

# Regional comparative analysis of the health infrastructure and the school network in the rural areas of Bulgaria

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## Abstract

The results of the research in the field of health infrastructure and school network are presented, which are one of the priority areas of the National Strategy for Regional Development (2012–2020). Their condition is analyzed on the basis of selected indicators – doctors, hospital beds, teachers and schools. The method of the Regional Factor Shift Analysis (RFSA) is applied, through which the degree and direction of changes in the health and educational infrastructure in the rural areas of Bulgaria in the period 2008–2020 is traced. Based on the analysis, summarized conclusions are presented and trends.

**Key words:** rural municipalities; urban municipalities; health infrastructure; school network

## Introduction

The paramount place and importance of education and health in social infrastructure, both nationally and regionally, is determined by their role as an essential factor for economic growth, social prosperity and harmonious regional development. Their development is extremely important for the quality of life in rural areas. The established health infrastructure and school network the number of doctors and teachers in the rural municipalities are a basic factor for providing health and educational services to the population in the cities and villages.

Healthcare and education as key sectors in social infrastructure are one of the priority areas of the National Strategy for Regional Development (2012–2022). They are of particular importance for the socio-economic development of rural areas in the country. This is because education has a key role to play in the development of human resources, as the level of completed education is a necessary condition

for employment, higher incomes, better quality and standard of living, and, in territorial terms, to reduce the risk of poverty and social exclusion. And the main task of health care is to improve the health status of the population by providing quality services in providing health care in all regions of the country.

The study was performed according to the methodology of Dunn (1960), Ashby (1970), Herzog and Olsen (1977) and Ivanov (2020), adapted for the needs of the present research. On the topic related to infrastructures in Bulgaria (including rural areas), their condition and potential have been worked on by authors such Marinov, 2017; Kazakov, 2016; Dimitrov, 2015; Simeonov, 2017 and others.

The object of this study are the rural municipalities in Bulgaria, and the main goal is to analyze the state of the health infrastructure and school network of the municipalities and to outline the changes that have occurred in the period 2008–2020.

## Research methods and sources of information

For the selected spatial analysis, key indicators (number of doctors, number of hospital beds, number of teachers and number of schools) have been selected, characterizing the health infrastructure and school network. The survey uses officially published NSI data from the last census of 2011, data from current demographic statistics. To achieve this goal, the regional factor shift analysis (RFSA) was applied in order to reveal the regional differences and peculiarities in the health infrastructure and school network in the rural areas of Bulgaria in the period 2008–2020.

Traditional regional factor shift analysis (RFSA) was developed by Dunn (1960), Ashby (1970) and later applied by Herzog and Olsen (1977). The regional analysis offers an opportunity to see in what direction and to what extent a certain sector and economic characteristic have changed, taking into account the influence of two types of factors. In the present study, this regional analysis was performed in 2 stages:

$$RS = \frac{LocalVar^{t-1} - LocalVar^{t-1} * NS^{t-1} / NS^{t-1} * (FL^t - FL^{t-1}) * (FL^t + FL^{t-1})}{(FL^t - FL^{t-1}) * (FL^t + FL^{t-1})} \quad (1)$$

$$RSDEV = \frac{(RSDEVIM - RSDEVAVER)}{(RSDEVAVER)} \quad (2)$$

where the variables involved are:

- Localvar – the four indicators of health infrastructure and school network for the period 2008–2020 are calculated separately;
- NS – the national 4th indicators of health infrastructure and school network;
- FL – factor loop stood for GVA at municipal level;
- RSDEVIM – the regional shift deviation of RS from the average;
- RSDEVAVER – average regional deviation of the whole set of municipalities.

Formulas (1 and 2) calculate the regional changes, which classify the municipalities separately on the basis of 4 indicators of the health infrastructure and school network. The calculations with formula (2) yield values of the coefficient RS, which are below 0 and exceed 1 and theo-

retically have no defined limits, which depend on the observed differences between the individual municipalities, on the selected indicators and the measured average values. That is why normalization is made by Ivanov (2020). Normalization is performed as:

$$RSCoefn = 1 - (RSDEV - RSDEVMIN) / (RSDEVMAX - RSDEVMIN) \quad (3)$$

If the RS coefficient is negative from 0 and if it exceeds 1 it is normalized to 0 and 1. Regional changes in health infrastructure and school network are calculated using the RS coefficient for each indicator in the analysis, both at municipal and district and national level. 2008 is used as the base year and 2020 as the final year. With values of the RS coefficient below 0.45 – this indicates a deterioration in the quality and reduction of the volume of health and school services in rural areas compared to the national and district level; between 0.45 and 0.55 – changes in health infrastructure and school network in rural areas reflect trends at district and national level; and over 0.55 – the improvement of the health infrastructure and school network in rural areas exceeds the district and national level.

The maps in the present study were prepared with the ArcMap software (ArcGIS ESRI), version 10.5. Static analysis was performed with Excel (MSOffice).

## Health infrastructure in the rural areas of Bulgaria

The condition of the health infrastructure is extremely important, as it depends on the access of the population to health services in the rural areas of the country. The principles for achieving quality health care are enshrined in the National Health Strategy 2020 for equal and fair access to health care, is the population of each region to be maximally covered by health care.

Negative natural growth and migration to large cities and abroad, the aging of the population in rural areas, are factors that determine the type of health services. It is necessary to overcome the regional imbalances and ensure interaction between the different levels of medical care. Measure 6.4 “Investments in support of non-ag-

gricultural activities” of the Rural Development Program (2014–2020) aims to improve access to medical care in rural areas where there is a lack of medical, dental specialists, medical centers.

The number of doctors includes practitioners in medical and health care institutions, regardless of departmental subordination. The security, expressed as the number of doctors per capita, shows the lowest values in the rural areas of the country (Fig. 1).

At the same time, the highest provision of the population with doctors is reported in the urban municipalities – 5.1 doctors per capita, this is due to the concentration of the population in the big cities of the country, where the need for health services is higher.

The change in the number of doctors in the rural municipalities of Bulgaria is calculated for the period 2008–2020 by the coefficient RS, which can take values from 0 to 1.

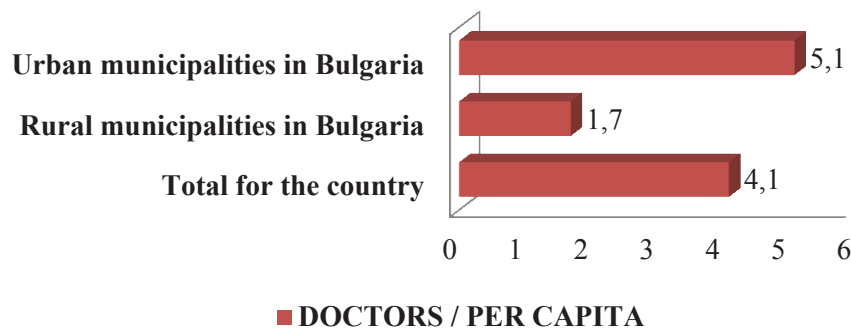


Fig. 1. Provision of the population with doctors per capita in the period 2008–2020

Source: According to NSI data.

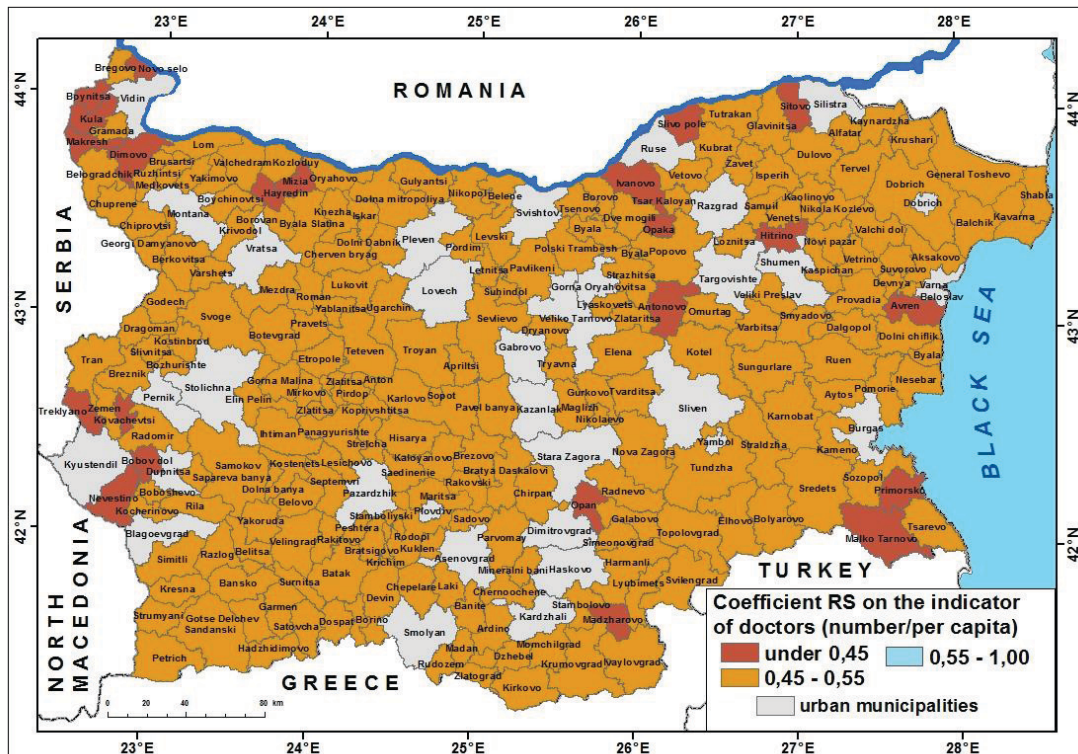


Fig. 2. Coefficient of regional positioning according to the indicator of doctors per capita in the rural areas of Bulgaria, 2008–2020

Source: Author's and according to NSI data.

In Fig. 2 shows that the coefficient RS has the lowest values in 21 rural municipalities such as Ivanovo, Kovachevtsi, Nevestino, Boynitsa, Makresh, Treklyano and others. These are remote and inaccessible rural municipalities, which report poor provision of doctors because they have a small population and a highly dispersed network of settlements.

In the remaining 211 rural municipalities, the values of the RS coefficient are between 0.45–0.55, which means that their provision with doctors coincides with that at the district and national level.

The provision of hospital beds, expressed as the number of hospital beds per capita, is comparatively lowest in the rural areas of Bulgaria (4.1 beds in hospitals / per capita). A significant part of the bed capacity is concentrated in the urban municipalities, because the medical establishments there offer a wider range of medical activities (Fig. 3).

The rural municipalities in Bulgaria are characterized by uneven distribution of hospital beds in medical institutions. The values of the RS coefficient are the lowest in 21 municipalities such as Primorsko, Oryahovo, Maglizh, Novi Pazar, Bobov Dol, Elena, Dryanovo, Lucky and others (Fig. 4). A detailed study of the results shows that the low values of this ratio in some of these municipalities are due to the fact that access to health services is limited due to the closure of hospitals. It turns out that the population in some of the rural municipalities does not have equal access to hospitals. In the remaining 211 municipalities,

the values of the RS coefficient are between 0.45 and 0.55, which means that their provision of hospital beds per capita coincides with that at the district and national level. Although there is no municipal hospital in 129 municipalities, the beds are distributed in several centers that serve areas where there are no hospitals.

### School network in the rural areas of Bulgaria

The development and maintenance of the school network in the rural areas is directly related to the optimization of the network of schools in the structure of education. The low birth rate and the declining number of children subject to schooling are reasons for the systematic closure of dozens of educational institutions. The declining number of people subject to education leads to a decline in the number of students, and hence to teachers and schools. Under the new conditions, dozens and perhaps hundreds of schools are faced with a dilemma: to close under the pressure of economic and market conditions or to maintain their existence mainly to preserve teachers' jobs. The decrease in the number of children in the rural areas of the country is also related to the definition of "protected schools". Sheltered schools are an approach to optimizing the school network. According to Marinov (2017), they continue to exist, despite the small number of students in them, so as not to restrict access to education.

A teacher or lecturer is a profession practiced by people who teach their theoretical knowledge

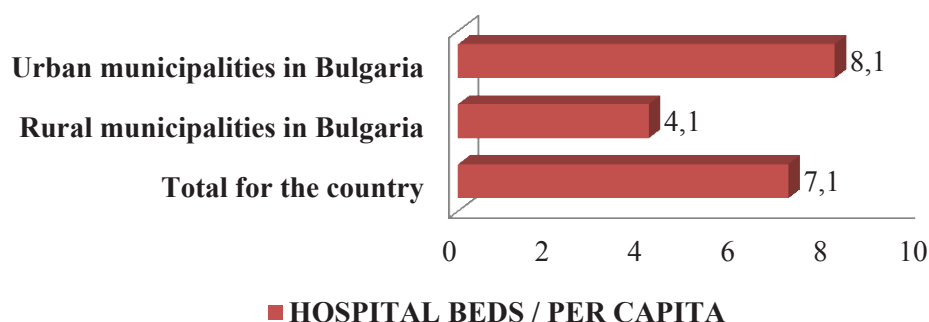


Fig. 3. Provision of the population with hospital beds per capita in the period 2008–2020  
Source: According to NSI data.

and practical skills to students. He works in the field of education. The provision, expressed as the number of teachers per capita, shows similar values in rural and urban municipalities and at the national level (Fig. 5). It is due to the fact that given the relationship between the quality of teachers and student achievement, the recruitment and retention of teachers in remote and sparsely populated areas in rural areas of the country is an im-

portant responsibility for the heads of educational institutions.

The shortage and demand for pedagogical staff often forces school principals in villages to appoint unqualified teachers, without higher education or with higher but no pedagogical qualifications. In order to provide the small schools with the necessary staffing, pedagogical specialists of retirement age are also kept in them.

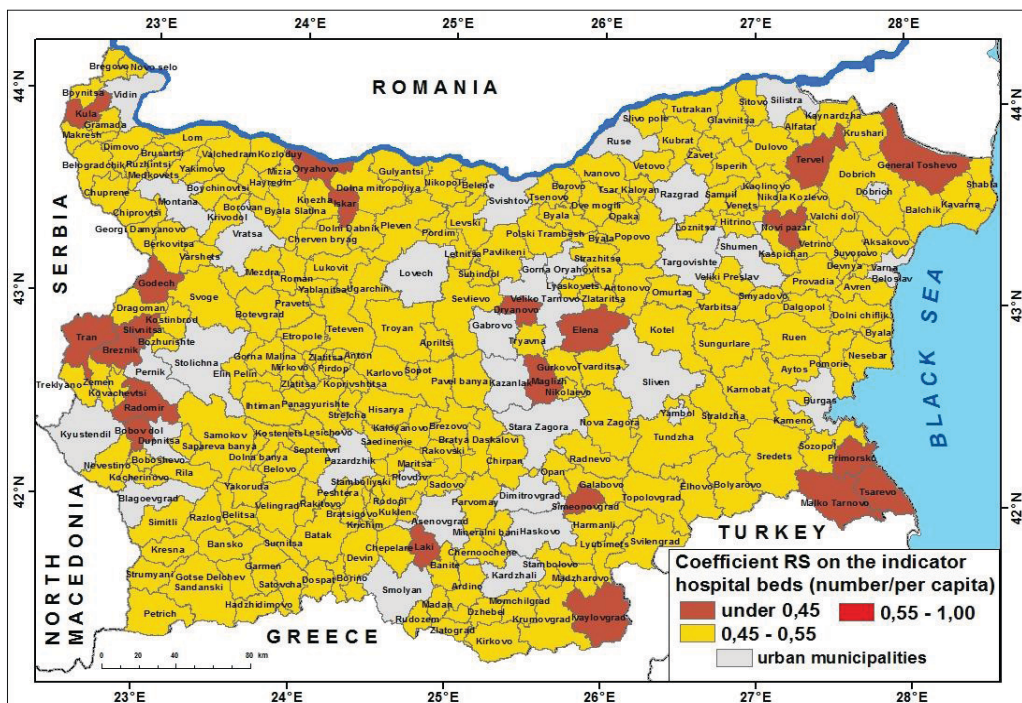


Fig. 4. Coefficient of regional positioning according to the indicator hospital beds per capita in the rural areas of Bulgaria, 2008-2020

Source: Author's and according to NSI data.

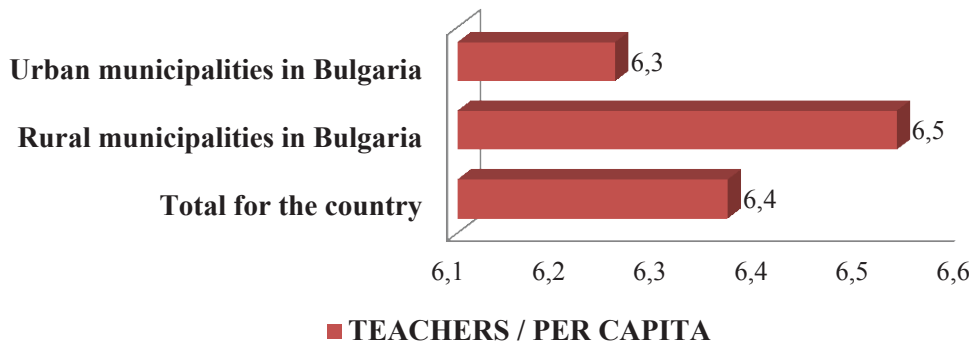


Fig. 5. Provision of the population with teachers per capita in the period 2008-2020  
Source: According to NSI data.

In the rural municipalities of Bulgaria the provision of teachers per capita is different. The values of the RS coefficient are the lowest in 21 municipalities such as Novo Selo, Georgi Damyanovo, Mirkovo, Rila, Kovachevtsi, Banite, Sarnitsa and others (Fig. 6). It is due to the shortage of pedagogical staff in these municipalities. The reasons for the reluctance of teachers to take positions in schools in municipalities with small settlements are mainly related to the working conditions specific to these organizations. They could be grouped as follows: geographical distance, professional isolation, career opportunities, pay, working conditions, working in merged classes dominated by students from ethnic minorities and marginalized communities, demographic trends and school prospects, many learning tasks and responsibilities, relationships with parents, etc.

The RS coefficient has the highest values in three municipalities Dobrich-selska, Avren and Madjarovo (Fig. 6). This shows that for the period 2008–2020 in these municipalities the staff-

ing of teachers has improved. In the remaining 208 rural municipalities, the value of the RS coefficient is between 0.45 and 0.55, which means that their provision of teachers per capita coincides with that at the district and national level.

The relative change in the number of schools provides information on the level of accessibility of educational services, as well as on the geodemographic development in the rural municipalities of the country. The optimization of the network of schools in the structure of education shows a tendency to reduce the number of schools in Bulgaria. The number of operating schools in the rural municipalities of Bulgaria in the period 2007/2008 and 2019/2020 school years decreased by 26.9%, which is higher than the national average.

The decrease in the number of schools in urban municipalities is the lowest due to the more favorable values of the demographic indicators (population of childbearing age, birth rate and natural increase) in them (Fig. 7).

In the rural municipalities of Bulgaria for the period 2008–2020, the change in the number of

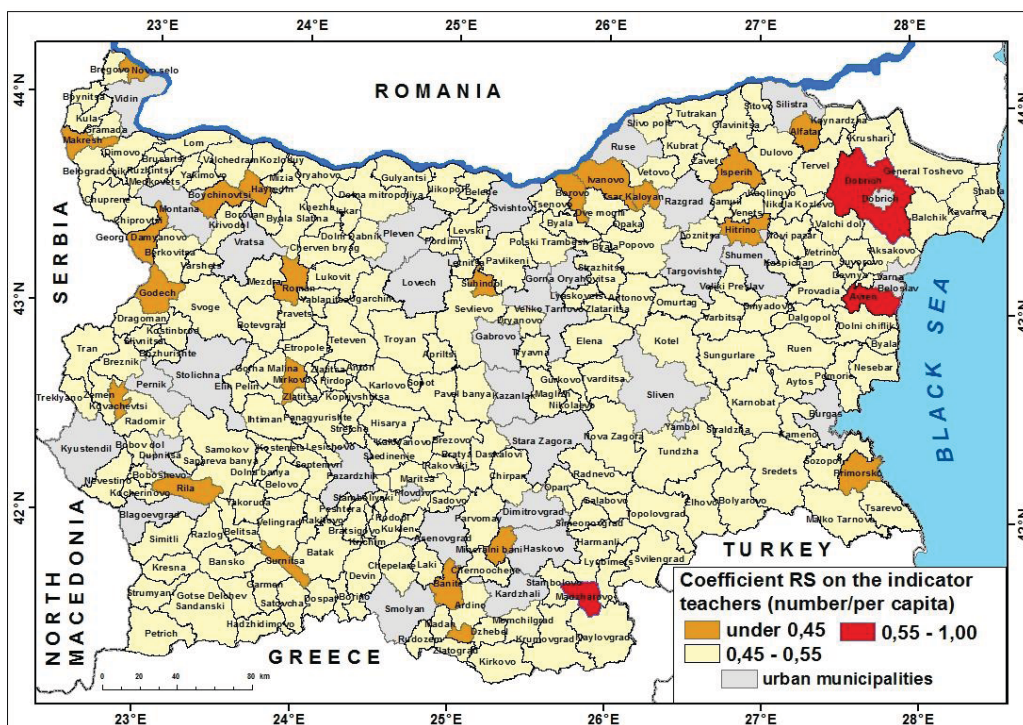


Fig. 6. Coefficient of regional positioning according to the indicator teachers per capita in the rural areas of Bulgaria, 2008–2020

Source: Author's and according to NSI data.

schools is different. The highest values of the RS ratio were reported in 11 municipalities such as Bobov Dol, Avren, Devin, General Toshevo, Tervel, Shabla and others. (Fig. 8).

This is due to the unchanged number of schools in these municipalities and preserving some of them with the status of secure schools.

On the other hand, the lowest values of the RS are reported in 25 municipalities such as Strumani, Godech, Pordim, Varshets, Dryanovo, Polski Trambesh, Alfatar, Apriltsi and others.

The reason for these low levels of the coefficient is the closure of schools due to the reduction in the number of students in small settlements.

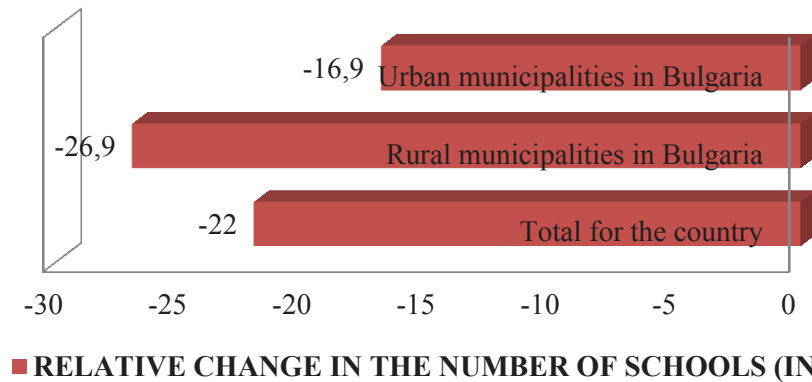


Fig. 7. Relative change in the number of schools in the period 2007/2008 and 2019/2020 school years (in %)

Source: According to NSI data.

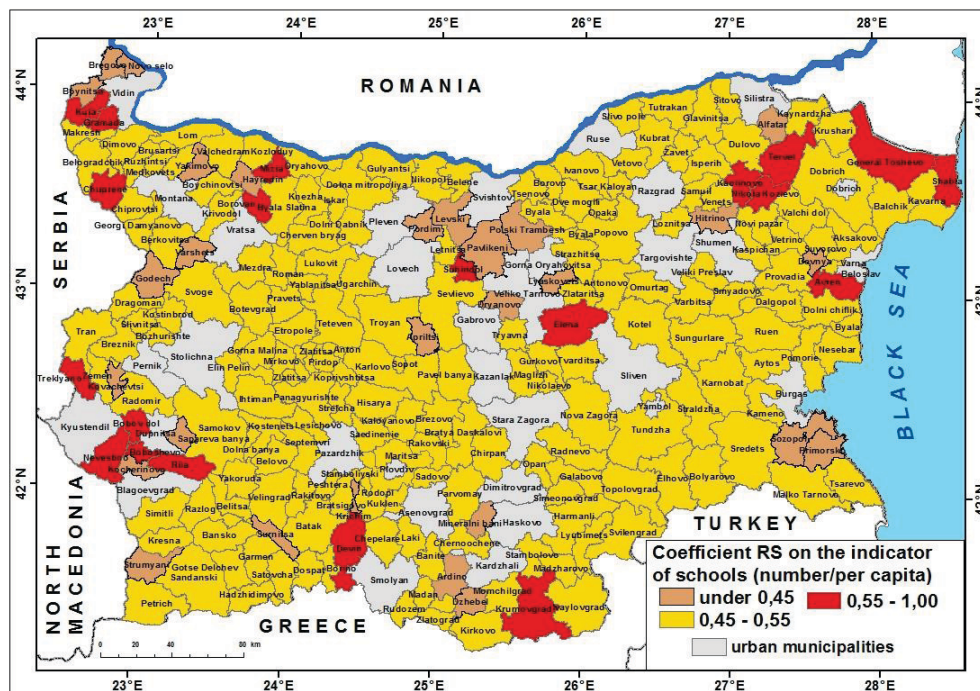


Fig. 8. Coefficient of regional positioning according to the indicator schools per capita in the rural areas of Bulgaria, 2008–2020

Source: Author's and according to NSI data.

In the remaining 196 rural municipalities, the ratio of Rs is between 0.45 and 0.55, which means that the change in the number of schools coincides with the district and national level.

## Conclusions

The persistent trend of declining population in rural areas of Bulgaria has a negative social impact. It leads to migrations and their further depopulation. This directly affects the education system – closing schools, kindergartens in settlements with low birth rates, typical of rural areas. Thus, the rural areas education sector faces the challenge of adapting to the declining demand for educational services in pre-school and school education.

The comparative analysis of the health infrastructure in rural areas shows differences in the number of doctors and the number of hospital beds. The population living in some of the rural municipalities does not have equal opportunities to access hospitals due to the concentration of health care in the municipal center or in large cities, which adversely affects the health and health prevention of the population.

More attention needs to be paid to developing projects with appropriate funding to carry out research to identify the causes of disparities in the distribution of schools and hospitals in rural areas, so that decisions can be taken to address these problems. Improving the municipal education network and health infrastructure is essential to ensure the quality of education, training and health care, but also to reduce the existing disparities between rural and urban municipalities. This is a necessary condition for keeping young people in rural areas and for stopping the demographic collapse and limiting their depopulation.

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