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Scientific substantiation of the assessment of the territorial availability of primary medical health care to the rural population

A.A. Kalininskaya[1,2], N.A. Bayanova[3,4]

[1]N.A. Semashko National Research Institute of Public Health, Moscow, Russia;
[2]Central Research Institute of Health Organization and Informatization, Moscow, Russia;
[3]Orenburg State Medical University, Orenburg, Russia;
[4]Ministry of Health of the Orenburg Region, Orenburg, Russia

Abstract

Aim. To assess the territorial accessibility of primary health care (PHC) to the rural population in the Orenburg region.
Methods. Statistical, monographic, organizational experiment research methods were applied. Statistical processing was carried out by using the Statistica 10.0 software. Basic statistics were calculated (arithmetic mean, weighted arithmetic mean). All parameters were checked by using Shapiro–Wilk, Kolmogorov–Smirnov and Lilliefors tests for normal distribution. The parametric method of statistics (Student's t-test) was used.
Results. The assessment of the territorial accessibility of primary medical health care to the population of the Orenburg region was carried out using the methodology developed by us for calculating the criteria for the accessibility of primary medical health care to the rural population "Rating of medical organizations according to the criterion of territorial accessibility of primary medical care to the rural population". The use the methodology allows making management decisions regarding the territorial planning of primary health care for the rural population in the selection of problem areas with low accessibility of primary medical care. In the Orenburg region, there are the following problems: different levels of accessibility of primary health care with a variety of distance up to 30 km and different population sizes in settlements create difficulties in organizing the provision of primary health care; remoteness from the regional center up to 300 km forms a personnel deficit.
Conclusion. Application of the methodology "Rating of medical organizations according to the criterion of territorial accessibility of primary medical care to the rural population" in the Orenburg region has allowed the development of the following recommendations for making management decisions at the regional level: (1) prioritization of territories for priority measures to ensure the availability help; (2) selection of the form of primary health care organization for the timely medical care provision to the population; (3) the formation of competition among medical organizations in the ranking of the availability of primary health care.
Keywords: primary medical care (PHC), territorial accessibility of PHC, first-aid obstetric point (FAP), medical organization, rating.

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Background. In 2018, 32.3 million people lived in the rural parts of the Russian Federation, which accounted for 25.7% of the entire population. Issues of health, organization, and condition of medical care for rural residents have great social, political, and economic importance. Russian researchers are seriously concerned about the health of the rural population, as their life expectancy is 4 years less, morbidity is 11.2% higher, and mortality is 1.1 ‰ higher than those of the urban population [1, 2].

Sociological surveys have shown that iatric medical organizations are geographically accessible only to 49.4% of the rural residents, hard to reach for 40%, practically inaccessible to 9%, and undecided in 1.6% of the responders. Given the low availability of medical care, rural residents visit a doctor 1.5 times less often than urban

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dwellers and are hospitalized only in case of emergency [1,3,4].

In conditions when it is difficult to reckon on a radical improvement in the socio-economic situation in a rural area, the role of health care as a factor that ensures the survival of the population and improves its health and quality of life intensifies [5,6].

The assignment of doctors by medical organizations in the rural area during the study period (2000–2015) increased from 12.5 to 14.3 per ten thousand of the rural population. The state program "Zemsky Doctor," which has been implemented since 2012, has attracted 19 thousand young doctors to work in rural areas [6]. The health care problem in the rural area is the low availability of medical care for residents of remote rural settlements. Moreover, one of the most significant problems in the village is the low population density and poor transportation and communication.

This study aimed to assess the territorial availability of primary medical care (PMC) to the rural population in the Orenburg region.

Materials and methods. Forms of the Federal State Statistical Surveillance of the Orenburg Region and the Russian Federation No. 12 "Information on the number of diseases registered in patients living in the service area of a medical organization," No. 30 "Information on the activities of a medical organization," No. 47 "Information on the network and activities of medical organizations," as well as analytical data of the Medical Information and Analytical Center of the Orenburg region "Demography of the Orenburg region for 2011–2015," and "Indicators of public health of the Orenburg region for 2011–2015" were used. During the study period, statistical, monographic, and organizational experiment methods were applied.

The statistical analysis was performed using the Statistica 10.0 program. Basic statistical indices were calculated (such as arithmetic mean and weighted arithmetic mean), and to assess whether observations were normally distributed, Shapiro–Wilk, Kolmogorov–Smirnov, and Lilliefors tests were used. The parametric method of statistics (Student's *t*-test) was used.

The study was performed in the period from 2011 to 2015, the results were obtained in 2016, within the framework of the state policy for the development of rural areas, i.e, the Resolution of the Government of the Russian Federation No. 598 dated July 15, 2013 "On sustainable development of rural areas for 2014–2017 for the period up to 2020."

We developed and patented a software product, which was given a certificate of state registration of a program for an electronic computer for intellectual property objects: "Calculation of the indicator of the availability of primary medical care" (No. 2018162752). This software enabled us to assess the issues of the Orenburg region, identify its vulnerabilities, and make proposals for the adoption of organizational solutions.

The study was based on the Orenburg region with a population of 1,990,343 people. The study population was composed of the rural residents of the Orenburg region (which accounted for 40.1% of the region's population), covering 35 rural areas with a total population of 799 thousand people. This study focused on the criteria of the territorial availability of PMC to the rural population.

Results and discussion. PMC for the rural population of the Orenburg region is provided in 35 district hospitals (RH), 11 district hospitals (DH), 154 rural medical outpatient clinics (RMOC), and 954 first-aid obstetric points (FAP). In this region, the restructuring of health care in the rural area included the repurposing of the DH in the departments of the RH, RMOC, and FAP. During the study period (2011–2015), the number of rural settlements in the Orenburg region decreased by 48 units, which amounted to 1036, which in turn led to a decrease in the number of FAPs by 40 units (from 1045 to 1011). The number of DHs decreased by 74 units (from 78 to 11) because of their transformation into RMOC (from 97 to 154) as there was a decrease in the population.

The provision of doctors to the population of the Orenburg region, Volga Federal District, and Russian Federation is presented in Table 1.

In 2016, 40.0 doctors per ten thousand of the population were assigned to the Orenburg, which is higher than that in the Volga Federal District with 36.0 and in the Russian Federation with 37.2. Moreover, the indicated number of PMC doctors was 22.64 per ten thousand populations, which is not significantly higher than that in the Volga Federal District and Russian Federation (22.39 and 21.97, respectively).

In rural areas, 22.6 doctors were provided per ten thousand populations. The indicator in rural areas ranges from 16.8 (Sol-Iletsky) to 33.9 (Sharlynsky) per 10 thousand population. Significant variations in the indicator are associated with different population densities in rural areas and the infrastructure of medical organizations.

The territorial accessibility of the PMC was assessed using the author's methodology for calculating the criteria (Kv) of the accessibility of FAP-provided PMC to the rural population.

Table 2 presents the predictive criteria of the territorial accessibility of PMC in all 35 rural districts of the Orenburg region and the distance of the FAP from the medical organizations to which the

Table 1. Provision of Doctors to the Population of the Orenburg Region, Volga Federal District, and Russian Federation in 2016 according to the Reporting Form of the Ministry of Health of the Russian Federation No. 47 "Information on the Network and Activities of Medical Organizations"

Medical specialties	Number of medical positions per 10 thousand population		
	Orenburg region	Volga Federal District	Russian Federation
Total	40.0	36.0	37.2
Primary care physicians (total)	6.53	4.92	5.07
Pediatricians (total)	15.82	16.43	16.26
GP	0.29	1.04	0.64
Total of PMC doctors	22.64	22.39	21.97

Note: GP — general practitioners; PMC — primary medical care.

FAP is subordinated (RMOC, DH, and RH). The maximum (Rmax) and minimum (Rmin) distances of the FAP from the medical organizations, where the PMC is provided, ranged from 1 to 85 km.

These indicators were different for each rural area. We have calculated the amplitudes of the distances (a) from the FAP to RMOC, DH, and RH (a) for each rural area according to the following equation:

$$a = Rmax–Rmin,$$

where a is the amplitude of the distances from FAP to RMOC, DH, and RH; Rmax is the maximum distance of FAP from RH, DH, and RMOC; and Rmin is the minimum distance of FAP from the RH, DH, and RMOC.

The territorial coefficient of the territorial accessibility of PMC (T_V) was calculated by the following equation:

$$Tv = (Rmax – Rmin) / 100,$$

where Rmax is the maximum distance of the FAP from the RH, DH, and RMOC, and Rmin is the minimum distance of FAP from RH, DH, and RMOC.

The number of FAPs in 35 rural areas of the region ranged from 8 (in Sorochinskiy) to 45 (in Buzuluk) (Table 2).

Indicators of FAP remoteness from the RH, DH, and RMOC ranged from 1 to 85, while the weighted average was 30 km.

The intensive indicator of the territorial availability of PMC (Fv) was calculated using the following equation:

$$Fv = \frac{Dv}{A} \times 100$$

where Fv is an intensive indicator of the territorial availability of PMC, A is the number of FAPs in the estimated area, and Dv is the number of FAPs located at a distance of ≥30 km from the RH, DH, and RMOC.

The criterion of the territorial accessibility of PMC to the rural population living in areas served by the FAP was calculated.

The criterion of the territorial availability of PMC to the rural population living in areas served by the FAP was calculated using the following equation:

$$Kv = Fv \times Tv,$$

where Kv is the criterion of the territorial availability of PMC, Fv is the intensive indicator of the territorial availability of PMC, and Tv is the territorial coefficient of the territorial availability of the PMC.

In the course of the study, rural areas of the Orenburg region were ranked according to the criteria of the territorial accessibility of PMC (Kv) to the rural population living in areas served by FAPs (Fig. 1).

Based on the ranking results, we have determined the values of the estimated indicators of the criterion for the territorial accessibility of PMC to the rural population living in areas served by FAPs (Table 3).

Table 3 reveals the extremely low level of territorial accessibility of PMC in Belyaevsky rural area (Kv = 26.56), low level in Svetlinsky rural area (Kv = 22.5), level below the average in Kvarkensky rural area (Kv = 17.55), and average level in rural areas of Abdulinsky (Kv = 11.32), Akbulaksky (Kv = 12.57), and Gaysky (Kv = 12.43).

The level of territorial accessibility of PMC above the average level (Kv from 10 to 14) was noted in 34.3% of the rural areas (12 districts), high level (Kv to 4) in 37.1% (13 districts), and maximum level (Kv = 0) in 11.4% (four districts).

Based on the assessment criteria of the territorial availability of PMC to the rural population, a rating of medical organizations providing PMC was compiled, which was used to plan organizational measures to increase the availability of medical care to rural residents, primarily for individual settlements with a low level of territorial availability of PMC.

Table 2. Criteria of the Territorial Accessibility of PMC to the Rural Population Covered by FAP in the Districts of the Orenburg region

Rural areas	Number of FAPs	Maximum distance from the RH, DH, and RMOC			Minimum distance from the RH, DH, and RMOC			Intensive indicator of FAP distance from the RH, DH, and RMOC	Coefficient of the distance amplitude territory of the FAP to RH, DH, and RMOC	Criterion of PMC accessibility
		km	Number of FAP		km	Number of FAP				
			Rmax	≥30 km		Rmin	up to 30 km			
	A	Rmax		Dv	Rmin			Fv	Tv	Kv
Abdulinsky	38	48	2	10	5	5	28	26.32	0.43	11.32
Adamovsky	23	37	2	2	7	6	21	8.70	0.3	2.61
Akbulaksky	35	60	1	8	5	6	27	22.86	0.55	12.57
Alexandrovsky	37	50	1	6	5	2	31	16.22	0.45	7.30
Asekeevsky	37	45	1	5	4	11	32	13.51	0.41	5.54
Belyaevsky	25	85	1	8	2	3	17	32.00	0.83	26.56
Buguruslansky	41	38	1	3	6	1	38	7.32	0.32	2.34
Buzuluksky	45	40	2	8	4	7	37	17.78	0.36	6.40
Gaisky	28	60	1	6	2	2	22	21.43	0.58	12.43
Grachevsky	27	50	2	5	4	3	22	18.52	0.46	8.52
Dombarovsky	16	50	2	3	8	3	13	18.75	0.42	7.88
Ileksky	15	24	1	0	12	4	4	0.00	0.12	0.00
Kvarkensky	31	71	2	8	3	3	23	25.81	0.68	17.55
Krasnogvardeisky	42	62	1	5	3	6	37	11.90	0.59	7.02
Kuvandyksky	40	45	2	5	5	3	40	12.50	0.4	5.00
Kurmanaevsky	28	31	1	1	2	11	27	3.57	0.29	1.04
Matveevsky	23	42	1	3	4	4	20	13.04	0.38	4.96
Novoorsky	15	30	1	1	5	4	14	6.67	0.25	1.67
Novosergeevsky	44	45	1	6	3	4	38	13.64	0.42	5.73
Oktyabrsky	30	45	1	3	3	3	27	10.00	0.42	4.20
Orenburgsky	29	36	1	1	4	9	28	3.45	0.32	1.10
Pervomaisky	41	32	1	1	4	8	40	2.44	0.28	0.68
Perevolotsky	31	31	2	2	3	3	29	6.45	0.28	1.81
Ponomarevsky	19	25	2	0	2	3	19	0.00	0.23	0.00
Sakmarsky	13	20	2	0	2	4	13	0.00	0.18	0.00
Saraktashsky	42	45	1	5	3	7	37	11.90	0.42	5.00
Svetlinsky	8	57	2	4	12	2	4	50.00	0.45	22.50
Severny	36	55	1	4	1	4	32	11.11	0.54	6.00
Sol-Iletsky	32	55	1	4	5	2	28	12.50	0.5	6.25
Sorochinsky	27	20	3	0	2	3	27	0.00	0.18	0.00
Tashlinsky	37	49	1	3	3	5	34	8.11	0.46	3.73
Totsky	33	38	2	3	1	4	30	9.09	0.37	3.36
Tyulgansky	23	45	1	4	3	3	19	17.39	0.42	7.30
Sharlyksky	34	37	3	6	3	2	28	17.65	0.34	6.00
Yasnensky	11	36	2	3	5	2	8	27.27	0.31	8.45
Total	1036	44	52	136	4	152	894	13.13	0.40	5.23↑

Note: PMC — primary medical care; FAP — first-aid obstetric point; RMOC — rural medical outpatient clinic; DH — district hospital; RH — regional hospital.

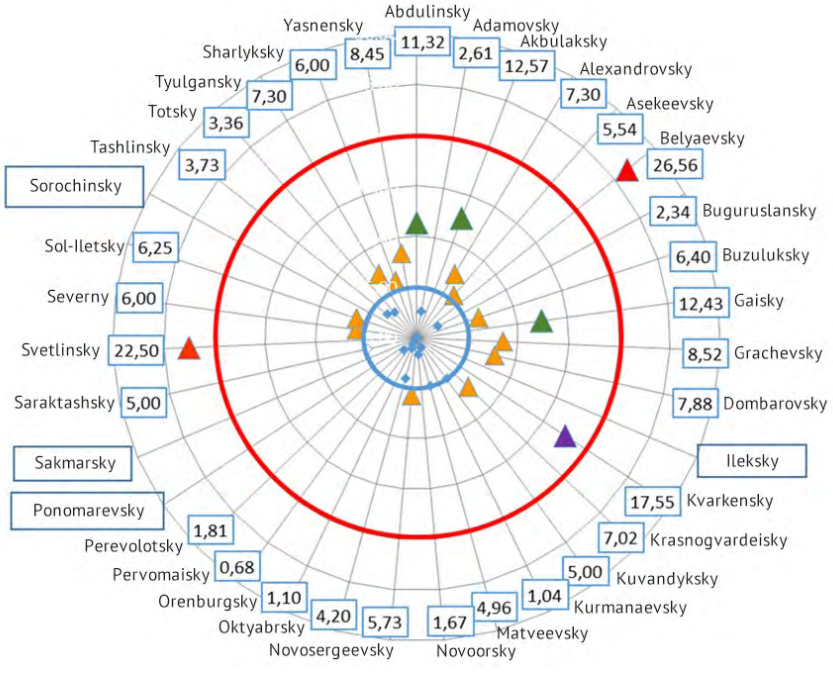

Fig. 1. Ranking of rural areas of the Orenburg region according to the criteria of the availability of primary medical care (Kv) to the rural population living in the territory covered by FAP

Table 3. Estimated Indicators of the Territorial Accessibility Level of Primary Medical Health Care to the Rural Population Living in Areas Served by First-Aid Obstetric Points in the Districts of the Orenburg region

Level	Value of the assessment indicator	Number of rural areas
Extremely low	≥25	1
Low	20–24	1
Below average	15–19	1
Average	10–14	3
Above average	5–9	12
High	up to 4	13
Maximum	0	4

With our patented technique, we assessed the provision of medical care to the rural population of the Orenburg region, which enabled us to identify the following problem points:

1) Territories with a low level of PMC availability.

2) Defects in the PMC organization.

3) Passiveness of health care management methods.

Knowledge of these issues prompted us to propose to the administration of the Orenburg region to give the following recommendations when planning PMC in the region:

1) Prioritization of territories for priority measures to ensure PMC availability.

2) Selection of the forms of PMC organization for timely provision of medical care to the population.

3) Formation of competition among medical organizations in the rating of PMC availability.

Conclusion. The methodology "Calculation of the indicator of availability of primary medical health care," which we developed and patented, enabled us to make managerial decisions in terms of territorial planning of PMC for the rural population and in choosing problem areas with low PMC availability in the Orenburg region. The positive results of the testing can be used as basis for proposals for the implementation of the methodology in other regions of the Russian Federation.

CONCLUSIONS

1. Based on the evaluation criteria of the territorial availability of PMC to the rural population established on the ranking of district hospitals in rural areas, we have compiled a rating of DH subordinate to the Ministry of Health of the Orenburg region, which can be used by the Ministry of Health of the Orenburg region for operational management of PMC in rural areas.

2. In accordance with our methodology, we ranked rural areas according to the criteria of the accessibility (Kd) of PMC and revealed that territorial accessibility is above the average level (Kv from 10 to 14) in 12 rural areas, high (Kv up to 4) in 13, and maximum (Kv = 0) in four districts.

3. We recommend the use of our methodology in assessing the level of accessibility of PMC when planning medical care provided by the Ministry of Health of the Orenburg region.

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Conflict of interest. The authors declare no conflict of interest.

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