Research Article

Resource provision of the cardiological service and population health status of the South Kazakhstan Region

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ABSTRACT

Aim: The main goal of the article is to enhance the organization and cardiac care management of the population in the administrative districts of South Kazakhstan Region (SKR) by studying the state of its resource provision. **Materials and Methods:** A comparative assessment of morbidity and mortality from circulatory system diseases (CSDs) of the population of the Republic of Kazakhstan and the economically developed countries of Europe and North America was conducted, which revealed 2-fold excess level of health indicators in our country. **Results:** The differences in the morbidity and mortality from the CSDs in the regional entities of the SKR were studied using statistical data of the cardiological services. Correlation and regression methods allowed to establish the risk factors of socioeconomic, demographic, and medical-organizational nature. It is shown that the resource potential of the cardiological services is of the greatest importance. **Conclusions:** A mathematical modeling methodology was developed and tested to evaluate the effectiveness of various scenarios for managing public health. New facts were obtained describing the implementation effectiveness of the Republican program in the South Kazakhstan event to improve the organization of medical care for patients with vascular diseases.

KEY WORDS: Cardiac diseases, Morbidity, Organization, Resource provision, Risk factors

INTRODUCTION

For several decades, circulatory system diseases (CSDs) remain one of the most acute medical and social problems in the world, including the Republic of Kazakhstan, whose proportion in the country's morbidity and mortality indicators in recent years was 52–54%. According to the National Statistical Committee of the Republic of Kazakhstan, the overall morbidity of CSD of the Republican adult population tends to increase (in 2009, it was 2933.3, and in 2016, - 3304.0 per 10,000 of the adult population, an increase of 21.5%). The main nosological types that caused an increase in the overall morbidity are coronary heart disease (in 2016 - 1215.2 per 10,000 adults and in 2005 - 908.5 per 10,000 adults) and cerebrovascular diseases (CVDs) (in 2016 - 553.9 per 10,000 adults and in 2005 - 466.2 per 10,000 people).

Compared to 2005, the morbidity of childrens' CSDs increased by 45.3% (from 117.9 in 2005 to 214.8 in 2016 per 10,000 children). The number of children with arterial hypertension and heart rhythm disorders remains increasing.[1-3]

In 2016, the mortality rate from the CSDs was 417.8 cases per 100,000 people, whereas in Western Europe countries - 214.5 cases, in Eastern Europe countries - 493.6 cases, and in the USA - 315.7 per 100,000 cases. In addition, in the past 20 years, a steady decreasing tendency in mortality from cardiovascular system diseases has been formed in the countries of Western Europe and North America; however, its growth continued until 2015 in South Kazakhstan Region (SKR) and only in the past 2 years did its level decrease slightly.[4]

Despite the urgency of the epidemiological situation of CSD, studies that allow to get a complete picture of the nature of their distribution and the dynamics of changes in different regions of the country are insignificant. Since there are significant differences between the administrative districts of SKR, reaching 3–4 times in the mortality rate from cardiovascular diseases, and 4.5 times in the level of primary morbidity, the need for such studies is high. There are also no studies assessing the factors influencing the formation of CSDs.

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At present, a limited number of integrated works have been carried out, aiming to assess the epidemiological situation of various types of CSD on a regional scale, and therefore, many questions remain unclear about the nature and trends of its changes in rural entities that differ in their level of socioeconomic development, the demographic structure of the population, and the resource potential of health systems.[5,6]

Since 1992, a number of major projects have been implemented in Kazakhstan, including those aimed to reduce the morbidity and mortality of CSD. In particular, the program for improving the organization of medical care for patients with vascular diseases was implemented, and all regions of the Republic of Kazakhstan joined by 2010. However, according to a few studies, the effectiveness of activities carried out in different regions of the country is significantly different. Thereby, an important task is to assess the effectiveness of the implementation of measures to strengthen the resources of local cardiological services and increase the availability of specialized care for the population.[7,8]

The need for a study is aimed to assess the epidemiological situation of the CSD and the resource potential of cardiological services at the regional and district levels, and the development of measures to improve the organization of specialized assistance in the SKR is due to the high relevance of this issue and the limited scientific information available in this area.[9]

Aim

The aim of this study is to enhance the organization and cardiac care management of the population by studying the condition of resource provision of cardiological services.

MATERIALS AND METHODS

The impact of regional vascular centers (RVC) and primary vascular departments (PVD) on the change in mortality from ischemic heart disease (IHD) and CVD in the cities of their deployment and regional administrative entities within their areas of responsibility was assessed. The comparison was done between the indicators of 2015 (before the implementation of the Program to improve medical care for patients with vascular diseases) and 2017 (2 years after the start of the program).

Using the method of phased allocation of district formations on the basis of a typology of mortality rates and staffing, district medical organizations were identified that need to strengthen the cardiological service foremost.[10,11]

RESULTS AND DISCUSSION

During 2010–2017, the provision of the SKR population with cardiologists remained stable - 0.6 per 10,000 people, the proportion of these high category specialists increased from 39.0 to 46.0%, and the provision of a specialized bed foundation decreased from 5.1 to 4.6 per 10,000 people. The resource distribution of the regional cardiological service is uneven: There are no cardiologists in 10% of the regions, and there are hospital beds of this profile in 35%.[8]

In areas of the region where no cardiologists, doctors of the highest qualification category among the medical personnel of the local health-care systems and, in the structure of hospital beds with no cardiological beds, the levels of general and primary morbidity of IHD and CVD were statistically lower, and overall mortality and working age mortality are statistically significantly higher [Table 1].

The results of a multivariate analysis showed that the impact on the overall mortality rate in the regional administrative entities of the region from IHD and CVD is 37% and 56%, respectively, for the resources of the cardiological services; local health care resources - 21% and 19%; socioeconomic development of the territory - 30% and 15%; and the age structure of the population - 12% and 10%, respectively. The results of the study with the same methodology, as applied to the overall morbidity of IHD and CVD, were as follows: The contribution of resources of the cardiological service was 44% and 53%; local health resources - 24% and 22%; socioeconomic development - 14% and 15%; and the age structure of the population - 18% and 10%, respectively. Thus, the level of "cardiological" health of the population of regional administrative entities of the region is influenced by a complex set of factors, among which the resource potential of specialized services is of the greatest importance.

The potential effectiveness of various management scenarios was assessed using developed multifactorial mathematical models. It has been established that the greatest effect can be achieved with the strengthening of all the resources of the local cardiological services as a whole. With the availability of cardiologists up to 0.2 per 10,000, specialized beds to 2.0 per 10,000, an increase in the proportion of highest category doctors up to 50% can be expected to reduce the group of territories with a high mortality rate from IHD by 31%, and from CVD by 31% and with cardiology provision up to 0.3 per 10,000, with specialized beds up to 5.0 per 10,000, an increase in the proportion of the highest category doctors up to 70% - by 74% and 46% respectively [Table 2].

Table 1: The morbidity and mortality of coronary heart disease, cerebrovascular diseases in the regional administrative entities of the region, depending on the availability of cardiologists, these specialists of the highest category, and specialized hospital beds, 2017

Regional administrative units	Overall morbidity		Primary morbidity		Overall mortality		Elderly age mortality	
	IHD	CVD	IHD	CVD	IHD	CVD	IHD	CVD
Cardiologists								
No	27.8*	30.7*	4.6*	7.0*	4.1*	0.5*	0.92*	0.49
Yes	31.4	41.0	5.4	7.5	3.4	2.6	0.78	0.46
High category cardiologist								
No	28.6*	32.6*	4.7*	7.0*	3.9*	3.4*	0.90*	0.49
Yes	32.0	45.0	5.0	8.1	3.4	2.9	0.71	0.40
Cardiologic bed								
No	28.4*	32.0*	4.8*	7.1*	0.96*	0.5*	0.90*	0.47
Yes	31.7	42.8	5.2	7.5	3.39	1.8	0.75	0.45

*Statistically significant differences ($P<0.05$). IHD: Ischemic heart disease, CVD: Cerebrovascular diseases

Table 2: Different level effectiveness to strengthen the resources of the cardiological services of the regional administrative entities

Levels to strengthen the resources of the cardiological services	Reduction of the group territories with a high mortality rate from various types of CSD (%)	
	IHD	CVD
Provision by cardiologists up to 0.2 per 10,000, with specialized beds up to 2.0 per 10,000, an increase in the proportion of physicians with the highest category up to 50%	31	31
Provision by cardiologists up to 0.3 per 10,000, with specialized beds up to 5.0 per 10,000, an increase in the proportion of physicians with the highest category up to 70%	74	46

IHD: Ischemic heart disease, CVD: Cerebrovascular disease, CSD: Circulatory system disease

Studies have been conducted on the effectiveness of measures implemented in 2015–2017 in the regional administrative units of the region under the state program "improving the organization of medical care for patients with vascular diseases" to verify the results objectivity of mathematical modeling. A cardiology center (RCC) is located in Shymkent city, and four district primary cardiology departments (PCD) are located on the basis of medical institutions in the cities of Turkestan, Saryagash, Maktaral, and Lenger. The population of district administrative entities assigned to the RCC was 373.5 thousand people or 4.8% of all adult residents of the region, PCD№1 (Turkestan city) - 341.3 thousand people (9.5%), for PCD№2 (Maktaral city) - 138.4 thousand people (3.8%), for PCD№3 (Saryagash city) - 236.6 thousand people (6.6%), and for PCD№4 (g Lenger) - 180.0 thousand people (5.0%). In general, the total population of the region, assigned to the RCC and PCD, amounted to 2969.8 thousand people or 100% of the total adult population. It was found that the activity of the cardiological centers led to an increase in regional administrative entities belonging to their area of responsibility, the detection of acute coronary syndrome (ACS) cases, and acute myocardial infarction (AMI), including the ST-segment elevation in electrocardiogram and, in most acute cerebral circulation disorders (ACCDs), as well as to reduce the mortality rate of such patients [Table 3].

In the period of 2014–2017, the overall mortality rate of the region's population from the CVD decreased by 15.9% (from 3.41 to 2.87 per 1000 people) and from IHD increased by 12.3% (from 3.18 to 3.57 per 1000 people). Thus, despite the coverage of program to improve the organization of medical care for patients with vascular diseases, only one-third of the adult population of the region, in the region as a whole, mortality from CVD was reduced, but the increasing trend in mortality from IHD persisted. The same processes took place in the Republic of Kazakhstan: For 2015–2017, mortality from IHD has decreased only by 1.2% and from CVD by 8.0%.

It was necessary to determine the priority RAE, where it is necessary to create new vascular departments in the first place. The selection criteria were indicators from IHD and CVD, availability of cardiologists per 1000 people.

According to the results of the typologization, the most unfavorable situation regarding mortality from IHD was observed in four RAEs including the areas of responsibility PCD №1-4 [Table 4].

Thus, a group of 8 district administrations were identified, where the creation of a PCD is a priority.

Table 3: The performance of the cardiology department and centers in the RAE of the region, 2015-2017

Region territory	Detection of cardiovascular diseases (per 100,000 people)			Mortality from cardiovascular diseases (per 100 patients)		
	ACS	STEMI	ACCD	ACS	STEMI	ACCD
Responsibility area of the vascular centers and the departments	581.8	148.2*	597.4*	9.5	20.8	21.5
The rest of the region's territory	571.9	132.4	554.7	10.2	22.6	23.8

*Statistically significant differences (*P*<0.05). RAE: Regional administrative entities, STEMI: ST segment elevationin electrocardiogram, ACCD: Acute cerebral circulation disorder, ACS: Acute coronary syndrome

Table 4: District entities with the most unfavorable situation according to the typology results of mortality from IHD, CVD (per 1000 people), the availability level of cardiologists, and cardiology centers, 2017

Cardiology department or center	District administrative entities	IHD* 2017	The availability of cardiologists per 10,000 people (2017)
Cardiology department	Shardara	6.33	0.09
Cardiology department	Tulkubas	3.23	0.32
Cardiology department	Maktaral	5.93	0.16
Cardiology center	Sary-Agash	2.69	0.38
Cardiology department	Baidibek	5.55	0.11
Cardiology department	Tolebi	3.79	0.30
Cardiology center	Turkestan	2.67	0.39
Cardiology department	Kazygurt	4.75	0.24
Cardiology department	Kentau city	2.42	0.44
Regional cardiology center	Shymkent city	0.73	1.24
Cardiology department	Shymkent city	1.04	0.94

*typological groups: Mortality from IHD and CVD per 1000 people:
more than 5.0   from 3.0 to 5.0   up to 3.0

IHD: Ischemic heart disease, CVD: Cerebrovascular disease

Regional research results and materials of the Ministry of Health RK indicate a lower effectiveness of the measures taken to reduce mortality from cardiovascular diseases than from CVD. According to the study, the reasons are (1) insufficient quality of specialized medical care provided to patients with ACS and MI; (2) lack of equipment and personnel qualifications of the medical obstetric point (MOP), general medical practices, and emergency teams; (3) the lack of clear criteria for the treatment choice and algorithms of medical personnel action at each stage of care; (4) violation of continuity in the provision of medical care to patients at different stages; and (5) equipment inconsistency of the medical institutions with the requirements specified in the Procedures for the provision of medical care for CSD.

In conclusion, research results were summarized, and enhancement directions were formulated to patients with vascular diseases in the SKR to provide medical care, as well as prevention of CSD.

CONCLUSIONS

A comparative assessment of morbidity and mortality from CSDs of population of the Republic of Kazakhstan and the economically developed countries of Europe and North America showed a 2-fold excess level of health indicators in our country:

1. In 2010–2017, the provision of the SKR population with cardiologists averaged 0.4 per 10,000 people, the proportion of these high qualification category specialists increased from 39.0 to 46.0%, and the availability of specialized hospital beds decreased by 9.0% (from 5.1 to 4.6 per 10,000 people). There are no cardiologists in 23.7% of district administrative entities, 82.8% of specialists do not have qualification category, and 25.0% do not have cardiological hospital beds.
2. The contribution of the resource potential of the cardiological service in the formation of the overall morbidity of IHD is 44%, the mortality from this cause is 37%, the total morbidity of CVD is 53%, and the mortality from them is 56%.[12-14]
3. Analysis of management scenarios based on mathematical modeling revealed the possibility of reducing mortality from IHD to 74% and from the CVD to 46% of district administrative entities with an increase of cardiologists availability to 0.3 units, specialized hospital beds to 5.0 units per 10,000 people, and the proportion of high qualification category cardiologists is up to 70%.
4. Effectiveness analysis of the organization in the five vascular centers providing cardiological care in 13 regional administrative entities indicates an increase in the detection of ACS, AMI, and acute cerebral circulation disorders, as well as a decrease in mortality from these diseases in comparison with other regions.[15-17]

5. Method of phased allocation of target groups on the basis of a typology of mortality rates and staffing was developed and implemented. The application of the methodology allowed to identify 4 of 11 RAEs that have the highest mortality rates for IHD and CVD, which is the scientific rationale for expanding the network of vascular centers.[18,19]

6. The correction necessity of the program is to improve the medical care organization for patients with vascular diseases in the region is justified. Its main directions should be: (1) The network expansion of vascular centers with an emphasis on the prevention and treatment of CVD; (2) strengthening the personnel and logistic resources of the cardiological service in the responsibilityarea of all PVD and RVC; (3) strengthening the compliance monitoring of the medical care standards for patients with vascular diseases; (4) advanced qualification training in cardiology for medical personnel of emergency medical crews, rural medical ambulance stations, and large settlement outpatient organizations of the region.[20-22]

ACKNOWLEDGMENTS

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