

The search for the criteria in reforming health care: evaluation of the spatial accessibility of primary healthcare service

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Summary. This article analyzes the spatial accessibility of primary healthcare services, i.e. the population's possibilities to receive healthcare services within an acceptable period of time in healthcare institutions situated in a certain territorial-administrative unit – the municipality. The aim of the study was to develop the technique for the quantitative evaluation of the spatial accessibility of primary healthcare services in different territories. The object of the study was the network of primary healthcare institutions and their subdivisions in the municipalities of Klaipėda, Tauragė, and Vilnius districts.

The methods of the study were geometrical modeling and applied graphics used for the quantitative determination of the ratios between the total zone area of the accessible primary healthcare institutions and the area of the respective municipal territory.

The result of the study was the developed and proposed technique allowing for the evaluation of the spatial accessibility of primary healthcare institutions. The proposed technique of the evaluation of the spatial accessibility of primary healthcare services may be valuable in solving the problems of the development of primary healthcare institutions primarily in the rural regions of Lithuania. The quantitative expression of the evaluation could be used in decision-making related to investments into the development of the primary healthcare institution network in different administrative units of the country. The method of geometrical modeling involving the application of digital graphics may create preconditions for the creation of the geographical information system of the primary healthcare institution network in Lithuania.

Introduction

The society's evaluation of healthcare policy decisions is frequently controversial. Such contradictory approach is conditioned by the state governing institutions' aspiration to improve healthcare in the country coupled with the necessity to save and to invest rationally into healthcare.

The population expects from the healthcare system that is largely state-owned to receive better service accessibility in the economical and the organizational-spatial sense and follows the solidarity principle when paying for the provided services. However, expectations related to the improvement of healthcare are continuously rising, and the lack of resources forces the policy-makers to limit investments into the development of healthcare. Such situation frequently re-

sults in tension between the society and the governing structures that regulate healthcare.

One of the ways to decrease the tension frequently arising from the population's incredulity or dissatisfaction with the decisions of the health policy-makers is the selection of understandable, public, and transparent criteria for decisions. Evidence-based criteria that comply with the principles of fairness and prudence would allow for the expectation of the population's greater understanding and supporting for the state regulatory sector in solving relevant healthcare problems.

Methods of the study

According to the population census, in 2001 67% of the state population lived in 106 cities of the country. The rest of the population (over 1.15 million) lived

in 21 600 rural areas. The majority of these areas were small villages (up to 30 inhabitants). The mean population density in the state territory of 65 300 km² amounted to 52.4 inhabitants per 1 km²; in district municipalities, the population density ranged between 14 inhabitants per 1 km² to the mean population density in the country, and only in some municipalities (Kaunas and Jonava districts), the population density exceeded the mean population density of Lithuania.

Despite relatively small areas of some districts, timely access of the population to healthcare institutions is hampered by limited possibilities of the public transport of the district. The inhabitants of the majority of villages can only once a day access the district center via public transport, most frequently – early in the morning. This results in long lines at the consulting-rooms of district hospitals, polyclinics, or primary healthcare centers which, in turn, decreases the quality of services due to time deficit, since patients who have arrived from villages are forced to use the only possibility to come back home on the same day by public transport.

Such situation could be amended by renewing, enlarging, and decentralizing the network of the primary healthcare establishments and subdivisions (dispensaries, medical stations, and general practitioners' offices) in the rural areas of Lithuania, which is already quite well developed. However, a significant part of such institutions are located in old buildings that require marked investments for the improvement of the condition of these buildings, the energy-saving means and measures, the improvement of hygiene and working conditions, etc.

A number of various criteria may be used in the decision-making related to the investments into the development of the healthcare institution network in municipalities; one of such criteria may be the evaluation of the spatial accessibility of healthcare services.

Spatial accessibility of healthcare institutions has been analyzed by a number of researchers. Some of them evaluated spatial accessibility according to the provider-to-population ratio in a certain territory and the time needed to reach the nearest healthcare institution (1). There are gravitational healthcare accessibility models, in which a combination of a variety of factors is used in the assessment, including distances, the density of healthcare institution in the area, the amount of population served, etc. (2).

In order to estimate the accessibility of primary healthcare institutions in municipalities, we have selected and proposed to use the ratio between the area of the zones located within the radius of 3 km from healthcare institutions and the area of the municipality in which those institutions are located.

The selected methods of our new assessment model were geometric modeling and applied graphics used to present information on the distribution of healthcare institutions in municipalities in the geometrical form. The application of our models allows tackling the problem of priority in planning the investments for the development of the primary healthcare units in different regions of the country.

The basis of this technique is that each subdivision having its own address was assigned zones whose radius was 3 km, and we calculated to which ratio these zones cover the territory of the municipality. We chose the radius of 3 km from the center of the territory of each institution or its subdivision because within this distance the lack of public or personal transport does not have any essential influence. When calculating the total area covered by zones of healthcare institutions and their subdivisions, the zones that exceeded the borders of the district were considered to be half-zones, *i.e.* covering, on the average, the area of 14.13 km². Only one of some overlapping zones was also considered a whole zone of good accessibility.

The area of the municipal territory was calculated by graphically dividing the geographical map into squares of 25 km² according to the scale (each side of the square being 5 km). Incomplete squares were considered to be half-squares. The total area of municipal territories was calculated by summing up the areas of the squares (both complete and half-squares). Thus, the difference between the areas calculated using this method and those presented by the Department of Statistics of the Republic of Lithuania did not exceed 2.8%.

The ratio (*r*) between the spatial accessibility zones of primary healthcare institutions and the total area of the territories was calculated according to the following our original formula:

$$r (\%) = (\text{Area covered by zones, 3 km in radius, km}^2) / (\text{Area of municipal territory, km}^2) \times 100$$

Results and discussion

During the period of 2004–2005, we investigated the density of the primary healthcare institution network in certain districts of Lithuania. The effectiveness of the primary healthcare institution network in Klaipėda, Tauragė, and Vilnius districts in the aspect of spatial accessibility was investigated using the selected geometrical modeling technique.

The graphical representation of the coverage of the Klaipėda municipal territory by the accessibility zones of primary healthcare institutions and their subdivisions is given in Fig. 1; the ratios (*r*) between the

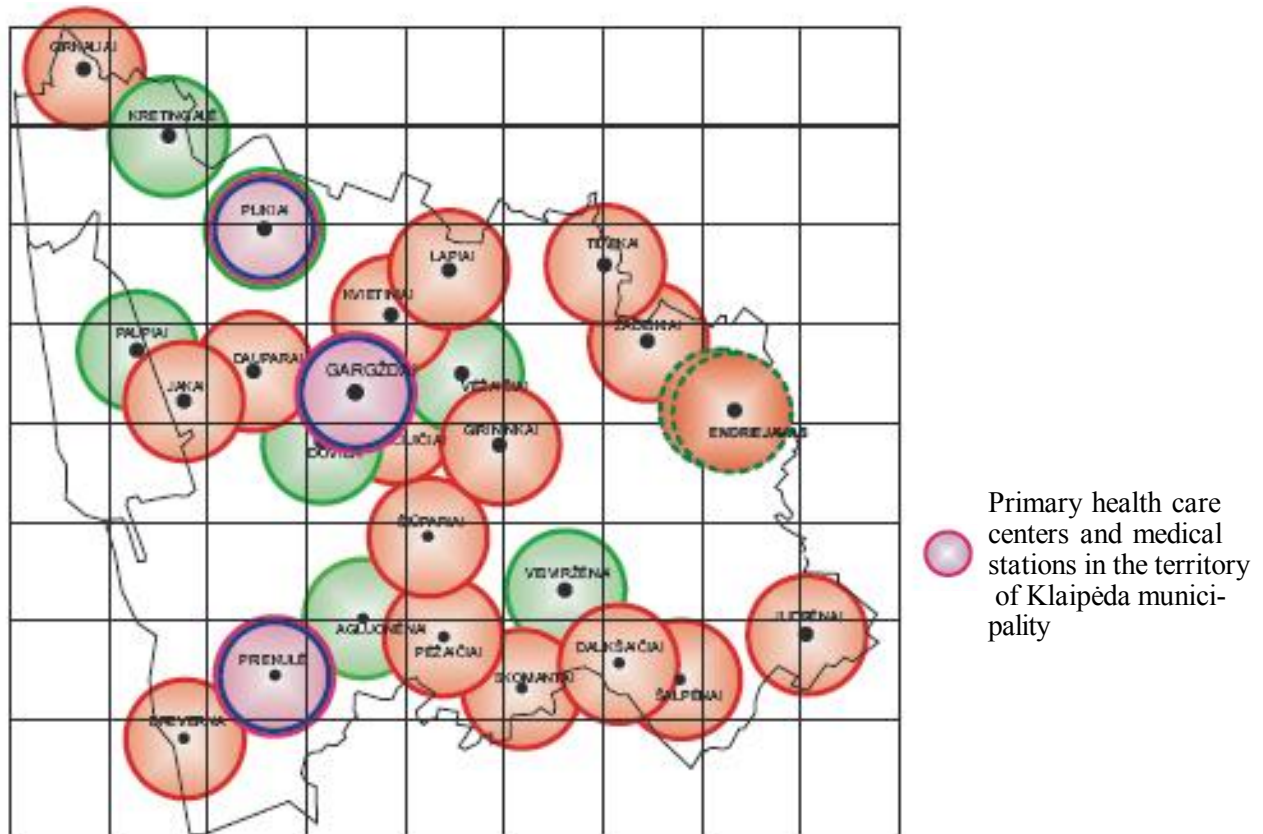


Fig. 1. The coverage of Klaipėda municipal territory by the good accessibility zones of primary health care institutions and their subdivisions

Table. The ratio (r) between the area of the spatial accessibility zones of primary healthcare institutions and the total area of Klaipėda, Tauragė, and Vilnius regional municipality

Municipality	Spatial accessibility of primary healthcare institutions, r (%)
Klaipėda region	53.00
Tauragė region	35.80
Vilnius region	36.00

good spatial accessibility zones of primary healthcare institutions and the total area of the Klaipėda, Tauragė, and Vilnius district territories are given in Table.

Analogous investigations in Tauragė and Vilnius municipalities revealed the results of spatial availability of the primary healthcare institutions in these territories (Table).

During the decision-making related to the financing of the development of institution networks, the priority would be given to Tauragė and Vilnius regions, because the spatial accessibility in these municipalities is low in comparison with Klaipėda region.

In cases when the value of the parameter (r) in several districts is similar, additional conditions should

be taken into consideration; the quantitative expressions of these conditions should be considered adjustment coefficients.

Such additional conditions would be the following:

- The level of the development of emergency medical service (EMS) in the district;
- The population's composition with respect to age.

When evaluating the development of EMS in municipalities on three levels (parameters: the number of vehicles, the number of medical stations, maximal distances, etc.), the coefficient k_{EMS} corresponding to each level would be 1 (the first level of development), 0.9 (the second level of development), and 0.8 (the third level of development), respectively.

In the evaluation of the demographic situation in municipalities on three levels, where municipalities with the youngest population would belong to the first level, the adjustment coefficient k_{dem} for the first level would be 1, for the second level – 0.9, and for the third level – 0.8.

When making decisions about the development of primary healthcare institutions in municipal territories, we suggest to use the investment limitation indicator I_{lim} , which would be calculated according to the following our original formula:

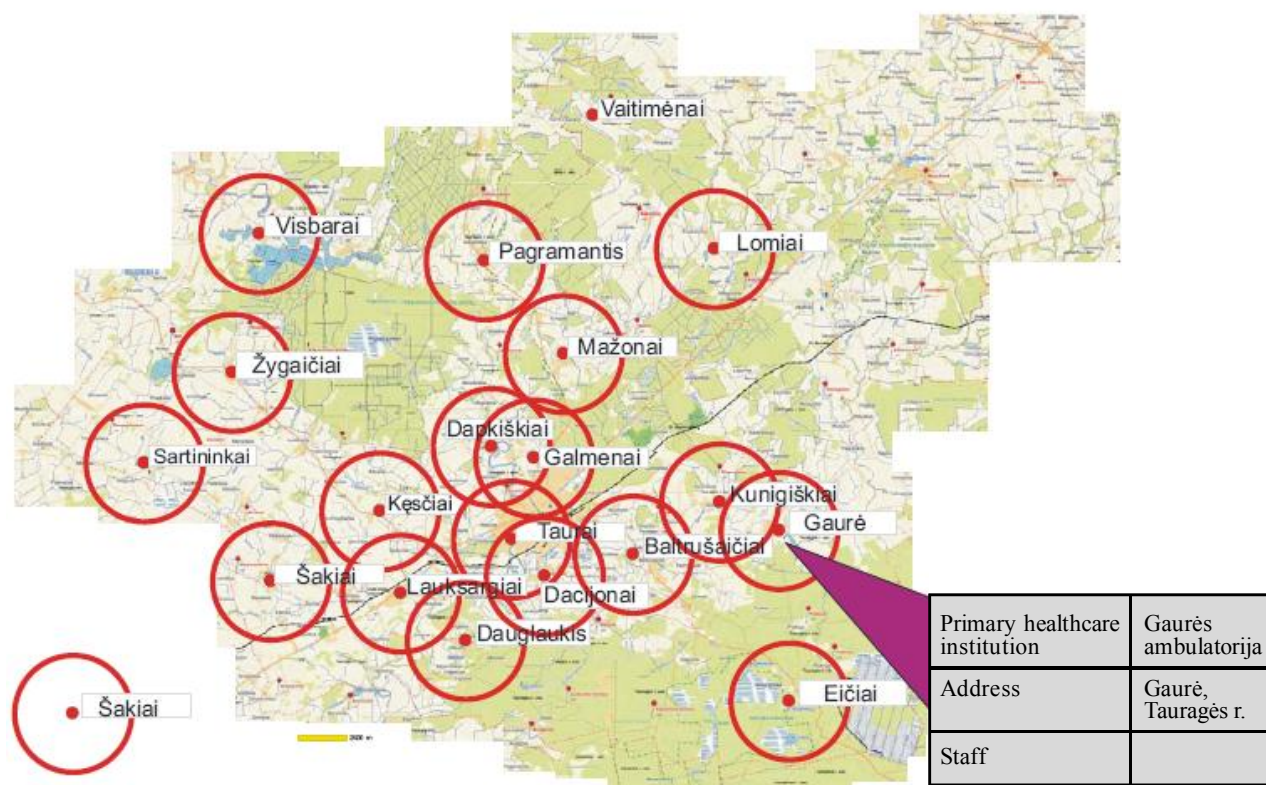


Fig. 2. The geographic info system of primary healthcare institutions in Tauragė municipality

$$I_{lim} = r \times k_{EMS} \times k_{dem}$$

The greater the value of I_{lim} , the greater the limitations to the investments for the development should be applied in case the decisions are based on the proposed spatial accessibility evaluation technique.

Using digital graphics, this method of modeling would be closely related to the globally known geographical public health information system – geographical information sciences and public health mapping (3, 4) – and may create preconditions for the creation of the geographical information system of the Lithuanian primary healthcare network, created on the basis of the applied graphics info model (Fig. 2).

Conclusions

1. Geometric modeling allows the quantitative evaluation of spatial accessibility of services provided by primary healthcare institutions in municipalities.
2. The quantitative expression of the evaluation of the spatial accessibility of services provided by primary healthcare institutions may be used in the calculation of the investment-planning index.

When evaluating the spatial accessibility of services provided by primary healthcare institutions in municipalities, involving the application of digital graphics, geometric modeling creates the preconditions for the creation of the geographical information system of Lithuanian healthcare.

Sprendimų reformuoti sveikatos apsaugą paieška: Pirminės sveikatos priežiūros paslaugų teritorinio prieinamumo įvertinimas

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Raktažodžiai: pirminės sveikatos priežiūros įstaigos, teritorinis prieinamumas, geografinės informacinės sistemos.

Santrauka. Šiame straipsnyje nagrinėjamas pirminės sveikatos priežiūros paslaugų teritorinis prieinamumas – gyventojų galimybė gauti sveikatos priežiūros paslaugas įstaigose, kurios išdėstytos tam tikrame teritoriniame

administraciniame vienetė, t. y. savivaldybėje. Tyrimo tikslas. Parengti sveikatos priežiūros paslaugų teritorinio prieinamumo atskirose teritorijose kiekybinio vertinimo metodiką. Tyrimo objektas – Klaipėdos, Tauragės ir Vilniaus rajonų savivaldybių pirminės sveikatos priežiūros įstaigos ir jų padaliniai. Tyrimo metodai – geometrinis modeliavimas ir taikomoji grafika, kuriais nustatomas prieinamų sveikatos priežiūros įstaigų zonų bendrojo ploto ir atitinkamos savivaldybės teritorijos ploto santykis. Parengta ir rekomenduojama metodika, kurią naudojant galima įvertinti pirminės sveikatos priežiūros įstaigų teritorinį prieinamumą gyventojams. Sveikatos priežiūros paslaugų teritorinio prieinamumo vertinimo metodika gali būti vertinga sprendžiant sveikatos priežiūros įstaigų plėtros klausimus, pirmiausia – Lietuvos kaimuose. Geometrinio modeliavimo būdas, panaudojant skaitmeninę grafiką, gali sudaryti prielaidas sukurti Lietuvos pirminės sveikatos priežiūros tinklo geografinę informacinę sistemą.

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