its main manifestations were known by 341 (92.2%) respondents after the conducted classes: 243 (93.5%) and 240 (92.3%) patients and 98 (89.1%) and 101 (91.8%) relatives, respectively. 346 (93.5%) indicated in the questionnaire that they knew how to help a person who had a sudden epileptic seizure (253 (97.3%) patients and 93 (84.5%) relatives). All patients (260; 100%) and 105 (95.5%) relatives were satisfied with the school conducted for patients with epilepsy and their relatives (Table 94) [111].

There were no statistically significant differences by gender between the analyzed responses. Thus, in MTEC #2, the questionnaire survey revealed the respondents' satisfaction with the conducted educational programs for patients and relatives.

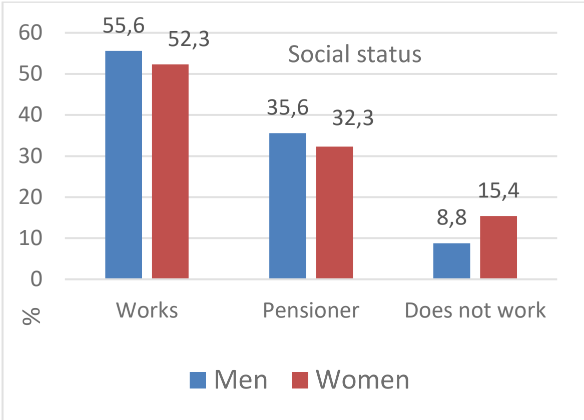
Table 93 – Schools for epileptic patients and their relatives in MTEC No. 2 for 2015-2022

SCHOOL №	CONTINUOUS GENT.	2015	2016	2017	2018	2019	2020	2021	2022	TOTAL
1	patient	9 (17,3%)	12 (24,5%)	17 (18,3%)	18 (20,5%)	18 (18,4%)	6 (15,8%)	-	9 (16,1%)	89 (18,8%)
	relatives	10 (19,6%)	12 (22,6%)	11 (15,1%)	14 (16,7%)	18 (19,1%)	10 (22,7%)	-	10 (16,7%)	85 (18,5%)
2	patient	8 (15,4%)	6 (12,2%)	16 (17,2%)	15 (17,0%)	12 (12,2%)	4 (10,5%)	-	7 (12,5%)	68 (14,4%)
	relatives	4 (7,8%)	2 (3,8%)	11 (15,1%)	13 (15,5%)	7 (7,4%)	2 (4,6%)	-	4 (6,7%)	43 (9,4%)
3	patient	8 (15,4%)	8 (16,3%)	19 (20,4%)	20 (22,7%)	15 (15,3%)	7 (18,4%)	-	11 (19,6%)	88 (18,6%)
	relatives	9 (17,7%)	4 (7,6%)	9 (12,3%)	9 (10,7%)	12 (12,8%)	5 (11,4%)	-	12 (10,0%)	60 (13,1%)
4	patient	6 (11,5%)	5 (10,2%)	20 (21,5%)	14 (15,9%)	14 (14,3%)	7 (18,4%)	-	8 (14,3%)	74 (15,6%)
	relatives	12 (23,5%)	15 (28,3%)	10 (13,7%)	24 (28,6%)	27 (28,7%)	13 (29,6%)	-	16 (26,7%)	117 (25,5%)
5	patient	10 (19,2%)	8 (16,3%)	8 (8,6%)	12 (13,6%)	13 (13,3%)	6 (15,8%)	-	9 (16,1%)	66 (13,9%)
	relatives	7 (13,7%)	9 (17,0%)	15 (20,5%)	8 (9,5%)	10 (10,6%)	5 (11,4%)	-	4 (6,7%)	58 (12,6%)

6	patient	11 (21,2%)	10 (20,4%)	13 (14,0%)	9 (10,3%)	26 (26,5%)	8 (21,0%)	-	12 (21,4%)	89 (18,8%)
	relatives	9 (17,7%)	11 (20,8%)	17 (23,3%)	16 (19,0%)	20 (21,4%)	9 (20,5%)	-	14 (23,3%)	96 (20,9%)
TOTAL	patient	52 (100%)	49 (100%)	93 (100%)	88 (100%)	98 (100%)	38 (100%)	-	56 (100%)	474 (100%)
	relatives	51 (100%)	53 (100%)	73 (100%)	84 (100%)	94 (100%)	44 (100%)	-	60 (100%)	459 (100%)



Patients



Relatives

Figure 61 – Social status of MTEC #2 respondents, %

Table 94 – Results of questionnaire survey on schools conducted for patients with epilepsy and their relatives in MTEC No. 2

Answer options	Patients		Relatives	
	Men	Women	Men	Women
Do you think it is necessary to hold such schools for patients and their relatives?				
Yes	127 (99,2%)	130 (98,5%)	45 (100%)	65 (100%)
No	-	-	-	-
I can't answer that	1 (0,8%)	2 (1,5%)	-	-
Do you know the triggers for the development of epilepsy?				
Yes	121 (94,5%)	122 (92,4%)	40 (88,9%)	58 (89,2%)
No	7 (5,5%)	7 (5,3%)	4 (8,9%)	5 (7,7%)
I can't answer that	-	3 (2,3%)	1 (2,2%)	2 (3,1%)
Do you know the manifestations of epilepsy?				
Yes	120 (93,8%)	120 (90,9%)	40 (88,9%)	61 (93,8%)
No	8 (6,3%)	12 (9,1%)	4 (8,9%)	4 (6,2%)
I can't answer that	-	-	1 (2,2%)	-
Can you help a person who has a sudden epileptic seizure?				
Yes	125 (97,7%)	128 (97,0%)	36 (80,0%)	57 (87,7%)
No	3 (2,3%)	4 (3,0%)	8 (17,8%)	6 (9,2%)
I can't answer that	-	-	1 (2,2%)	2 (3,1%)

Are you satisfied with the "School for stroke patients and their relatives"?				
Yes	128 (100%)	132 (100%)	42 (93,3%)	63 (97,0%)
No	-	-	-	1 (1,5%)
I can't answer that	-	-	3 (6,7%)	1 (1,5%)

In the period 2015-2019 in MTEC #3, topic #1 was attended by 74 (20.2%) patients and 85 (23.2%) relatives, which was comparable to the period 2020-2022, where this topic was attended by 18 (20.2%) and 22 (19.1%) patients and relatives, respectively (p=0.9 and p=0.4). Topic #2 was attended by 48 (13.1%) patients and 30 (8.4%) relatives between 2015-2019 and 12 (13.5%) patients and 9 (7.8%) relatives between 2020-2022 (p=0.90 and p=0.9, respectively). Patients who visited topic #3 between 2015-2019 and 2020-2022 were 72 (19.6%) and 19 (21.4%), respectively (p=0.7), and relatives were 46 (12.9%) and 23 (20.0%), respectively (p=0.1).

Theme #4 was listened to by 41 (11.2%) patients and 90 (25.2%) relatives between 2015-2019 and 9 (10.1%) patients and 28 (24.4%) relatives between 2020-2022 (p=0.8 and p=0.9, respectively).

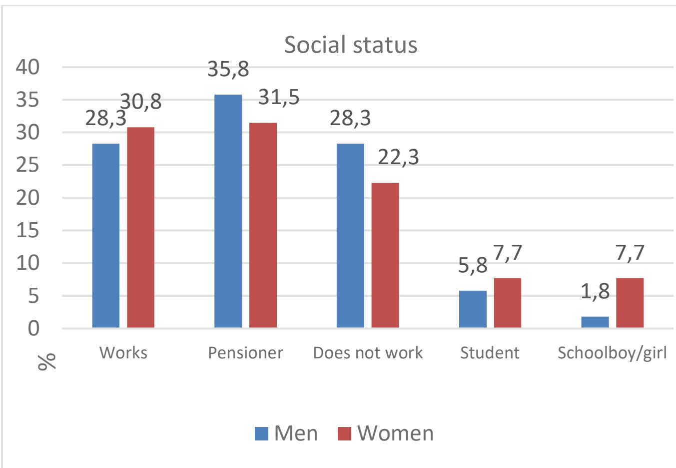
Patients who attended topic #5 between 2015-2019 and 2020-2022 were 57 (15.5%) and 13 (14.6%), respectively (p=0.9), and relatives were 47 (13.2%) and 11 (9.6%), respectively (p=0.4). Topic 6 was listened to by 75 (20.4%) patients and 59 (16.5%) relatives between 2015-2019 and between 2020-2022. – 18 (20.2%) and 22 (19.1%) patients and relatives, respectively (p=0.93 and p=0.5, respectively) (Table 95).

Table 95 – Schools for epileptic patients and their relatives in MTEC #3 for 2015-2022

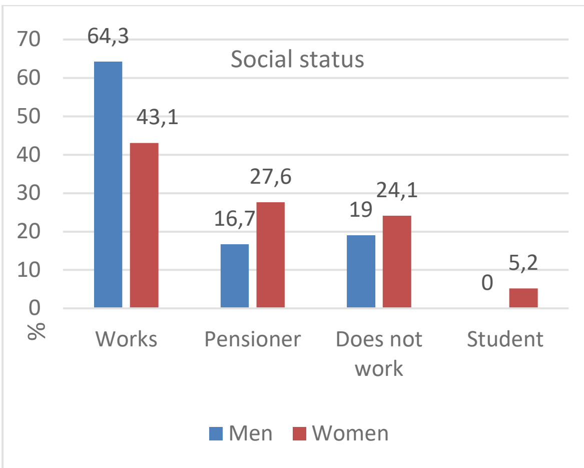
SCHOOL №	CONTINUOUS GENT.	2015	2016	2017	2018	2019	2020	2021	2022	TOTAL
1	patient	12 (26,7%)	11 (28,2%)	18 (19,6%)	16 (16,9%)	17 (17,7%)	8 (21,1%)	-	10 (19,6%)	92 (20,1%)
	relatives	15 (22,7%)	17 (28,3%)	10 (15,4%)	18 (24,3%)	25 (27,2%)	11 (23,9%)	-	11 (15,9%)	107 (22,7%)
2	patient	5 (11,1%)	5 (12,8%)	13 (14,1%)	12 (12,6%)	13 (13,5%)	4 (10,5%)	-	8 (15,7%)	60 (13,1%)
	relatives	4 (6,1%)	3 (5,0%)	8 (12,3%)	6 (8,1%)	9 (9,8%)	3 (6,5%)	-	6 (8,7%)	39 (8,3%)

3	patient	9 (20,0%)	8 (20,5%)	19 (20,7%)	20 (21,1%)	16 (16,7%)	8 (21,1%)	-	11 (21,6%)	91 (20,0%)
	relatives	11 (16,7%)	7 (11,7%)	8 (12,3%)	10 (13,5%)	10 (10,9%)	8 (17,4%)	-	15 (21,7%)	69 (14,6%)
4	patient	5 (11,1%)	4 (10,3%)	10 (10,9%)	12 (12,6%)	10 (10,5%)	5 (13,2%)	-	4 (7,8%)	50 (11,0%)
	relatives	12 (18,2%)	12 (20,0%)	19 (29,2%)	23 (31,1%)	24 (26,1%)	9 (19,6%)	-	19 (27,5%)	118 (25,0%)
5	patient	6 (13,3%)	4 (10,3%)	15 (16,3%)	12 (12,6%)	20 (20,8%)	6 (15,8%)	-	7 (13,7%)	70 (15,4%)
	relatives	11 (16,7%)	10 (16,7%)	10 (15,4%)	8 (10,8%)	8 (8,7%)	6 (13,0%)	-	5 (7,2%)	58 (12,3%)
6	patient	8 (17,8%)	7 (17,9%)	17 (18,4%)	23 (24,2%)	20 (20,8%)	7 (18,4%)	-	11 (21,6%)	93 (20,4%)
	relatives	13 (19,7%)	11 (18,3%)	10 (15,4%)	9 (12,2%)	16 (17,3%)	9 (19,6%)	-	13 (18,8%)	81 (17,2%)
TOTAL	patient	45 (100%)	39 (100%)	92 (100%)	95 (100%)	96 (100%)	38 (100%)	-	51 (100%)	456 (100%)
	relatives	66 (100%)	60 (100%)	65 (100%)	74 (100%)	92 (100%)	46 (100%)	-	69 (100%)	472 (100%)

350 questionnaires were analyzed, of which 250 (71.4%) patients and 100 (28.6%) relatives were analyzed. Among the respondents, 136 (38.9%) were employed (84 (33.6%) patients and 52 (52.0%) relatives), 107 (30.6%) were retired (84 (33.6%) patients and 23 (23.0%) relatives), 85 (24.3%) were not employed (63 (25,2%) patients and 22 (22, 0%) relatives), 15 (4.3%) were students (12 (4, 8%) patients and 3 (5, 2%) relatives), and 7 (1, 9%) were school students (all in the 2, 8% patient group) (Figure 62) [111].



Patients



Relatives

Figure 62 – Social status of MTEC #3 respondents, %

All respondents (100%) gave an affirmative answer to the questions "Was the information you received at the training session sufficient?" and "Was the information delivered at the school accessible to you?". Almost all respondents (339; 96.9%) gave an affirmative answer to the question "Was the information you received at the session sufficient?" and the remaining 11 (3.1%) gave a negative answer or found it difficult to answer (7 (2.8%) patients and 4 (4.0%) relatives) [111].

After the educational interventions, 325 (92.9%) respondents (236 (94.4%) patients and 89 (89.0%) relatives) knew the provoking factors of epilepsy, 15 (4.3%) could not name the provoking factors (8 (3.2%) patients and 7 (7.0%) relatives) and 10 (2.8%) found it difficult to answer this question (6 (2.4%) patients and 4 (4.0%) relatives).

332 (94.9%) respondents (247 (98.8%) patients and 85 (85.0%) relatives) knew the manifestations of epilepsy, the remaining 18 (5.1%) had difficulty answering or could not answer the question. 332 (94.9%) respondents reported in the questionnaire that they could help a person who had a sudden epileptic seizure (233 (93.2%) patients and 99 (99.0%) relatives) [111].

After each school, trainees received handouts in the form of booklets, leaflets, etc. In MTEC #3, 342 (97.7%) respondents reported that the materials received were sufficient for them (247 (98.8%) patients and 95 (95.0%) relatives).

342 (97.7%) respondents (243 (97.2%) patients and 99 (99.0%) relatives) were completely satisfied with the quality and results of the conducted schools; only 2 (0.6%) respondents (from the relatives group – 0.8%) were not satisfied with the conducted classes, explaining this by the insufficient number of handouts (Table 96) [111]. There were no statistically significant differences by gender of respondents according to the answers received.

Table 96 – Results of questionnaire survey on schools conducted for patients with epilepsy and their relatives in MTEC #3

Answer options	Patients		Relatives	
	Men	Women	Men	Women
Was the information you received in class sufficient?				
Yes	118 (98,3%)	125 (96,2%)	41 (97,6%)	55 (94,8%)
No	-	2 (1,5%)	1 (2,4%)	3 (5,2%)
I can't answer that	2 (1,7%)	3 (2,3%)	-	-
Do you know the triggers for the development of epilepsy?				
Yes	115 (95,8%)	121 (93,1%)	38 (90,5%)	51 (87,9%)
No	3 (2,5%)	5 (3,9%)	4 (9,5%)	3 (5,2%)
I can't answer that	2 (1,7%)	4 (3,0%)	-	4 (6,9%)
Do you know the manifestations of epilepsy?				
Yes	118 (98,3%)	129 (99,2%)	35 (83,3%)	50 (86,2%)
No	-	-	4 (9,5%)	4 (6,9%)
I can't answer that	2 (1,7%)	1 (0,8%)	3 (7,2%)	4 (6,9%)
Can you help a person who has a sudden epileptic seizure?				
Yes	113 (94,2%)	120 (92,3%)	42 (100%)	57 (98,3%)
No	-	-	-	-
I can't answer that	7 (5,8%)	9 (7,7%)	-	1 (1,7%)
Do you have enough handouts?				
Yes	118 (98,3%)	129 (99,2%)	40 (95,2%)	55 (94,8%)
No	2 (1,7%)	1 (0,8%)	1 (2,4%)	2 (3,5%)
I can't answer that	-	-	1 (2,4%)	1 (1,7%)
Are you satisfied with the "School for epilepsy patients and their relatives"?				
Yes	118 (98,3%)	125 (96,2%)	42 (100%)	57 (98,3%)
No	1 (0,9%)	1 (0,8%)	-	-
I can't answer that	1 (0,9%)	4 (3,0%)	-	1 (1,7%)

In the Oblast Epilepsy Center, the demand for the school topics was comparable to MTEC. Topic #1 was attended by 116 (18.8%) patients and 155 (18.5%) relatives, which was comparable to the period 2020-2022, where 40 (22.9%) and 46 (22.2%) patients and relatives, respectively, attended this topic (p=0.20 and p=0.3).

Theme #2 was visited by 86 (13.9%) patients and 104 (12.4%) relatives between 2015-2019 and 2020-2022, and 21 (12.0%) patients and 22 (10.6%) relatives between 2020-2022 (p=0.5 and p=0.6, respectively). Patients who visited topic #3 between 2015-2019 and 2020-2022 were 110 (17.8%) and 32 (18.3%) patients and 32 (18.3%) relatives, respectively (p=0.9), while relatives were 116 (13.9%) and 31 (14.9%) patients and 31 (14.9%) relatives, respectively (p=0.8).

Topic #4 was attended by 80 (12.9%) patients and 222 (26.5%) relatives between 2015-2019 and 2020-2022, and 18 (10.3%) patients and 46 (22.2%) relatives between 2020-2022 (p=0.4 and p=0.2, respectively). Patients who attended topic #5 between 2015-2019 and 2020-2022 were 111 (17.9%) and 31 (17.7%), respectively (p=0.9), and relatives were 112 (13.4%) and 27 (13.0%), respectively (p=0.9). Topic #6 was listened to by 115 (18.6%) patients and 128 (15.3%) relatives between 2015-2019 and between 2020-2022. – 33 (18.9%) and 35 (16.9%) patients and relatives, respectively (p=0.90 and p=0.7, respectively) (Table 97).

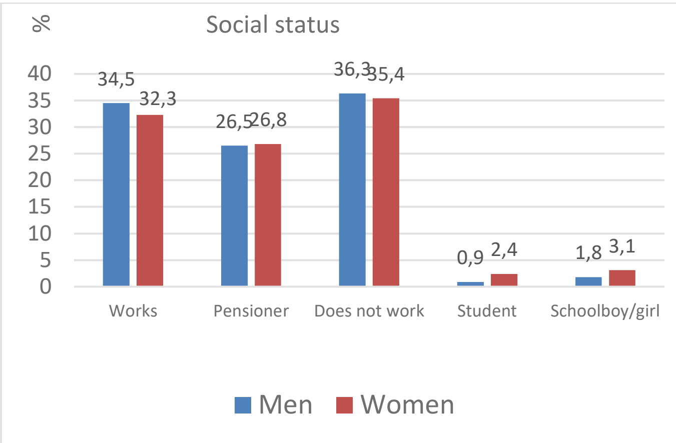
Thus, the demand for the topics was similar at both the MTEC and the Regional Epilepsy Center, as well as during the periods during and during the pandemic of the new coronavirus infection.

In order to assess the effectiveness of the educational interventions, 340 questionnaires were analyzed, of which 240 (70.6%) were questionnaires completed by patients and 100 (29.4%) by relatives. Assessment of the social status of the respondents showed that 132 (38.8%) were working at the time of the education (80 (33.3%) patients and 52 (52.0%) relatives), 89 (26.2%) were retired (64 (26.7%) patients and 25 (25,0%) relatives), 108 (31.8%) were not working (86 (35.8%) patients and 22 (22.0%) relatives), 5 were students (4 (1.7%) patients and 1 (1.9%) relative) and 6 (1.7%) were school students (all from the 2.5% patient group) (Figure 63) [111].

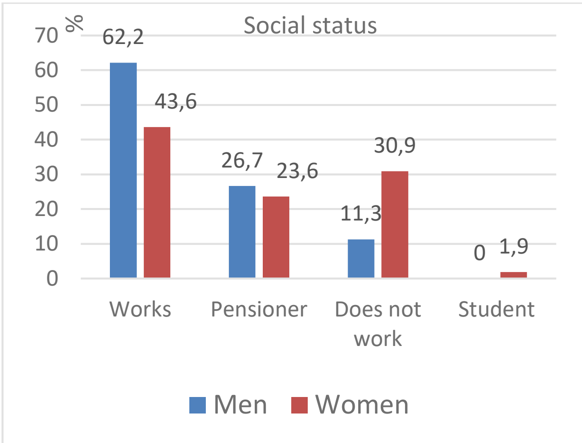
Table 97 – Schools for epilepsy patients and their relatives at the Regional Epilepsy Center for 2015-2022

SCHOOL №	CONTINUOUS GENT.	2015	2016	2017	2018	2019	2020	2021	2022	TOTAL
1	patient	19 (19,6%)	21 (21,7%)	24 (18,9%)	25 (17,9%)	27 (17,2%)	23 (32,4%)	5 (18,5%)	12 (15,6%)	156 (19,7%)
	relatives	23 (18,3%)	24 (18,3%)	38 (20,4%)	33 (17,3%)	37 (18,2%)	24 (23,5%)	6 (15,8%)	16 (23,9%)	201 (19,3%)
2	patient	11 (11,3%)	13 (13,4%)	18 (14,2%)	21 (15,0%)	23 (14,6%)	10 (14,1%)	2 (7,4%)	9 (11,7%)	107 (13,5%)
	relatives	15 (11,9%)	17 (13,0%)	30 (16,1%)	23 (12,0%)	19 (9,4%)	17 (16,7%)	-	5 (7,5%)	126 (12,1%)
3	patient	19 (19,6%)	18 (18,6%)	20 (15,7%)	23 (16,4%)	30 (19,1%)	11 (15,5%)	6 (22,2%)	15 (19,5%)	142 (17,9%)

	relatives	14 (11,1%)	21 (16,0%)	29 (15,6%)	25 (13,1%)	27 (13,3%)	21 (20,6%)	6 (15,8%)	4 (6,0%)	147 (14,1%)
4	patient	16 (16,5%)	14 (14,4%)	18 (14,2%)	15 (10,7%)	17 (10,8%)	8 (11,3%)	3 (11,1%)	7 (9,1%)	98 (12,4%)
	relatives	32 (25,4%)	29 (22,1%)	45 (24,2%)	56 (29,3%)	60 (29,6%)	14 (13,7%)	11 (29,0%)	21 (31,3%)	268 (25,7%)
5	patient	15 (15,5%)	16 (16,5%)	24 (18,9%)	27 (19,3%)	29 (18,5%)	9 (12,7%)	6 (22,2%)	16 (20,8%)	142 (17,9%)
	relatives	19 (15,1%)	21 (16,0%)	21 (11,3%)	23 (12,0%)	28 (13,8%)	11 (10,8%)	8 (21,1%)	8 (12,0%)	139 (13,3%)
6	patient	17 (17,5%)	15 (15,5%)	23 (18,1%)	29 (20,7%)	31 (19,8%)	10 (14,1%)	5 (18,5%)	18 (23,4%)	148 (18,7%)
	relatives	23 (15,1%)	19 (14,5%)	23 (12,4%)	31 (16,3%)	32 (15,7%)	15 (14,7%)	7 (18,4%)	13 (19,4%)	163 (15,6%)
TOTAL	patient	97 (100%)	97 (100%)	127 (40,6%)	140 (42,3%)	157 (43,6%)	71 (100%)	27 (100%)	77 (100%)	793 (100%)
	relatives	126 (100%)	131 (100%)	186 (59,4%)	191 (57,7%)	203 (56,4%)	102 (100%)	38 (100%)	67 (100%)	1044 (100%)



Patients



Relatives

Figure 63 – Social status of respondents of the Regional Epileptology Center, %

The analysis of the questionnaires showed that all respondents (100%) who attended schools at the Regional Epilepsy Center gave an affirmative answer to the questions "Do you think it is necessary to hold such schools?" and "Was the information provided at the school accessible to you?". 332 (97.6%) respondents reported that the information they received at the schools was sufficient (235 (97.9%) patients and 97 (97.0%) relatives). [111].

308 (90.6%) respondents knew the provoking factors of epilepsy and its main manifestations, including 224 (93.3%) patients and 84 (84.0%) relatives. 253 (74.4%) people reported that they would be able to provide first aid to a person who had a sudden epilepsy attack (177 (73.8%) patients and 76 (76.0%) relatives); 32 (9.4%) respondents reported that they did not know the first aid procedure for this category of patients (25 (10.4%) patients and 7 (7.0%) relatives) and 55 (16.2%) people had difficulty answering this question – 38 (15.8%) patients and 17 (17.0%) relatives [111].

The majority of respondents (299; 87.9%) reported that they had sufficient handouts on all school topics (208 (86.7%) patients and 91 (91.0%) relatives).

Almost all trainees (332; 97.6%) were fully satisfied with the quality, informative and accessible schools conducted (233 (97.1%) patients and 89 (89.0%) relatives) (Table 98) [111].

Table 98 – Results of the questionnaire survey on the conducted schools for patients with epilepsy and their relatives at the Regional Epileptology Center

Answer options	Patients		Relatives	
	Men	Women	Men	Women
Was the information you received in class sufficient?				
Yes	110 (97,3%)	125 (98,4%)	44 (97,8%)	53 (96,4%)
No	2 (1,8%)	1 (0,8%)	-	1 (1,8%)
I can't answer that	1 (0,9%)	1 (0,8%)	1 (2,2%)	1 (1,8%)
Do you know the triggers for the development of epilepsy?				
Yes	103 (91,2%)	121 (95,3%)	39 (86,7%)	45 (81,8%)
No	10 (8,8%)	6 (4,7%)	6 (13,3%)	8 (14,6%)
I can't answer that	-	-	-	2 (3,6%)
Do you know the manifestations of epilepsy?				
Yes	103 (91,2%)	121 (95,3%)	39 (86,7%)	45 (81,8%)
No	10 (8,8%)	6 (4,7%)	6 (13,3%)	8 (14,6%)
I can't answer that	-	-	-	2 (3,6%)
Can you help a person who has a sudden epileptic seizure?				
Yes	90 (79,6%)	87 (68,5%)	32 (71,1%)	44 (80,0%)

No	13 (11,6%)	12 (9,4%)	5 (11,1%)	2 (3,6%)
I can't answer that	10 (8,8%)	28 (22,1%)	8 (17,8%)	9 (16,4%)
Do you have enough handouts?				
Yes	97 (85,8%)	111 (87,4%)	42 (93,3%)	49 (89,1%)
No	5 (4,4%)	6 (4,7%)	-	2 (3,6%)
I can't answer that	11 (9,8%)	10 (7,9%)	3 (6,7%)	4 (7,3%)
Are you satisfied with the "School for epilepsy patients and their relatives"?				
Yes	112 (99,1%)	121 (95,3%)	45 (100%)	54 (98,2%)
No	1 (0,9%)	-	-	1 (1,8%)
I can't answer that	-	6 (4,7%)	-	-

It is interesting to note that a positive answer to the question "Can you help a person who has had a sudden epilepsy attack?" was more common among men than women (p=0.1), while women were more likely than men to answer "I find it difficult to answer" (p=0.05). Also among women more often than among men the answer "I find it difficult to answer" to the question "Are you satisfied with the "School for epilepsy patients and their relatives"?" was observed (p=0.1). (p=0,1).

When analyzing 70 questionnaires of the comparison group (45 patients and 25 relatives), it was found that only 8 (11.4%) people knew the factors provoking epilepsy (5 (11.1%) patients and 3 (12.0%) relatives); 21 (30.0%) people could correctly name the manifestations of epilepsy (13 (28.9%) patients and 8 (32.0%) relatives) and only 6 (8.6%) people knew what kind of help to give to a person who had a sudden epileptic seizure (4 (8.9%) patients and 2 (8.0%) relatives) [111].

Positive answers to questions reflecting knowledge of the disease were significantly less frequent in the control group than in the main group (p<0.01), whereas negative answers and difficulty in answering were significantly more frequent (p<0.01) (Table 99). The obtained data once again confirm the effectiveness of the conducted educational activities, after which most of the trainees knew all the above aspects.

Table 99 – Results of the questionnaire on the conducted schools for patients with epilepsy and their relatives and control group

Answer options	Patients	Relatives

	Main group (n=1002)	Control group (n=45)	Main group (n=410)	Control group (n=25)
Do you know the triggers for the development of epilepsy?				
Yes	948 (94,6%)	5 (11,1%)*	356 (86,8%)	3 (12,0%)*
No	44 (4,4%)	28 (62,2%)*	42 (10,2%)	14 (56,0%)*
I can't answer that	10 (1,0%)	12 (26,7%)*	12 (3,0%)	8 (32,0%)*
Do you know the manifestations of epilepsy?				
Yes	953 (95,1%)	13 (28,9%)*	359 (87,6%)	8 (32,0%)*
No	44 (4,4%)	17 (37,8%)*	33 (8,0%)	11 (44,0%)*
I can't answer that	5 (0,5%)	15 (33,3%)*	18 (4,4%)	6 (24,0%)*
Can you help a person who has a sudden epileptic seizure?				
Yes	896 (89,4%)	4 (8,9%)*	355 (86,6%)	2 (8,0%)*
No	40 (4,0%)	28 (62,2%)*	26 (6,3%)	12 (48,0%)*
I can't answer that	66 (6,6%)	13 (28,9%)*	29 (7,1%)	11 (44,0%)*
Note: * – p<0.01 – significant differences between the answers of the main and control groups and control groups				

Thus, the schools for patients with epilepsy and their relatives held in the Tyumen Oblast demonstrated their demand, which was manifested by the stable attendance of the schools during the three years of their existence.

In addition, the analysis of the quality of the sessions and the satisfaction of the trainees provided positive feedback and also demonstrated knowledge of significant aspects of the disease such as risk factors, manifestation of the disease, and actions to be taken in case of sudden onset [111].

Thus, the Tyumen Oblast has developed a system for organizing medical care for epilepsy patients (children and adults) with due regard to accessibility for the rural population; schools for patients and their relatives are actively conducted, which have shown their relevance and effectiveness.

6.2. Achieving remission in patients with epilepsy

One indicator of the effectiveness of epilepsy centers and offices is the percentage of remission achieved by patients. Table 100 shows the sex and age characteristics of adult patients with epilepsy.

Women with idiopathic generalized epilepsies were found to be statistically significantly more likely to have symptomatic (or probably symptomatic) focal epilepsies ($p<0.01$), including those aged 18-44 years ($p=0.0$) and 44-60 years ($p<0.0$).

The organized antiepileptic service made it possible to create a register of epileptic patients, which made it possible to assess remission rates. We analyzed the individual charts of 2163 adults and 826 children with epilepsy to assess the achievement of remission.

Assessment of the sex and age characteristics of the patients demonstrated that the diagnosis of symptomatic (or probably symptomatic) focal epilepsy was the most frequent and was established with equal frequency in males and females. The incidence decreased in direct proportion to the age of the patients.

Idiopathic and familial (autosomal dominant) focal epilepsies were diagnosed significantly less frequently: more often in women than in men. In half of the patients this type of epilepsy was observed at the age of 18-44 years, in 1/3 – at the age of 60-75 years, and least often at the age of 44-60 years and 75-90 years, where such a diagnosis was established in only 1 patient.

Table 100 – Distribution of adult patients with epilepsy by sex and age

Patients with epilepsy	Age, years				Total
	18-44	44-60	60-75	75-90	
Symptomatic (or probably symptomatic) focal epilepsies					
Men	571 (61,9%)	192 (20,8%)	122 (13,2%)	38 (4,1%)	923
Women	512 (59,4%)	196 (22,7%)	127 (14,7%)	27 (3,1%)	862
Total	1083 (60,7%)	388 (21,7%)	249 (13,9%)	65 (3,6%)	1785 (82,5%)
Idiopathic and familial (autosomal dominant) focal epilepsies					
Men	6 (54,5%)	2 (18,2%)	3 (27,3%)	-	11
Women	9 (50,0%)	3 (16,7%)	5 (27,8%)	1 (5,6%)	18

Total	15 (51,7%)	5 (17,2%)	8 (27,6%)	1 (3,4%)	29 (1,4%)
Idiopathic generalized epilepsies					
Men	76 (63,9%)	16 (13,4%)	25 (21,0%)	2 (1,7%)	119
Women	111 (57,2%)	46 (23,7%)	33 (17,0%)	4 (2,1%)	194
Total	187 (59,7%)	62 (19,8%)	58 (18,5%)	6 (1,9%)	313 (9,9%)
Progressive myoclonus epilepsies					
Men	-	-	-	-	
Women	1 (100%)	-	-	-	1
Total	1 (100%)	-	-	-	1 (0,5%)
Seizures for which the definition of "epilepsy" is not necessary					
Men	12 (60,0%)	7 (35,0%)	1 (5,0%)	-	20
Women	10 (66,7%)	2 (13,3%)	2 (13,3%)	1 (6,7%)	15
Total	22 (62,8%)	9 (25,7%)	3 (8,6%)	1 (2,9%)	35 (1,6%)
N =					2163 (100%)

Idiopathic generalized epilepsy accounted for 9.9% of all diagnoses, was diagnosed in women slightly more frequently than in men, and was also most commonly observed in the 18-44 age group. No differences in the prevalence of this type of epilepsy were found between patients aged 44-60 and 60-75 years, and it was least frequently observed in those aged 75-90 years. Progressive myoclonus epilepsy was diagnosed in 1 patient.

Among children, the diagnosis of symptomatic (or probably symptomatic) focal epilepsies in boys and girls occurred with equal frequency and the incidence increased in proportion to age. Idiopathic and familial (autosomal dominant) focal epilepsies and idiopathic generalized epilepsies were also seen with equal frequency in boys and girls, most commonly between the ages of 6-18 years. No sex differences were also found for epileptic encephalopathy, but this diagnosis was most commonly observed in boys between the ages of 6-10 years, whereas in girls between the ages of 0-6 years. The diagnosis of "seizures for which epilepsy is optional" was more common in boys, who were diagnosed at ages 3-18 years, whereas girls were diagnosed at ages 0-10 years (Table 101).

Table 101 – Distribution of pediatric patients with epilepsy by sex and age

	Age, years				Total
	0-3	3-6	6-10	11-18	
Symptomatic (or probably symptomatic) focal epilepsies					
Boys	13 (4,5%)	52 (18,2%)	87 (30,4%)	134 (46,9%)	286
Girls	11 (5,6%)	38 (17,7%)	73 (34,0%)	92 (42,8%)	214
Total	24 (5,0%)	90 (18,0%)	160 (31,9%)	226 (45,1%)	500 (60,5%)
Idiopathic and familial (autosomal dominant) focal epilepsies					
Boys	2 (3,0%)	2 (3,0%)	29 (43,9%)	33 (50,0%)	66
Girls	4 (6,7%)	9 (15,0%)	23 (38,3%)	24 (40,0%)	60
Total	6 (4,8%)	11 (8,7%)	52 (41,3%)	57 (45,2%)	126 (15,3%)
Idiopathic generalized epilepsies					
Boys	2 (3,0%)	6 (9,1%)	24 (36,4%)	34 (51,5%)	66
Girls	4 (4,9%)	9 (11,0%)	20 (24,4%)	49 (59,8%)	82
Total	6 (4,1%)	15 (10,1%)	44 (29,7%)	83 (56,1%)	148 (17,9%)
Epileptic encephalopathies					
Boys	6 (20,0%)	5 (25,0%)	9 (45,0%)	2 (10,0%)	22
Girls	6 (37,5%)	5 (31,3%)	3 (18,8%)	2 (12,5%)	16
Total	12 (27,8%)	10 (27,8%)	12 (33,3%)	4 (11,1%)	38 (4,6%)
Seizures for which the definition of "epilepsy" is not necessary					
Boys	-	3 (30,0%)	2 (20,0%)	5 (50,0%)	10
Girls	1 (25,0%)	2 (50,0%)	1 (25,0%)	-	4
Total	1 (7,1%)	5 (35,7%)	3 (21,4%)	5 (35,7%)	14 1,7%
N=					826 100%

When the percentage of remissions was assessed, it was found that remission was most often achieved in patients diagnosed with idiopathic and familial (autosomal dominant) focal epilepsies, both in children and adults. The next diagnosis, in which remission was also observed in almost half of the patients, was "idiopathic generalized epilepsies." In symptomatic (or probably symptomatic) focal epilepsies, remission was also achieved in a significant number of patients. Remission was achieved least frequently in children diagnosed with "epileptologic encephalopathies," being observed in only 1/3 of patients (Table 102) [107].

Table 102 – Frequency of occurrence of remission of epileptic seizures

Diagnosis	Population group	remission					No remission
		Total	1-2 years.	2-3 years old	3-4 years old	More than 4 years	
Symptomatic (or probably symptomatic) focal epilepsies	Adults, n=1583	642 40,6%	154 9,7%	152 9,6%	22 1,4%	314 19,8%	941 59,5%
	Children, n=500	228 45,6%	43 8,6%	57 11,4%	56 11,2%	72 14,4%	272 54,4%
Idiopathic and familial (autosomal dominant) focal epilepsies	Adults, n=29	22 75,9%	2 6,9%	2 6,9%	2 6,9%	16 55,2%	7 24,1%
	Children, n=126	71 56,3%	16 12,7%	19 15,1%	18 14,3%	18 14,3%	55 43,7%
Idiopathic generalized epilepsies	Adults, n=312	172 55,1%	26 8,3%	29 9,3%	27 8,7%	90 28,8%	140 44,9%
	Children, n=148	73 49,3%	13 8,7%	17 11,4%	23 15,4%	20 13,4%	75 50,7%
Epileptic encephalopathies	Children, n=38	12 31,6%	5 13,2%	5 13,2%	1 2,6%	1 2,6%	26 68,4%
TOTAL	Adults, n=1924	836 43,5%	182 9,5%	183 9,5%	51 2,7%	420 21,8%	1088 56,5%
	Children, n=812	384 47,3%	77 9,4%	98 25,5%	98 25,5%	111 28,9%	428 52,7%

The diagnosis of "seizures for which the definition "epilepsy" is optional" was observed with equal frequency in males and females most often in the 18-44 age group and decreased proportionally with age (Table 101).

Among adult patients, remission was statistically significantly more frequent in those diagnosed with Idiopathic and familial (autosomal dominant) focal epilepsies and Idiopathic generalized epilepsies compared to patients diagnosed with symptomatic (or probably symptomatic) focal epilepsies (p=0.01 and p=0.02).

Among children aged 1-2 years, remission was statistically significantly more frequent in patients diagnosed with "Symptomatic (or probably symptomatic) focal epilepsies" than in "Idiopathic generalized epilepsies" (p=0.1), while, conversely, at the age of 3-4 years, less frequently (p=0.01).

It is important to note that according to the 2016-2017 data, the percentage of remission achievement among adults was 28.7%-30.6% and among children 29.4% and 31.2%, respectively, which further emphasizes the importance of the establishment and effectiveness of the antiepileptic service.

We analyzed remission rates depending on whether patients lived in urban or rural areas. It was found that remission was 1.6 times more frequent in urban adults than in rural adults (p<0.01). In the pediatric population, remission rates were also 1.9 times higher in urban than in rural populations (p<0.01) (Figure 64).

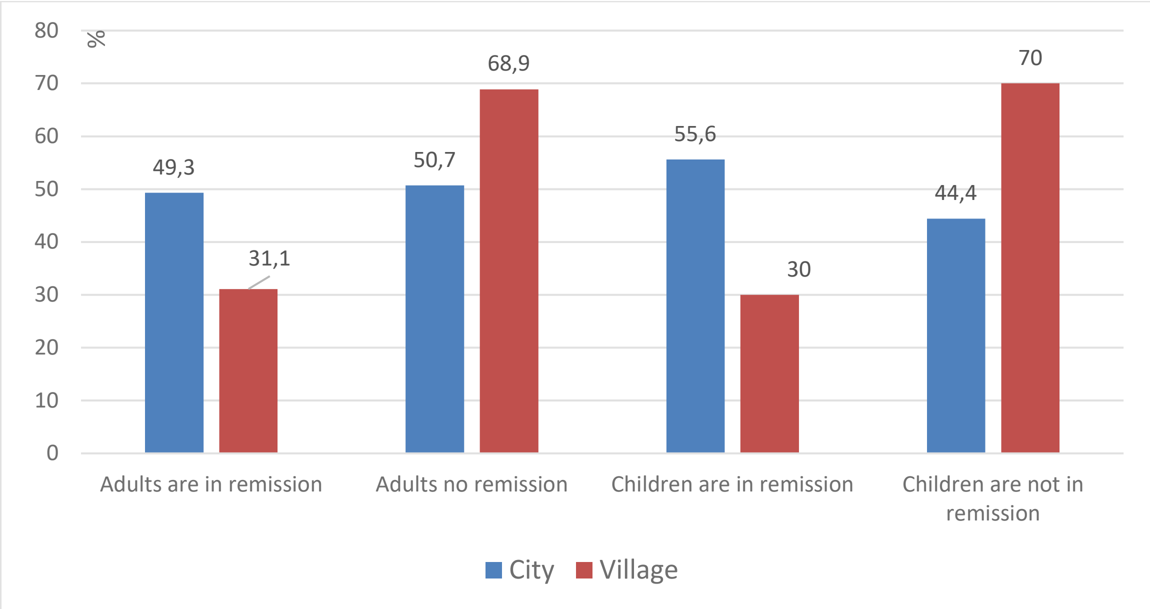


Figure 64 – Occurrence and absence of remission of epileptic seizures in patients living in urban and rural areas, %

The main differences between remission rates in urban and rural populations were observed in patients with remission for more than four years. The main differences between remission rates in urban and rural populations were observed in patients with remission for more than four years: in the urban adult population, this indicator was 2.1 times higher than in the rural population (p<0.01), and in the pediatric population – 2.8 times higher (p<0.01). 2.8 times higher (p<0.01).

The urban pediatric population also showed a higher percentage of children in remission for 3-4 years compared to those in rural areas by a factor of 2.9 (p<0.01) (Table 103).

Table 103 – Frequency of occurrence of remission of epileptic seizures

Population group		remission				
		1-2 years.	2-3 years old	3-4 years old	More than 4 years	No remission
Adults (n=1924)	City (n=1303)	131 10,1%	135 10,4%	33 2,5%	344 26,3%	660 50,7%
	Village (n=621)	51 8,2%	48 7,7%	18 2,9%	76 12,3%*	428 68,9%
Children (n=812)	City (n=549)	56 10,2%	70 12,8%	84 15,3%*	95 17,3%*	244 44,4%
	Village (n=263)	21 8,0%	28 10,6%	14 5,3%*	16 6,1%*	184 80,0%
Note: * – p<0.01 – significant differences between patients living in urban and rural areas						

Thus, the data obtained indicate the need for further maintenance of the registry and improvement of diagnostic and treatment measures, especially in patients with epilepsy living in rural areas, in order to increase the proportion of patients in remission and, consequently, to improve their quality of life.

Thus, the opening of an epileptology center and inter-territorial epileptology offices in the Tyumen Oblast has significantly improved the detection of epilepsy, as well as made it possible to achieve a high remission rate among both adult and pediatric populations, which has significantly improved the quality of life of this category of patients.

Summary

In addition, the system has made it possible to organize a register of patients and ensure interaction at all stages of the neurological service, as well as to improve the system of organization of specialized diagnostic and therapeutic care. We see the development of standards for the management and treatment of patients and the further development of schools for epilepsy patients and their relatives as the most promising future directions.

CHAPTER 7. SCIENCE-BASED DIRECTIONS FOR IMPROVING THE SYSTEM OF REGIONAL ORGANIZATION OF NEUROLOGICAL CARE FOR RURAL POPULATION OF THE TYUMEN REGION

The main directions of improving the neurological service in the Tyumen Oblast without AD were:

Development of routes for hospitalization of patients both by ambulance for suspected acute cerebral circulatory failure and for planned hospitalization, taking into account transport accessibility.

Establishment of primary vascular centers and inter-territorial epileptology offices.

Establishment of schools for stroke/epilepsy patients and their relatives, where all aspects of the disease, basic principles of its treatment, rehabilitation and prevention are described in detail.

Introduction of telemedicine technologies, which will allow consultations of patients and doctors located in remote hard-to-reach areas in order to adjust the treatment/rehabilitation regimen.

Introduction of traveling multidisciplinary crews for the purpose of both periodic check-ups and diagnostic examinations required for patients with chronic neurological diseases and/or their consequences.

All the above-mentioned areas of improvement are implemented taking into account the specific features of the region, namely its large territory and uneven population density in urban and rural areas. The main emphasis is placed on the population living in rural areas, as it is there that the availability of high-tech and highly qualified assistance is limited.

Based on the data obtained at the previous stages of the study, the main directions of improving the system of regional organization of neurological care for rural population were scientifically developed, substantiated and tested. The data obtained in the course of the study made it possible to make adjustments to the existing interrelationships in the system, which was reflected in the complex target program for patients with stroke, epilepsy and other neurological diseases living in rural areas, and made it possible to optimize the system of neurological care for the population at the regional level and to formulate the basic principles on which it is based.

Improvement of this regional system was aimed at the fullest and most efficient use of all available means, resources, methods, types of treatment to achieve the least (optimal) costs for the society, the fullest coverage of the population living in rural areas with diagnostic and treatment measures, primarily with the consequences of acute cerebral circulatory failure and epilepsy, the prevalence of which in the Tyumen Oblast is higher than other diseases of the nervous system. In order to reduce social and economic costs, schools for patients with these diseases and their relatives have been introduced.

The system includes an interconnected network of medical organizations, subordinated and financed from various sources, united by a single task of providing neurological care to the population, taking into account the territorial peculiarities of the region. The system includes medical organizations of the general medical network (territorial hospitals and polyclinics), specialized children's and adult hospitals and centers.

The Department of Organization of Medical Care and Implementation of Territorial Programs of State Guarantees, as well as the Department of Licensing, Drug Provision and Informatization of Health Care of the Department of Health Care of the TO carry out continuous monitoring of the indicators of efficiency of neurological care to the population.

The Territorial MHI Fund of TO promotes the efficiency of expenditure management within the framework of the developed system in order to increase the effectiveness of program expenditures on health care and more effective solution of existing problems. The joint work of the Department of Health Care of the TO and the Territorial MHI Fund contributes to the concentration of efforts on systemic problems of health care and the expansion of coverage of the population, primarily living in rural areas, with health care services, which, in turn, contributes to the improvement of public health.

All necessary information on epidemiological indicators, as well as the effectiveness and quality of care provided, is received by the Department of Health and the Territorial Compulsory medical insurance Fund from the Medical information and analysis centres, to which the relevant data are sent on a monthly basis.

In turn, the Department of Health sends the main epidemiologic and performance indicators to the Ministry of Health of the Russian Federation (Figure 65).

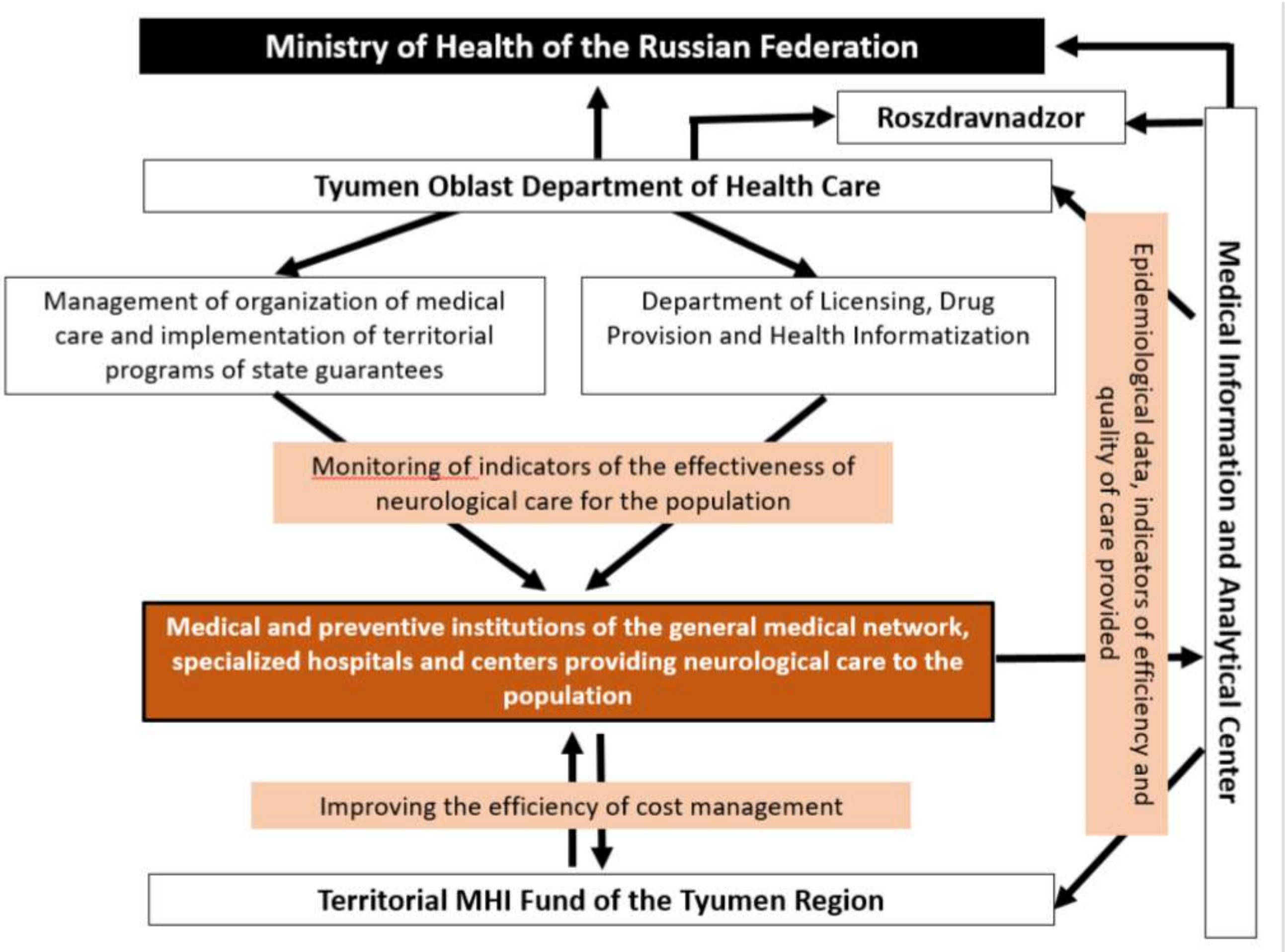


Figure 65 – System of regional organization of neurological care for rural population of the Tyumen Oblast

The ultimate goal of optimizing and improving the neurological care system is to integrate prevention and treatment programs, as well as to provide patients with access to the best evidence-based medical practice. The presence of vascular centers and departments organized in accordance with the order of medical care for patients with acute disorders of cerebral circulation (928n of 2012), epileptology rooms, as well as regular visits of multidisciplinary visiting crews to distant areas of the city contributes to the continuity and efficiency of the work process at every stage, and allows to make a huge contribution to improving the outcomes of patients with various neurological diseases.

At the level of the regional system of neurological care for the population of the Tyumen Oblast, including those living in remote rural areas, vascular centers and departments with a specially developed routing system that takes into account the need to hospitalize patients from remote areas, as well as an epileptology center and inter-territorial epileptology rooms have been introduced. In order to monitor the neurological health of the population, multidisciplinary visiting crews have been introduced, which make regular visits to remote rural areas of the Tyumen Oblast.

Thus, scientifically developed, substantiated and tested the main directions of improving the system of regional organization of neurological care for rural population contributed to the improvement of the quality of neurological medical care organization for the population. Based on the results obtained, we have developed a model of the organization of neurological care for the rural population of the Tyumen Oblast (Figure 65). The requirements for the developed model are presented in Table 104.

The regional system of providing neurological care to the rural population implies:

- adherence to a unified comprehensive approach and uniform principles of diagnostics and treatment of neurological diseases regardless of territorial remoteness from the city;
- efficient transfer of patients from one stage to another when the need arises (e.g., high-tech surgical interventions);
- application of uniform standards for assessing the quality of medical care based on the opinion of patients and caregivers;
- ensuring unified document flow within the entire system and the creation of a unified register and monitoring of patients in need of medical care;
- a clear system of training and professional development of medical personnel involved in the system.

In addition, the developed model assumes that the system of medical care delivery to the population should be flexible, agile and self-regulating, taking into account specific medical, demographic, social and economic factors. The system also envisages and takes into account the role of patients and their relatives, their awareness and satisfaction with the quality of medical care based on regular sociological studies.

Table 104 – Basic requirements for the model of organization of neurological care for rural population in the Tyumen Oblast

The main task of organizing the provision of neurological care to patients living in rural areas	Providing patients with neurological pathologies living in rural areas with timely, accessible and quality medical care
Purpose of optimization of the system of organization of neurological care for rural population	Compliance of the system of organization of neurological care for rural population of the Tyumen Oblast with modern standards
Principles of optimization of the system of organization of neurological care for rural population	– Accessibility of quality neurological care to the rural population. – Utilization of modern achievements of science and practice. – Intradepartmental control.
Scientific basis for optimization of the system of organization of neurological care for rural population	– Analyzing the prevalence of neurological diseases among the population living in rural areas. – The existing system of organization of neurological care for rural population. – Available socio-economic conditions. – Available positive world and domestic experience in providing neurological care to rural population – Study of patients' opinion about the quality of medical and educational services provided.
Conditions for the development of the system of organization of neurological care for rural population	– Development within a holistic health system in line with its development indicators. – Efficient utilization of health care resources. – Quality and accessibility of neurological care for rural population. – Participation of the population in the protection and promotion of their own health.

Figure 66 shows the general developed model of neurological care in the Tyumen Oblast.

The organizational model developed allowed:

- increase the level of detection of neurological diseases through the work of visiting multidisciplinary crews in the supervised districts;
- reduce the frequency of recurrent Acute disorders of cerebral circulation s by identifying patients in risk groups and further referring them to medical institutions providing high-tech medical care (e.g., carotid endarterectomy, angioplasty with stenting, etc.);
- reduce the frequency of seizures and, consequently, the rates of temporary disability of patients with epilepsy by maintaining a register of the dispensary group in the form of an electronic database of epileptological patients developed as part of this study, as well as referring non-curable patients to the Regional Epileptology Center for additional tests and change of therapy;
- to use in work the recommendations on routing of neurological patients proposed in the course of this study, developed for all rural districts of the Tyumen Oblast.
- to use clinical recommendations on routing, diagnosis and treatment of neurological patients in work, which will increase the availability of specialized care for residents of the region's districts;
- regularly organize educational events for patients and their relatives in the following areas: "School for patients with Acute disorders of cerebral circulation and their relatives", "School for epilepsy patients and their relatives" with subsequent questionnaires to monitor the quality of training;
- to monitor the detection rates of neurological pathology both for the oblast as a whole and taking into account the distribution by districts in order to take timely measures to eliminate the identified shortcomings;
- Provide timely high-tech care to patients referred from rural medical organizations, as well as primary vascular centers and interterritorial offices;
- analyze the quality of medical care using quality of care assessment cards for patients with Acute disorders of cerebral circulation, remission rates for patients

with epilepsy, and questionnaires of patients consulted by specialists of visiting multidisciplinary crews;

- as key performance indicators of the regional neurological service: levels of standardization of the treatment and diagnostic process, detectability of neurological diseases, training of specialists of medical organizations, patient satisfaction with the quality of care and educational activities, as well as indicators of temporary disability, disability and mortality due to neurological diseases;
- to use in the educational process the developed training and methodological complex for patients with Acute disorders of cerebral circulation and epilepsy and their relatives, as well as for the staff of medical organizations conducted by specialists of visiting crews.

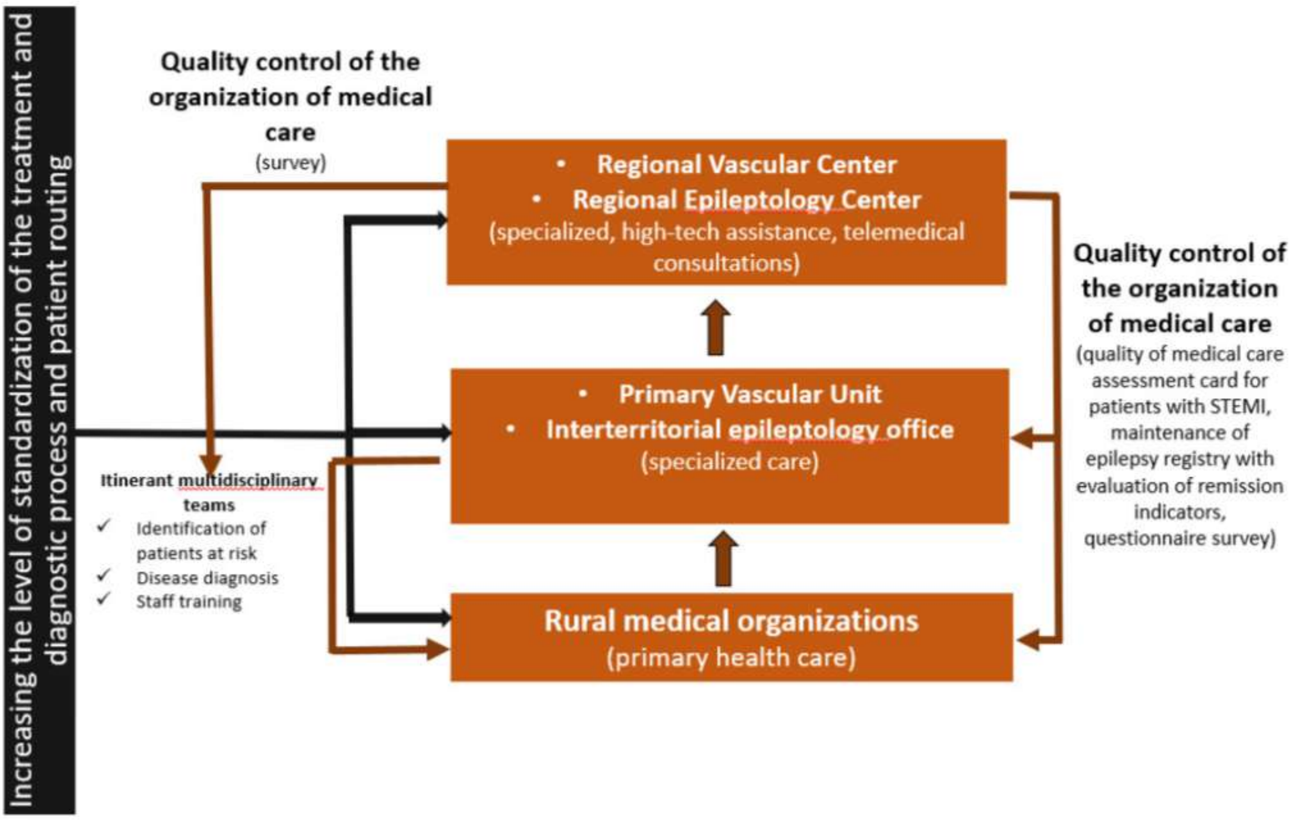


Figure 66 – Model of organization of the neurological care system in the Tyumen Oblast

Figure 67 shows the model of organization of medical care for patients with Acute disorders of cerebral circulation.

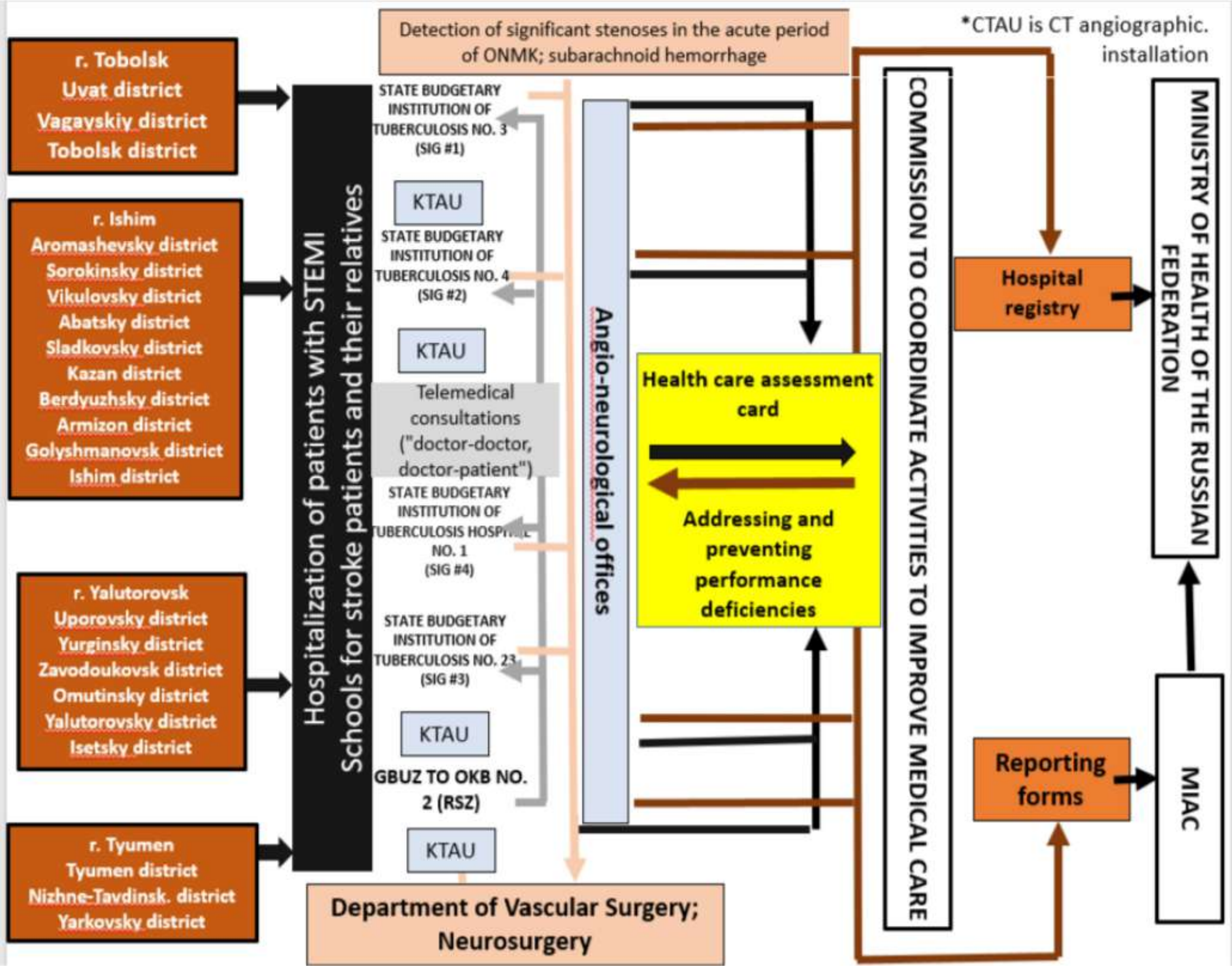


Figure 67 – Model of neurological care for patients with acute cerebral circulatory failure

Patient routing has been developed for each district of Tatarstan, according to which patients are hospitalized in PCP No. 1-3 or RRC. In the RRC there is a vascular surgery department, where patients from the PCS are hospitalized when hemodynamically significant stenoses are detected in the acute period of Acute disorders of cerebral circulation.

In addition, patients with subarachnoid hemorrhages are hospitalized in the RCC, as it has a neurosurgery department where this category of patients undergoes surgical intervention.

When there are complex clinical cases, RRC physicians conduct telemedicine consultations with PCP physicians and/or patients, which not only helps the physicians' work but also enhances their knowledge.

Every month, the medical care assessment cards from the RRCs and PCPs are received by to the commission for coordination of measures to improve medical care, which evaluates these cards and develops measures aimed at eliminating and preventing deficiencies in the work of vascular departments and the center.

In addition, all information about patients treated at the PCPs and RHCs is entered into the hospital register, which is a reporting form for the Ministry of Health of the RF and RRCs are entered into the hospital register, which is a reporting form for the Ministry of Health of the Russian Federation, as well as into reporting forms that are are further transferred to the MIAC, analyzed and also forwarded to the Ministry of Health of the Russian Federation. to the Ministry of Health of the Russian Federation.

The developed model of neurological care for patients with Acute disorders of cerebral circulation allowed:

- to increase the availability of specialized medical care for patients with Acute disorders of cerebral circulation, including those living in remote rural areas of Tatarstan;
- Increase the volume of high-tech medical care provided to patients with Acute disorders of cerebral circulation (first of all, TLT);
- reduce mortality of patients with STEMI;
- introduction of medical care assessment cards for inpatients allowed to reduce the number of identified defects and errors, to timely identify defects in medical care

and establish cause-and-effect relationships, and to improve the process of providing medical care to this category of patients;

- introduction of the commission for coordination of measures to improve medical care and a unified form of keeping medical records of patients with Acute disorders of cerebral circulation made it possible to practically implement compliance with the Procedures for the provision of medical care to patients with Acute disorders of cerebral circulation, improve quality control of medical care and reduce the frequency of violations in the provision of medical care to this category of patients.

When conducting a detailed assessment of the medical care provided to patients with acute cerebral circulatory disorders it was revealed that in accordance with the order of the Ministry of Health and Social Development of the Russian Federation from November 15, 2012 № 928n "On Approval of the Procedure for the provision of medical care to patients with acute cerebral circulatory disorders" the deficit of beds is currently 51.8 [110]. This is due to the fact that 30 beds should be allocated for 150000 adults. When conducting a detailed analysis it was determined that with the load of work the SICU No. 2 (State Budgetary Institution of TO "OB No. 4", Ishim), in which the deficit of beds is 5 and RRC (State Budgetary Institution of TO "OKB No. 2"), where the deficit of beds was 47.

In this regard, in 2020 a primary vascular department for 30 beds was opened in the city of Tyumen on the basis of the State Budgetary Institution of Tyumen Regional Clinical Hospital No. 1 (order of the Department of Health of Tyumen Regional Clinical Hospital No. 402 of 16.06.2020, Annex L, p. 334), with the functions of the second regional vascular center, which will change the routing of patients as follows:

Before the opening of the new vascular center, in order to reduce the bed deficit, a regional vascular center was deployed on the basis of the Regional Clinical Hospital No. 2 and a department for the second stage of rehabilitation of patients with acute cerebral circulatory failure was opened. Patients with 3-4 points on the Rankin scale and 3, 4 and 5 points on the rehabilitation routing scale are transferred to this department, which allows early positioning of patients, increasing bed turnover in the RCC and freeing up beds not only for early rehabilitation, but also in the PIT and neuroreanimation wards.

In addition, the information program of the angio-neurological office is planned to include information on all patients treated in the PCO/RCS since 2014 in order to develop a plan of rehabilitation and preventive measures and monitor these patients to improve the availability of specialized and high-tech care for patients with acute cerebral circulation disorders and reduce mortality and disability [158].

The first official document regulating the work of the epileptology service was Order No. 147 of 12.01.2004 of the Department of Health of the Republic of Tatarstan "On the organization of care for children with epilepsy".

According to this order, 1.5 rates of a neurologist (epileptologist) were allocated to treat children and adolescents with epilepsy and other paroxysmal conditions.

Tobolsk
Uvat district
Vagayskiy district
Tobolsk district

→ State Budgetary Institution of TO "Regional Hospital No. 3" (Tobolsk)
127,368 people
SOA 1

Ishim
Aromashevsky district
Sorokinsky district
Vikulovsky district
Abatsky district
Sladkovsky district
Kazan district
Berdyuzhsky district
Armizon district
Golyshmanovsky district
Ishim district

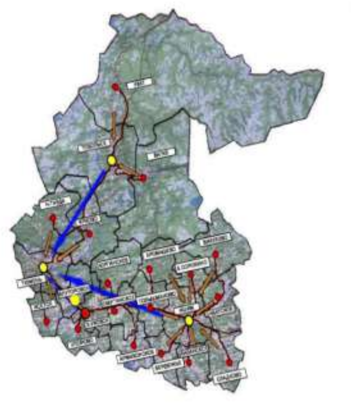
→ Regional Hospital No. 4 (Ishim).
179,625 people
SOA 2

Yalutorovsk
Uporovsky district
Yurginsky district
Zavodoukovsky district
Omutinsky district
Yalutorovsky district
Isetsky district

→ State Budgetary Institution of TO "Regional Hospital No. 23" (Yalutorovsk)
156,520 people
SOA 3

Tyumen

→ State Budgetary Institution of TO "Regional Clinical Hospital No. 2"
596 930



Population of Tyumen and the south of the Tyumen Oblast
1 498 779

RCC

Tyumen district
Yarkovsky district
Nizhne-Tavda district

→

Regional Clinical Hospital No. 1,
State Budgetary Institution of TO
123 402
SOA 4

Figure 68 – New routing scheme for patients with acute cerebral circulatory failure in 2020

The next stage in the development of the service was the unification of "adult" and "pediatric" neurologists-epileptologists within one Epileptology Center in 2015. The next stage in the development of the service was the merger of "adult" and "pediatric" neurologists-epileptologists within one Epileptology Center, which made it possible to expand the issue of continuity of pediatric and adult epileptology services. In 2015, the Tyumen Oblast Department of Health approved Order No. 486 "On the organization of specialized medical care for patients with epilepsy in the Tyumen Oblast", which officially recognized the existence of the Tyumen Regional Epileptology Center on the basis of the Regional Treatment and Rehabilitation Center, with the children's service included in its structure. In addition, a group of neurologists was allocated to receive patients with epilepsy locally, in inter-territorial offices [158]. (Figure 68).

Figure 69 presents a model of neurological care for patients with epilepsy. Just as in the previous model, each district of the region is assigned to a specific hospital located as close as possible to these settlements. Specialists of the treatment and rehabilitation center located in Tyumen conduct both on-site and telemedicine consultations with doctors and/or patients. If necessary, patients are referred to GBUZ TO "OKB № 1" for neuroimaging studies, video-EEG monitoring and EEG Holter monitoring for children, as well as assessment of the concentration of antiepileptic drugs in blood plasma, which is also conducted by JSC "Zdorovye". For neuroimaging and neurosurgical intervention, patients from MTEC № 1-3 and the treatment and rehabilitation center are transferred to the Federal Center for Neurosurgery. Video-EEG monitoring and EEG Holter monitoring for adults is carried out in the treatment and rehabilitation center.

The medical and diagnostic base includes emergency and planned inpatient care for children with epilepsy in the Children's Neurological Department of the Children's Hospital No. 1 (40 beds, 30% of which are for patients with epilepsy). In Tyumen, there are opportunities, including within the framework of MHI, to perform practically all the investigations necessary for epilepsy: video-EEG monitoring (including invasive), brain MRI (1.5-3T), tractography, MR reconstruction, MR spectroscopy, functional MRI, SPECT, PET/CT. Some of these studies are used in the routine practice of the epileptologist, and some are performed thanks to the Federal Center for Neurosurgery located in the city as part of the pre – and intraoperative preparation of pharmacoresistant patients [158].

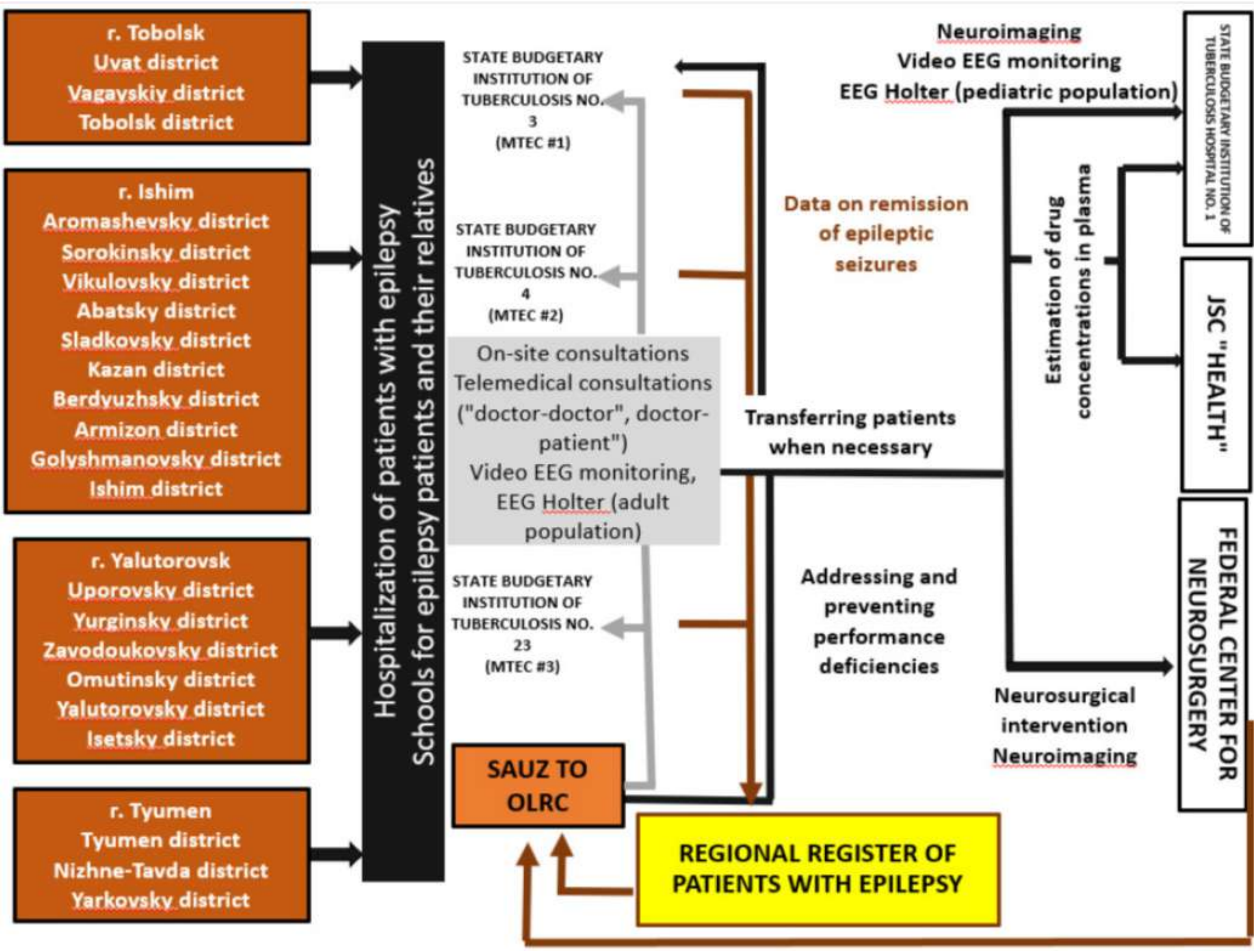


Figure 69 – Model of neurological care for patients with epilepsy

Specialists of the Regional Treatment and Rehabilitation Center also form a regional register of patients suffering from epilepsy, based on the data of which (primarily, the frequency of remission of epileptic seizures) they develop and implement measures aimed at eliminating and preventing deficiencies in the work of MTEC No. 1-3.

As a result of creating a model of neurological care for patients with epilepsy, a regional register of patients suffering from epilepsy was developed for the first time on the territory of the Russian Federation, which makes it possible to assess the epidemiological situation in the region, as well as to evaluate the indicators of therapeutic and diagnostic activity in order to optimize the provision of medical care to this category of patients.

For each patient, the diagnosis of the underlying disease, history, age of onset, presence/absence of febrile seizures, syndrome, neurologic status, results of tests and investigations, recommendations, and prescribed medications are entered into the register (Figure 70).

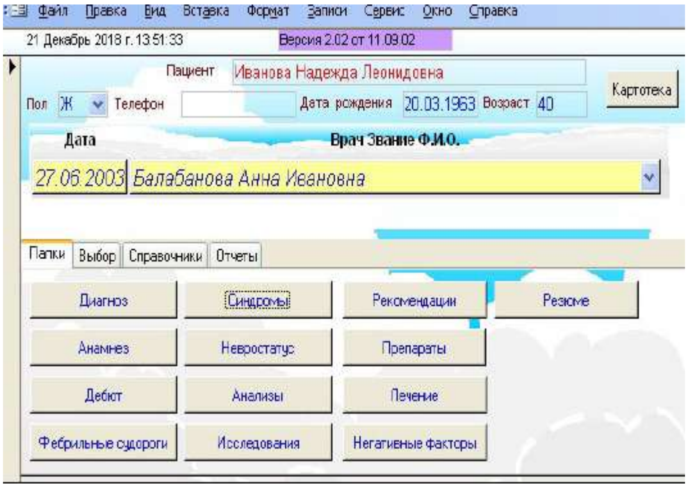
In this connection, in addition to the introduction of these models, specialized multidisciplinary visiting crews, whose specialists examine the population, have played an important role in optimizing the organization of neurological care for the population living in rural areas.

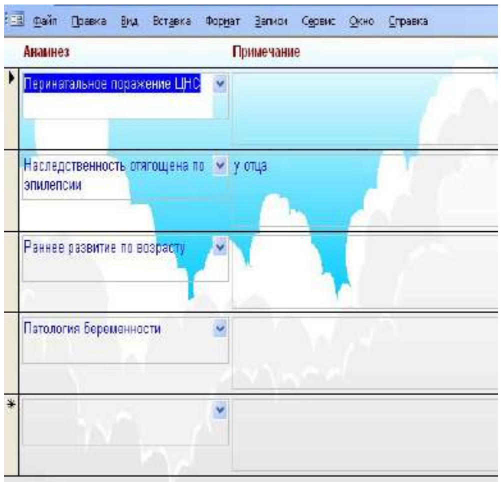
In addition, when pathology requiring consultation or treatment of more narrow specialists is detected, specialists refer them to regional centers (for example, when hemodynamically significant stenoses are detected – to the Department of Vascular Surgery in the RRC, and when neurosurgical intervention or neuroimaging study of a patient with epilepsy is required – to the Federal Center for Neurosurgery FGBU) (Figure 71).

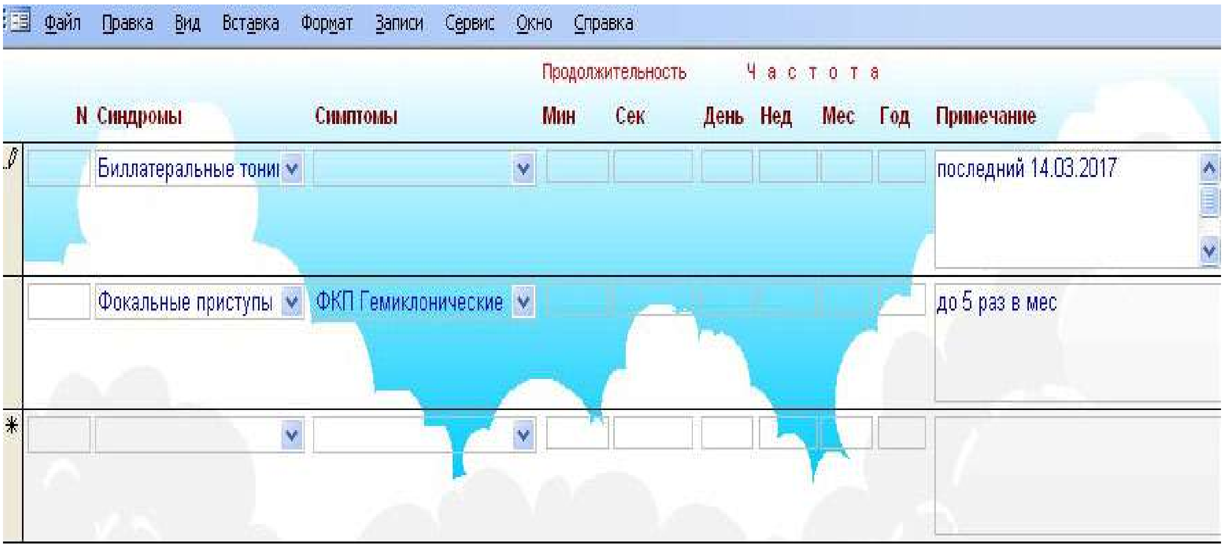
Thanks to the introduction of multidisciplinary visiting crews in the supervised districts, it was possible to:

- Increase the detection rate of neurological diseases;

- reduce the incidence of STEMI by actively implementing primary/secondary prevention of STEMI (e.g., identification of hemodynamically significant stenoses);
- to reduce the percentage of morbidity with temporary loss of working capacity;
- Improve the health literacy of medical staff in rural hospitals.







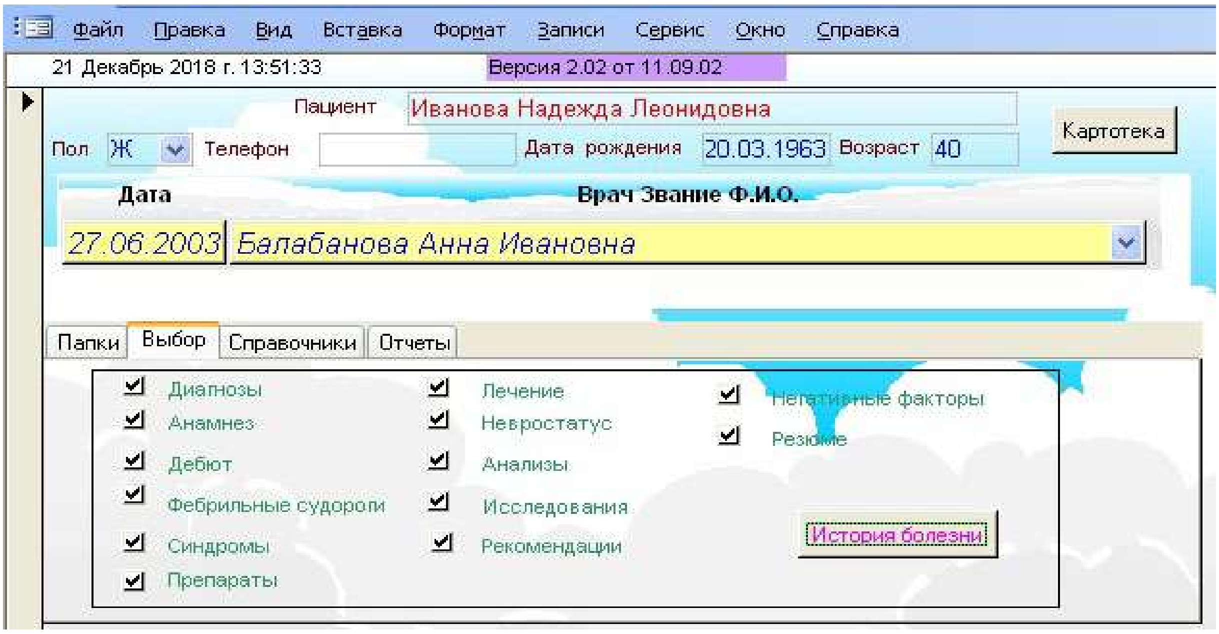


Figure 70 – Appearance of the user interface of the developed register for patients with epilepsy

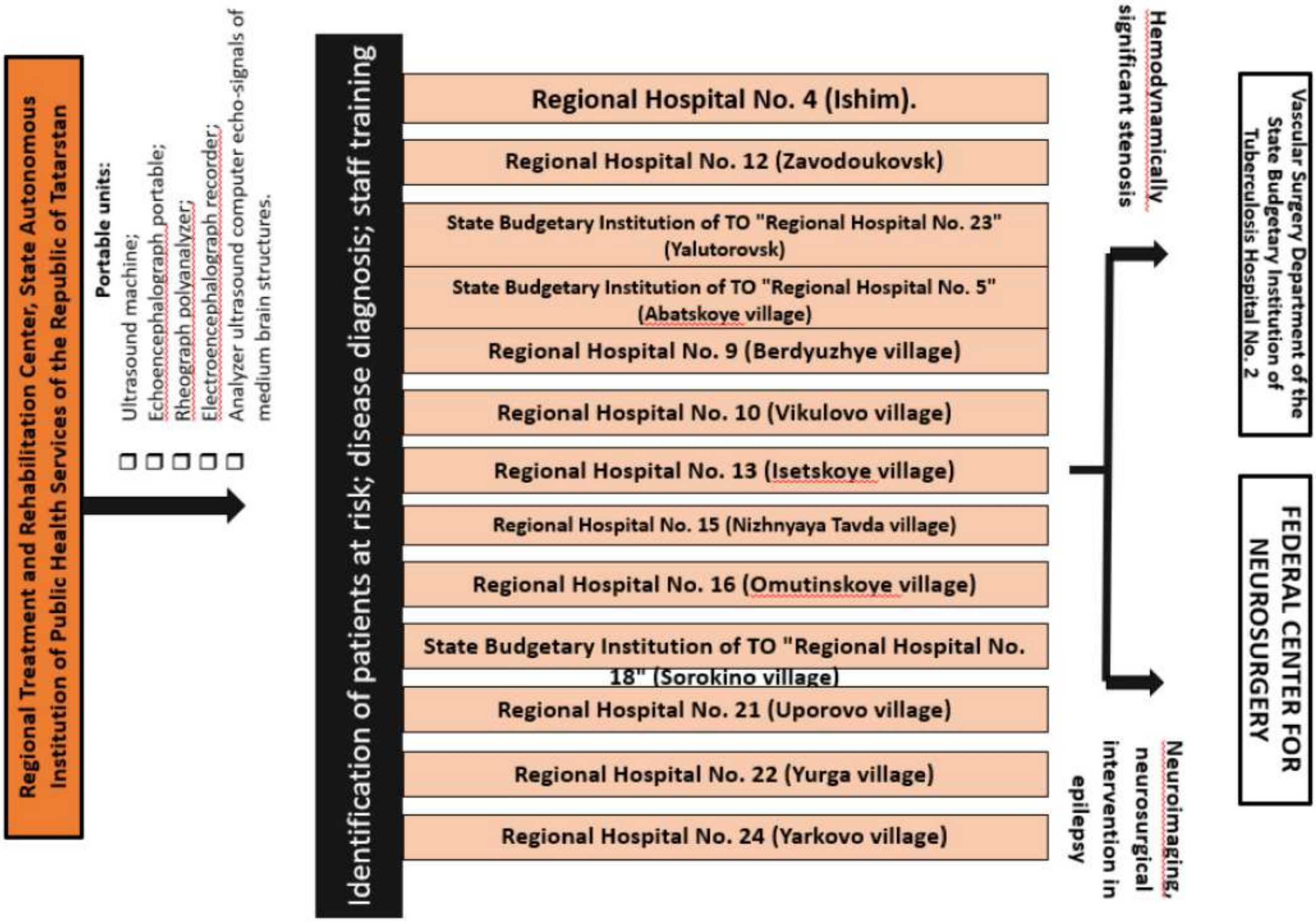


Figure 71 – Model of organization of neurological care for patients with the help of visiting multidisciplinary crews

At all stages of the organization of neurological care within the framework of the developed model, a mandatory condition is the assessment of patient satisfaction with the specialist's consultation and the doctor's feedback to the patient, which allows to ensure that the system responds to the patient's questions and needs, which plays an essential role in improving the system of medical care. In this regard, patient questionnaires are conducted in all PCPs, RRCs, MTECs, as well as in the regional treatment and rehabilitation center, as well as after the consultation of specialists of visiting crews. An important role in the life of patients with STEMI and epilepsy should be played by the patient's family, which can also inform the doctor about the patient's health problems, as well as take an active part in the measures of secondary prevention of the disease. In this regard, relatives of patients are actively involved in training in schools for stroke and epilepsy patients, where they receive the necessary knowledge on care, drug therapy, rehabilitation programs, etc.

Summary

Thus, the results of the study allowed us to propose practical recommendations to improve the system of organization of neurological care for rural population, the implementation of which will ensure an effective system of medical care for this category of patients. The results of the implementation of this model correspond to the recommendations of the Russian National Project "Health". The obtained data allow us to recommend the developed model of organization of neurological care for rural population for implementation in the national health care, taking into account the peculiarities of the region.

CONCLUSION

The ultimate goal of optimizing and improving the organization of the neurological care delivery system is to integrate prevention and treatment programs and ensure that patients have access to the best evidence-based medical practices. The availability of properly organized vascular centers and departments, epileptology rooms, as well as regular visits of multidisciplinary visiting crews to distant areas from the city helps to ensure continuity and efficiency of the workflow at every stage, and allows to make a huge contribution to improving the outcomes of patients with various neurological diseases.

The provision of neurological medical care in rural areas is highly dependent on the needs and available resources, as well as the availability of qualified medical personnel. Currently, there is a significant mismatch between the burden of neurologic diseases and the availability of medical resources, including modern equipment and medical personnel, especially in rural areas [38].

In the Tyumen Oblast, the system of organization of neurological care for the population is an integral part of the regional health care system, which depends both on various constantly updated and new regulatory normative acts (regional, federal level) and on patients' requirements to the quality of medical care.

With increasing life expectancy, a dramatic increase in non-communicable neurological diseases, including Alzheimer's disease, Parkinson's disease, stroke, etc., is foreseen. Cultural practices, superstitions and social stigma associated with diseases such as epilepsy, for example, deny a significant proportion of the population access to treatment [192].

Strategies must now be implemented to improve the medical infrastructure, ensure the necessary number of qualified medical personnel and the availability of medications and medical procedures at affordable prices for all patients with neurological diseases [23, 44]. In addition, with the introduction of information technology and telemedicine, the provision of medical care to remote areas of developing countries has become much easier.

The research conducted focused on the following main areas:

– studying the state of organization of specialized neurological medical care for stroke patients;
– to analyze the activity of visiting medical crews of regional clinical hospitals in providing consultative, organizational and methodological neurological assistance to rural health care in remote and hard-to-reach areas of the Tyumen Oblast;
– analysis of the system of organization of specialized neurological medical care for rural population with epilepsy; evaluation of the effectiveness of epileptological centers and schools for patients with epilepsy and their relatives; evaluation of the effectiveness of the organization of antiepileptological service according to the register data.

Stroke is the second most common cause of death worldwide. Stroke patients treated in primary vascular center settings have higher rates of survival, independent living, and living at home 1 year after stroke compared with treatment in a conventional inpatient unit [73, 261]. In the last two decades, there has been a significant improvement in the delivery of care for stroke patients [125], but unfortunately most patients still fail to receive care within the recommended therapeutic window [332]. In addition, patients treated in a vascular center setting have lower mortality during a follow-up period of up to 9 years and an increase in median survival of one year. The impact of reduced stroke mortality cannot be overemphasized. For example, a 2-3% reduction in stroke mortality in the US alone could mean 16000-24000 fewer deaths annually. Globally, this translates into a reduction of 320000-480000 deaths annually [334].

In order to reduce the burden of morbidity and mortality due to stroke in the Russian Federation in 2007, the Federal Targeted Program to improve the organization of medical care for patients with vascular diseases (National Project "Health") was adopted, which contributed to the establishment of regional vascular centers and primary vascular departments in all regions of the country [210]. The Tyumen Oblast joined this project in

2011, and due to the successful organization of work a decrease in mortality and disability of patients was noted.

The Stroke Treatment and Prevention System is a comprehensive, multifaceted longitudinal system that takes into account all aspects of stroke care and provides organization and coordination of the treatment process [157]. Such a system includes the entire spectrum from primary prevention to activation of emergency medical care, treatment in the acute period, secondary prevention, rehabilitation, and return to society. As in any system, its strength is determined by the weakest link. The hallmarks of an effective stroke treatment and prevention system are care coordination adapted to local conditions, able to maximize the use of available resources, and maintaining a tradition of quality care. Ideally, a stroke treatment and prevention system should ensure effective communication and collaboration among different organizations, services, and key individuals, promote a standardized approach in each institution and component of the system, and include a mechanism for evaluating effectiveness at both the system-wide and component levels [253].

The introduction and successful operation of the primary vascular center and vascular departments in the Tyumen Region contributed to the successful creation of an effective system of specialized medical care for this category of patients [22, 178].

The stroke treatment and prevention system should also aim for continuous improvement to provide patients and health care providers with the necessary tools to enhance stroke prevention, treatment, and rehabilitation. Principled decisions on patient work and treatment protocols should be based on the interests of stroke patients, addressing potential barriers to successful delivery of the treatment process [268].

In high-income countries, results from randomized controlled trials and systematic reviews have demonstrated that a vascular unit/vascular center can improve outcomes in patients with stroke [292, 326]. An important question that remains unresolved is whether it is feasible and feasible to implement vascular units/centers in middle – and low-income countries. Current comparative studies of stroke treatment in specialized vascular units or a conventional neurological unit in low – and middle-income countries using World Bank criteria have demonstrated lower mortality in the group of patients treated in a specialized unit compared with a control group [288], which is confirmed by the results of this study. At the same time, the transfer of the experience of implementation of vascular centers in high-income countries to middle – and low-income countries may be associated with certain difficulties. Despite the fact that most stroke patients do not require the use of extremely expensive and high-tech medical technologies, the establishment of a vascular center requires a hospital with certain equipment for stroke treatment and qualified personnel (physicians, nurses, and other staff). In a general ward setting, especially with limited resources, measures aimed at preventing complications of stroke (eg, deep vein thrombosis, aspiration pneumonia, urinary tract infection) and increasing the likelihood of a good functional outcome are not routinely applied. In addition, the presence of a vascular unit allows for continuous training of the hospital's medical staff in stroke treatment and prevention, as well as educating patients and their relatives about the basic signs and symptoms of the disease and the actions to be taken in case of suspected stroke.

Our study demonstrated high satisfaction with the quality of the organization of schools for stroke patients and their relatives. The knowledge obtained during these educational activities will allow patients to work more effectively on secondary prevention of the disease, and relatives, depending on the available anamnesis – on primary and/or secondary prevention of stroke. In addition, the knowledge gained may contribute to more effective compliance building.

Thus, the introduction and successful work of primary vascular centers and the regional vascular center in the Tyumen Oblast allowed to improve the efficiency of the organization of medical care for patients with stroke.

The next stage of the study was to evaluate the results of multidisciplinary visiting crews traveling to remote rural areas to conduct medical examinations of the population.

The introduction of the first periodic medical examinations (dispensaries) dates back to the industrial revolution, when employers began to pay for annual check-ups to keep employees healthy. Medical examinations, aimed at detecting various socially significant diseases, make it possible to carry out primary prevention measures based on evidence-based medicine, to advise patients on a proper lifestyle, to identify risk factors and diagnoses taking into account the analysis of accumulated data from the patient's medical history, and to recommend to patients at risk more detailed examination and/or treatment in specialized hospitals. Regular medical examinations of the adult population by physicians have led to significant changes in both the nature of the examination and the legal basis for performing such examinations. The results of several studies demonstrate the association of check-ups with improved evidence-based disease prevention and screening of various diseases.

Our study evaluated the organization of the work of visiting medical crews introduced in the Tyumen Oblast since 2009. The consultations resulted in changes in treatment tactics, development and/or correction of rehabilitation programs, specialized examinations, as well as referrals for follow-up examinations and treatment to regional medical organizations.

In Vikulovo village, which is a supervised district of the state-owned MO TO "Regional Hospital No. 10", regular diagnostic and treatment activities conducted by specialists of multidisciplinary visiting crews contributed to the reduction of morbidity, morbidity and morbidity with temporary disability due to diseases of the nervous system (including cerebrovascular disease), as well as diseases of the musculoskeletal system.

In addition, according to the results of the questionnaire, patients were satisfied with the quality and effectiveness of the examinations.

Thus, the conducted research on the example of optimization of neurological service in the Tyumen Oblast has demonstrated that for residents of rural areas passing periodic examinations carried out by specialists of mobile crews is an effective method contributing to the reduction of morbidity and morbidity.

The third stage of the study was devoted to evaluating the epileptology service, which began to develop actively in the Tyumen Oblast in 2015, when the Regional Epileptology Center and inter-territorial epileptology offices were opened, for which a routing system and special educational activities for patients and their relatives were developed. The creation of a registry of epileptologic patients (children and adults) made it possible to assess in dynamics the indicators of morbidity, morbidity, and remission, which is one of the main factors in the successful treatment of epilepsy patients of both pediatric and adult ages.

Official registers of morbidity, causes of death, prescribing and socio-demographic indicators are available at the state, regional and insurance company levels in many countries around the world [123]. The information obtained from these registries has enabled important studies on the dynamics of various diseases, including neurological diseases, medication use and prognosis [15]. These statistics are used to estimate the burden of neurological diseases, including epilepsy, and also allow for a population-level quantification of morbidity (the amount of care needed). Incidence, the number of new cases of a disease is expressed as an annual number of cases (the number of new patients seeking treatment) or as a frequency rate per 100,000 population per year. Incidence data are obtained from population-based registries. Registries may include information at the national level, but more often cover individual regions. In developing countries in particular, registries often include only data for the capital city and suburbs.

Incidence rates provide an estimate of the risk of neurologic disease in selected populations. Changes in incidence are an indicator of the impact of primary prevention strategies. The prevalence rate, which reflects the number of persons ever diagnosed with epilepsy (lifetime prevalence), is of less practical value. It may be possible to obtain data from registries of neurological diseases that have been in operation for very long periods of time and provide long-term follow-up of patients, with key indicators recorded over many years.

This study has demonstrated the need for further maintenance of a registry of patients with epilepsy in order to optimize treatment interventions based on remission rates.

At the level of the regional system of neurological care for the population of the Tyumen Oblast, including those living in remote rural areas, vascular centers and departments with a specially developed routing system that takes into account the need to hospitalize patients from remote areas, as well as an epileptology center and inter-territorial epileptology rooms have been introduced. In order to monitor the neurological health of the population, multidisciplinary visiting crews have been introduced, which make regular visits to remote rural areas of the Tyumen Oblast.

Thus, the conducted scientific work contributed to the improvement of the quality of organization of neurological medical care for the population.

CONCLUSIONS

1. The health indicators of the rural population are at a lower level than those of the urban population (the primary morbidity rate of diseases of the nervous system among the rural population of the Tyumen Oblast in 2009 was 6.7 cases per 100 thousand population higher compared to the urban population, while in the Russian Federation in 2009 this indicator was higher among the urban population by 0.1 cases per 100 thousand population), which may be due to the fact that only for 49.4% of the rural population of the Tyumen Oblast medical institutions are geographically accessible, and it is difficult to access them for 40,000 people.
2. In 2009, the incidence of nerve diseases among the adult population in the Tyumen Oblast was 43.6% higher than in the Russian Federation (68.8 and 47.9 per 1000 population in the Oblast and the Russian Federation, respectively), whereas in 2022 this indicator decreased to 22.1% (54.5 and 44.7 per 1000 population in the Oblast and the Russian Federation, respectively) against the background of optimization. At the same time, the morbidity of the oblast population in this class of nervous diseases decreased by 20.7% from 2009 to 2022
3. The indicator "Share of patients with ischemic stroke hospitalized in the first 3 hours of the disease" increased from 7.8% in 2013 to 15.1% in 2022, and the provision of high-tech specialized care to patients within the "therapeutic window" (increase in the indicator "frequency of systemic thrombolytic therapy) increased from 1.3% in 2013 to 8.0% in 2022.
4. Detection of patients with the class "acute cerebrovascular circulatory disorder" has improved, while the incidence of cerebrovascular disease in rural areas in 2009 was 9.7 times lower than in urban areas (7771.5 and 804.9 in urban and rural populations, respectively), and by 2022 this indicator decreased to 6.7 times (6378.4 and 954.2 for urban and rural populations, respectively), and the mortality rate from cerebrovascular disease in 2009 for both urban and rural populations was

lower than in the Russian Federation by 17.9 and 108.5 cases per 100,000 population, while in 2022, against the background of the measures taken – by 128.7 and 92 cases per 100,000 population.

5. The work of organized specialized multidisciplinary multidisciplinary neurological visiting crews allowed to reduce the incidence rates of diseases of the nervous system from 21.4 to 5.1 per 1000 population, and the incidence rate with temporary disability from 84.2 to 49.6 per 100 workers (in calendar days) from 2009 to 2021.
6. Questioning of the population of hard-to-reach areas about the medical care provided by multidisciplinary visiting crews revealed that 88.0% of patients were satisfied with the service provided, and 95.7% of patients would recommend the services of the visiting crew to their relatives and friends.
7. Improvement in the detection system through the operation of a unified antiepileptic service led to an increase in the "primary incidence of epilepsy" from 0.28 to 0.3 per 1,000 population, respectively (due to patient enrollment), and the overall incidence from 2017 to 2022 from 3.1 to 3.6 per 1,000 population. The incidence of epilepsy was 3.4 and 1.8 in 2017 and 3.1 and 3.4 per 1,000 population in 2022 among urban and rural residents, respectively.
8. Training activities in health schools conducted for persons with acute cerebral circulatory disorders and for caregivers of this category of patients enabled them to master the skills of caring for a stroke patient in 91.8% and 87.7% of cases; the rules of assisting a person with a stroke in 98.9% and 98.7% of cases, which indicates the effective results of the conducted training; for persons with epilepsy and caregivers of this category of patients, knowledge about predictors of epilepsy development was also obtained in 94.6% and 89.0%; manifestations of the disease – in 95.1% and 89.8% of cases; and skills for helping a person with epileptic attacks – in 89.3% and 88.8% of cases, respectively.
9. The developed and implemented science-based measures to improve the system of organization of neurological care for the rural population of the Tyumen Oblast have shown that visiting multidisciplinary crews and telemedicine consultations are the most priority type of medical care for hard-to-reach rural areas. The work

of organized specialized multidisciplinary neurological visiting crews allowed to reduce the incidence of cerebrovascular disease from 15.2 to 5.7 per 1000 population in the period from 2009 to 2021. The demand for telemedicine consultations is justified by the increase in the number of consultations from 679 in 2020 to 1637 in 2022.

PRACTICAL RECOMMENDATIONS

Health authorities

1. It is recommended to continue to further increase public awareness of stroke risk factors, disease prevention and algorithm of actions at the first signs of stroke. Particular attention should be paid to the male population of working age (order of the Department of Health of the Republic of Tatarstan of 10.03.2011 No. 58os, Annex A).
2. In order to improve the accessibility and quality of medical care to the rural population of the Tyumen Oblast, to recommend the creation of multidisciplinary visiting crews and to take measures to improve their activities: formation of such crews taking into account the settlement of the population and its remoteness from the territorial network of medical organizations; conducting further sociological surveys to study the opinion of the population on the accessibility and quality of medical care (Order of the Department of Health of the Tyumen Oblast dated 06.10.2009 No. 640).
3. To recommend further improvement of the epileptology service in the Tyumen Oblast, identification of epidemiological features of epilepsy morbidity, improvement of diagnostics, identification of risk factors and development of rational treatment tactics, maintenance of clinical and statistical register (Order of the Department of Health of the Tyumen Oblast dated 21.04.2015 No. 486).

Territorial medical organizations

1. Territorial medical organizations were recommended to hold "Schools for stroke patients and their relatives" on a regular basis.
2. As part of the activities of the regional epileptology center and inter-territorial epileptology offices, it is advisable to hold regular sessions of the "School for epileptic patients and their relatives", addressing the main aspects of the disease.

Educational medical organizations

Improve training programs for medical professionals, with special attention to the provision of neurological care to patients with acute cerebral circulatory failure and epilepsy, as well as their relatives.

LIST OF ABBREVIATIONS AND SYMBOLS

BP – blood pressure

AD – autonomous district

ACTT – activated partial thromboplastin time

BITR – intensive care and resuscitation unit

BSC – diseases of the circulatory system

WHO – World Health Organization

GP – general practitioner

IDPs – persons recognized as disabled for the first time

SAHA – state autonomous health care institution

GBUZ – state budgetary health care institution

HI – hemorrhagic stroke.

MI – ischemic stroke

CT – computerized tomography

INR – international normalized ratio

MO – medical organization

MRI – magnetic resonance imaging

MTEC – inter-territorial epilepsy unit

MHI – compulsory medical insurance

acute cerebrovascular accident – acute cerebral circulation disorder

Odds ratio

PWD – repeatedly recognized as disabled

Primary vascular unit – primary vascular unit

RVC – regional vascular center

REG – rheoencephalography.

SAH – subarachnoid hemorrhage.

CVD – cardiovascular disease

TIA – transient ischemic attack

TLT – thrombolytic therapy

TMC – telemedical consultations

TMT – telemedicine technologies

TO – Tyumen region

USDG – ultrasound dopplerography

FAP – feldsher-midwife station

CVD – cerebrovascular disease

CRB – central district hospital

CRCB – central district clinical hospital

ECHO-ES – echoencephalography.

EEG – electroencephalography.

GLOSSARY OF TERMS AND DEFINITIONS

Cerebrovascular diseases – a group of brain diseases caused by pathological changes in cerebral vessels with impaired cerebral blood circulation.

Acute cerebral circulatory disorder – acute cerebral circulatory disorder (ACBD) characterized by sudden onset of focal and/or general cerebral neurological symptoms persisting for more than 1 hour with the formation of a focus of infarction or hemorrhage, or leading to the death of the patient in a shorter period of time due to cerebrovascular pathology.

Ischemic stroke (IS) is an acute disorder of cerebral circulation as a result of sudden restriction of blood flow to a certain area of the brain (due to blockage of arteries feeding it or a sharp decrease in systemic arterial pressure) with the development of a focus of necrosis of brain tissue (cerebral infarction).

Hemorrhagic stroke (HI) – hemorrhage into the brain substance (parenchymatous) and/or under the brain membranes due to rupture of pathologically altered cerebral vessel walls or diapedesis.

Subarachnoid hemorrhage (SAH) – hemorrhage into the subcerebral space of the brain, caused by rupture of cerebral vessels or its membranes.

Epidemiology is a fundamental medical science that belongs to the field of preventive medicine and includes two sections with a unified research methodology: epidemiology of infectious and epidemiology of non-infectious diseases. The subject area of epidemiology consists of such phenomena as morbidity, its outcomes (disability, mortality, etc.), other phenomena that are in causal relations with morbidity, determining and characterizing the health of the population. The main subject of epidemiology is the morbidity of the population. Epidemiology has a universal scientific method that allows to study any (infectious and non-infectious) human pathology at the population level of its organization and public health. Epidemiology studies population morbidity by analyzing its distribution over the territory, among different population groups and over time, to identify the causes, conditions and mechanisms of its development and uses this knowledge to reduce morbidity and improve public health.

Epidemiological method is a specific set of techniques and methods designed to study the causes of occurrence and spread of any pathological conditions in the human population (includes observation, survey, historical and geographical description, comparison, experiment, statistical and logical analysis).

The incidence is the number of new cases of stroke occurring over a certain period of time (year), calculated per 1000 inhabitants.

Mortality is the number of stroke cases that ended in death (per year) (per year), calculated per 1000 inhabitants.

Lethality is the proportion of stroke deaths relative to all reported cases (in percent).

Neurological care is one of the main types of specialized medical care provided to patients with neurological diseases.

Epilepsy is a chronic brain disease of various etiologies characterized by repeated (2 or more) unprovoked epileptic seizures with impairment of motor, sensory, autonomic, thought or mental functions resulting from excessive neuronal discharges in the cerebral cortex.

Model – A system that provides information about another system; a representation of some real-world process, device, or concept.

A system is a set of elements that are interconnected with each other, and form a certain unity, integrity.

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APPENDICES

Annex A. Order of the Tyumen Oblast Department of Healthcare No. 58os of March 10, 2011

DEPARTMENT OF HEALTH OF THE TYUMEN REGION

ORDER

10 марта 2011г. Tyumen № 58ос

On organizing the provision of medical care oLLen s o':try cerebral circulatory disorders

To ensure quality and timely medical care for patients with acute cerebral circulatory disorders in the Tyumen Oblast

I'm sorry:

1. Open for to provide medical care for patients c acute cerebral circulatory disorders (OHMK) at the bases:
1.1. *GPPU* TO "Regional miyic hospital N--2" (r. Tyumen) regional vascular center (90 beds);
1.2. primary vascular departments (30 beds each):
- Regional Hospital N93 (Tobolsk);
- Regional Hospital No. 4 (Ishim);
- Regional Hospital No. 23 (Yalschorovsk).

2. Approve:
2.1. Regulations on the organization of the neurological department for patients with acute cerebral circulatory failure (appendix №1);
2.2. procedure for providing medical care to patients with acute cerebral circulatory failure (Appendix No. 2);
2.3. scheme of delivery of patients with OHMK to the regional vascular center and primary vascular centers (Appendix #3)
2.4. target indicators of implementation of the set of measures (Annex No. 4).

3. Heads of State medical and preventive treatment institutions of the Tyumen Oblast:
3.1. Provide referral of patients with acute cerebral circulatory disorders to the regional vascular center and primary vascular departments in accordance with Annex N°.3;
3.2. to ensure control over the execution of medical documentation when referring patients with OHMK to the regional vascular center and primary vascular departments;

3.3 organize observation and treatment of patients in accordance with the recommendations of the regional vascular center and primary vascular departments;
3.4. Ensure implementation of preventive measures to prevent and reduce OHMK mortality in accordance with the algorithm (Annex Ne5).

4. To recommend to the Head of the Health Department of the Administration of the City of Tyu"eni and the Health Advisor of the Administration of the City of Tobolsh:
4.1. to ensure referral of patients with acute cerebral circulatory disorders to the regional vascular center and primary vascular departments in accordance with Annex NZZ;
4.2. Ensure control over the execution of medical documentation when referring patients with OHMK to the regional vascular center and primary vascular departments;
4.3 organize follow-up and treatment of patients in accordance with the recommendations of the regional vascular center and primary vascular departments;
4.4. ensure implementation of preventive measures to prevent and reduce OHMK mortality in accordance with the algorithm (Annex N--5).

5. Chief physicians of the Regional Clinical Hospital N-2, Regional Hospital Ns3, Regional Hospital N--4, Regional Hospital N923:
5.1. Organize the submission of applications to the Tyumen Oblast Department of Health Care for training and retraining of medical staff for health care institutions, indicating the number of specialists trained and retrained, including specialties
"neurology", "psychiatry", " surgery", "neurosurgery",
"Anesthesiology x resuscitation, radiology and ultrasound diagnostics;
5.2. Allocate premises in health care institutions necessary for the provision of medical care to patients with vascular diseases, and carry out current and capital repairs in these premises, if necessary;

6. The First Deputy Director of the Department of Health Care shall be in charge of control over the execution of the order.

Director' of the Department A.Y.Kudryakov

Appendix B. Order of the
Tyumen Oblast Department of Healthcare
No. 60os of March 10, 2011

DEPARTMENT 2 OF PUBLIC HEALTH OF THE
TYUMEN REGION

ORDER

10 марта 2011 г. Tyumen № 60 ос

On the implementation of measures to improve medical care for patients with acute vascular diseases in the Tyumen Region

In order to reduce the mortality rate in acute vascular diseases - acute coronary syndrome and acute cerebral circulatory disorders - in the Tyumen Oblast population

I say:

1. To appoint M.N. Zhuravlev to the position of the Head of the Regional Vascular Center of the Regional Ministries Hospital No.2 of the Talnakh Concentration Hospital TO M.N. Zhuravlev.
2. To appoint the chief physicians of the Tyumen Regional Minicare Hospital and the Regional Minicare Hospital Y2 to be responsible for interaction between mukitsipalky, state and federal healthcare institutions.
3. Establish a commission to coordinate activities on
To improve medical care for patients with acute vascular diseases in the Tyumen Oblast in accordance with Appendix 1.
4. To approve the Regulations on the Commission for coordination of measures to improve medical care for patients with acute vascular diseases in the Tyumen Oblast in accordance with Appendix 2.
5. The first deputy director of the Tyumen Oblast Department of Healthcare shall be in charge of the order's execution.

Department Director A.Y.Kudryakov

Appendix B. Order of the Tyumen Oblast Department of Healthcare No. 682 of October 28, 2013

DEPARTMENT OF HEALTH OF THE TYUMEN REGION

ORDER

28 октября 2013 г. Tyumen № 682

On Approval of the Procedure for Providing Monitoring of Morbidity and Mortality Indicators of Blood Circulatory System Diseases in the Tyumen Region

In order to promptly record morbidity and mortality indicators of the population of the Tyumen Oblast and ensure timely entry of data into the federal information system

I say:

1. Approve:

1.1. the procedure for reporting monitoring of morbidity and mortality indicators from circulatory diseases (Annex 1);

1.2. algorithm for monitoring morbidity and mortality from diseases of the circulatory system (Annex N-°2);

1.2. reporting forms for monitoring morbidity and mortality from circulatory diseases (Annex 3);

2. Heads of medical organizations:

2.1. To appoint persons responsible for reporting of morbidity and mortality monitoring indicators;

2.2. to send information including full name, title, position, working phone number, e-mail address of the person responsible for reporting by 31.1O,2013 to the department of organization of medical care and development of medical technologies of the Tyumen region health care department. In case of change of the person responsible for reporting, the relevant information should be sent within one working day to the Department of organization of medical care and development of medical technologies of the Tyumen Oblast Health Department;

2.2. Organize monthly monitoring of indicators morbidity and mortality from diseases of the circulatory system;

2.3. to ensure preparation and submission of the report on monitoring of morbidity and mortality rates from circulatory diseases in due time.

3. To recommend to the heads of medical organizations of other forms of ownership to organize the preparation and submission of a report on

monitoring morbidity morbidity и mortality from
diseases of the circulatory system (Annex 1, 2, 3).

4. Director of the State Autonomous Establishment "Medical Information and Analytical Medical Center
Center" (hereinafter referred to as "MIAC"):

4.1. to organize through the module ACCOO IRIS TO the reception and statistical processing of reports on monitoring of morbidity and mortality rates from circulatory diseases (Annex 2, 3);

4.2. ensure that consolidated information on the Tyumen Oblast (without autonomous districts) is placed in the federal information monitoring system of the Ministry of Health of Russia.

5. To make the heads of health care institutions personally responsible for timely and proper (quality) implementation of the project.

6. I reserve control over the execution of the order.

Department Director I.B.Kulikova

Appendix D. Order of the Tyumen Oblast Department of Health No. 379 of June 14, 2018

HEALTH DEPARTMENT
TYUMEN REGION

ORDER

14 июня 2018 г. Tyumen 379

On cooperation of Tyumen Oblast medical organizations in providing medical care to patients with acute cerebral circulatory failureR

TSGLEACH. COBB|ZSHeHCTBOBQHIA. O|ZGNIZZNIZQTION MEDICAL CARE

to the population of the Tyumen region with acute cerebral circulatory disorders, in accordance with the Order of the **Ministry of Health of the** Russian Federation dated November 15, 201Z of the year N-- 928n **"On Approval of the** Order of **medical** care for **patients** with acute cerebral circulatory disorders" (hereinafter - the Order of the Ministry of **Health of the** Russian Federation dated 15.11.2012 NR 928n).

I'm sorry:

1. **Approve:**

1.1. Procedure for **interaction between** medical organizations of the Tyumen **Oblast** in providing medical care to patients with acute **cerebral circulatory** disorders **in accordance with Annex N9** 1 to this Decree.

2. Heads of medical organizations subordinated to the Tyumen Oblast Department of Health Care shall ensure:

2.1. communicating the order of the Ministry of Health of the Russian Federation from 15.11.2012 N- 928n to specialist physicians **medical** organization;

2.2. organization of medical care for patients with acute cerebral circulatory disorders in accordance with the order of the Ministry of Health of the Russian Federation from 15.11.2012 Nya 928n and Annex N- 1 to this order.

2.3. appointment of specialists responsible for providing medical care to patients with acute cerebral circulatory disorders.

3. The Chief Neurologist of the Tyumen Oblast Department of Health Care shall provide organizational and methodological assistance to specialists responsible for providing medical care to patients with acute cerebrovascular disorders.

4. To recommend the Director of the Department of Healthcare of the Tyumen City Administration to ensure the implementation of this order.

5. **To assign personal** responsibility for the execution of **this** order to the **heads of medical organizations subordinate to the** Department of Health Care of the Tyumen Oblast.

6. I reserve control over the implementation of paragraphs 1-3 of this order.

Director **I.B. Kulikova**

Appendix D. Map of monitoring indicators of the quality of medical care for a patient with STEMI

card no.________________________ ICD code X____

№ n/a	Monitoring of indicators	Attending physician	Zav. branch	Medical organization expert
Indicators at admission				
1.	Time of admission from onset of first signs to 4.5 hours			
2.	Time to obtain OAC results (20 min)			
3.	Time to obtain peripheral blood glucose results (20 min)			
4.	Time to obtain the results of ABPM and INR (40 min)			
5.	Time to obtain CT results (40 min)			
6.	Examination time by a neurosurgeon for hemorrhagic stroke (60 min)			
7.	Time of transfer to a specialized department (60 min)			
Indicators for the period of stay in the ward				
8.	Time to assess swallowing function (3 hours from admission to the ward)			
9.	Nutritional status assessment (3 hours from admission to the ward)			
10.	Time of USDG (3 hours from the moment of admission to the department)			
11.	Time to perform OAM (3 hours from admission to the department)			
12.	Time to perform a biochemical blood test (3 hours from admission to the department)			
13.	Time of neurological and somatic status monitoring in the PIT (once every 4 hours)			
14.	MDRO examination (48 hours from admission)			
15.	Rehabilitation scales			
Conclusion				

Attending physician _______________ Head of department ______________ Expert ____________________

Appendix E: Questionnaire for school attendees – patients and relatives of patients who have suffered from STEMIs

ПСО ____

Patient ☐ Relative ☐

Gender: Male☐ ;Female ☐

Age: under 30☐ ; 41-50☐ ; 51-60☐ ;over 60 years old ☐

Employment: employed☐; not employed☐; retired☐; student ☐

№ n/a	QUESTION	Yes	No	I don't know.
1	Do you think it is necessary to hold "Schools of..."?			
2	Was the information you received in class sufficient?			
3	Is the information delivered to you in an accessible manner?			
4	Did you gain practical nursing skills?			
5	Do you know the risk factors for stroke?			
6	Can you tell me the first signs of a stroke?			
7	Can you assist a person who has had a sudden stroke?			
8	Do you have enough handouts (booklets, leaflets, guidelines)?			
9	Are you satisfied with the "School of..."?			
Your suggestions				

Appendix G. Order of the Tyumen Oblast Department of Health Care No. 640 of October 6, 2009

HEALTH DEPARTMENT
TYUMEN REGION

ORDER

06 октября 2003 — № 640

Tyumen

On appointment of supervisors of state preventive medical institutions of the Tyumen Oblast

In order to improve the efficiency of state medical and prophylactic institutions in rural areas of the south of the Tyumen region, to provide organizational, methodological, practical assistance, including on issues of compliance with federal and regional legislation

"I do hereby"

1. To approve the Regulations on the curator of the state therapeutic and prophylactic institution (Annex No. 1).
2. To train the governors of the state medical-profilahticheskikh medical centers. institutions in rural areas of the south of the Tyumen Oblast according to Appendix N°-2
3. The supervisors of the institutions shall submit to the Department of Health Care a plan of work with the supervised institution in time, not later than December 16, 2009, to provide information on the implementation of the plan and proposals to improve the efficiency of the institution's operation.
4 First Deputy Director of the Department (Brynza N S) to organize the work of khurators according to Annexes 1-2
5 The head of the department for work with the territory (Lepeshkiya T V) should analyze the results of the supervisors' work on a quarterly basis.
6 Director of the AHO "Medical Information-Acalytic Center of Tiomen region" (Ermakov N V) to provide statistical data at the request of supervisors.
7. I retain control over the execution of the order

Department Director — A. Kudryakov

Appendix I. Questionnaire on the work of the visiting crew

1. Your age: under 20☐; 20-30☐; 31-40☐; 41-50☐; 51-60☐; over 60 ☐
2. Social status: manager☐; entrepreneur☐; employee☐; unemployed☐; pensioner☐; pupil☐; student☐; worker ☐
3. Your gender: male☐; female ☐
4. Purpose of referral to specialized visiting crew: consultation of neurologist -☐; consultation of epileptologist -☐; consultation of pediatric neurologist -☐; consultation of cardiologist -☐; consultation of neuro-ophthalmologist -☐; consultation of parkinsonologist -☐; USDG -☐ ; EEG -☐; REG -☐; ECHO-ES ☐
5. What points in the service organization to pay attention to – culture☐; appearance☐; optimizing patient flow☐ ; your option☐ ____
6. Planning to reapply: yes, for reasons beyond my control☐; no; yes☐☐, like; yes☐☐, because_________________; no☐, because _______________________
7. Would you recommend the services of the field crew to your friends: yes☐, because ___________________________; no☐, because___________________________
8. How many times have you seen the traveling crew doctors: 1 -☐; 2 -☐; more than 5 – ☐
9. Negative points: rudeness -☐; inattentiveness -☐; lack of professionalism (experience) -☐; other – ☐
10. How do you feel about field crews: they are needed -☐; other specialists should be included -☐; we are fine with them -☐; other ____ ____

Appendix K. Order of the Tyumen Oblast Department of Healthcare No. 486 of April 21, 2015

ДЕПАРТАМЕНТ ЗДРАВООХРАНЕНИЯ
ТЮМЕНСКОЙ ОБЛАСТИ

ПРИКАЗ

21 апреля 2015г. № 486

г. Тюмень

Об организации специализированной медицинской помощи больным эпилепсией в Тюменской области

С целью совершенствования медицинской помощи больным эпилепсией, повышения уровня знаний врачей по вопросам диагностики и лечения эпилепсии

приказываю:

1. Утвердить:
   1.1. Распределение территорий Тюменской области за медицинскими организациями, имеющими в своем составе эпилептологический кабинет, эпилептологический центр (приложение №1);
   1.2. Форму отчета медицинской организации, имеющей в своем составе эпилептологический кабинет (приложение №2).
2. Руководителям медицинских организаций, подведомственных Департаменту здравоохранения Тюменской области, осуществляющих первичную медико-санитарную помощь, обеспечить исполнение настоящего приказа.
3. Главному внештатному специалисту неврологу Департамента здравоохранения Тюменской области и главному внештатному детскому специалисту неврологу Департамента здравоохранения Тюменской области обеспечить:
   3.1. разработку алгоритма взаимодействия медицинских организаций при оказании медицинской помощи пациентам с эпилепсией в Тюменской области до 15.05.2015г.;
   3.2. разработку положения об областном эпилептологическом центре, эпилептологических кабинетах до 15.05.2015г.;
   3.3. организационно-методическую помощь врачам-неврологам эпилептологических кабинетов и областного эпилептологического центра;

3.4. осуществлять внутренний контроль за выполнением объемов и качества предоставления медицинских услуг в областном эпилептологическом центре и эпилептологических кабинетах.

4. Главному врачу ГАУЗ ТО «Областной лечебно-реабилитационный центр»:

   4.1. создать на базе учреждения Областной эпилептологический центр в соответствии с положением с 1 июня 2015г.;

   4.2. организовать работу детского кабинета эпилепсии и пароксизмальных состояний с 1 июня 2015г.;

   4.3. организовать проведение детям с 14 лет и взрослым пациентам ЭЭГ-видеомониторирование в условиях стационара по показаниям;

   4.4. организовать выезд в эпилептологические кабинеты медицинских организаций юга Тюменской области врача-эпилептолога и нейрофизиолога с целью повышения доступности специализированной помощи и проведения методической работы;

5. Главным врачам ГБУЗ ТО «Городская поликлиника»(г.Тобольск), ГБУЗ ТО «Областная больница №4» (г. Ишим), ГБУЗ ТО «Областная больница №23» (г. Ялуторовск) организовать:

   5.1. создать на базе учреждения эпилептологический кабинет в соответствии положением с 1 июня 2015г.;

   5.2. организовать подготовку врачей-неврологов и нейрофизиологов для работы в эпилептологическом кабинете.

   5.5.организовать представление руководителю Областного эпилептологического центра один раз в полугодие до 15 числа следующего за отчетным месяцем отчет на электронную почту gkb@sibtel.ru в соответствии с приложением №2 к настоящему приказу.

6. Главному врачу ГБУЗ ТО «Областная клиническая больница №2» организовать проведение детям до 14 лет ЭЭГ видео мониторинга в условиях стационара по показаниям.

7. Рекомендовать руководителю Департамента здравоохранения Администрации г. Тюмени обеспечить исполнение настоящего приказа.

8. Контроль исполнения пунктов 1-6 настоящего приказа возложить на первого заместителя директора.

Директор департамента И.Б.Куликова

Appendix L. Questionnaire for school attendees – patients with epilepsy and their relatives

Patient ☐ Relative ☐

Gender: Male☐ ;Female ☐

Age: under 30☐ ; 41-50☐ ; 51-60☐ ;over 60 years old ☐

Employment: employed☐; not employed☐; retired☐; student ☐

№ n/a	QUESTION	Yes	No	I don't know.
1.	Do you think it is necessary to hold "Schools of..."?			
2.	Was the information you received in class sufficient?			
3.	Is the information conveyed to you in an accessible manner?			
4.	Do you know the triggering factors for the development of an epizootic?			
5.	Do you know the manifestations of epilepsy?			
6.	Can you help a person who has a sudden epileptic seizure?			
7.	Do you have enough handouts (booklets, leaflets, guidelines)?			
8.	Are you satisfied with the "School of..."?			

Ваши предложения:____

Appendix M. Order of the Tyumen Oblast Department of Healthcare No. 402 of June 16, 2020

ДЕПАРТАМЕНТ ЗДРАВООХРАНЕНИЯ ТЮМЕНСКОЙ ОБЛАСТИ

ПРИКАЗ

16.06.2020 № 402

г. Тюмень

Об организации первичного сосудистого отделения в ГБУЗ ТО «Областная клиническая больница №1»

В соответствии с п. 8.2. Плана мероприятий региональной программы «Борьба с сердечно-сосудистыми заболеваниями» Тюменской области, утвержденной распоряжением Правительства Тюменской области № 688-рп от 21.06.2019

п р и к а з ы в а ю:

1. Главному врачу ГБУЗ ТО «Областная клиническая больница №1» обеспечить:
1.1. с 01.07.2020 работу первичного сосудистого отделения для пациентов с острым нарушением мозгового кровообращения;
1.2. внесение соответствующих изменений в устав учреждения;
1.3. внесение изменений в штатное расписание и структуру учреждения;
1.4. укомплектование первичного сосудистого отделения работниками.
2. Контроль за исполнением настоящего приказа оставляю за собой.

Заместитель директора департамента Н.В. Логинова

ДОКУМЕНТ ПОДПИСАН ЭЛЕКТРОННОЙ ПОДПИСЬЮ

Сертификат	3DF6FC9F3F13A00C2E8CC06177C68E
Владелец	Логинова Наталья Валерьевна
Действителен	с 30.04.2019 по 30.07.2020