HEALTH SYSTEM INDICATORS - A CASE STUDY OF THE REPUBLIC OF SERBIA

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Abstract The multidimensionality of the concept of health and the complexity of its practical application purposes of determining the health status of the population leads to talk about the process estimates and not measurements. Measurement is a much more exact and precise procedure for which not yet we have the appropriate instrument, unless we use synthetic or composite ones measures of health represented by numerical scales. The approach to measuring health depends on the approach to health. According to the traditional the concept of population health is measured based on how sick people are, how much they use health service and how many die. Today, research efforts are increasingly focused on the direction finding indicators for measuring the global state of health, which include both components i health and disease. The aim of the article is to present the situation in the Republic of Serbia through health indicators and to make recommendations for improvement.

Keywords: health of the population, helth system, helth indicator, state of helth, helth service

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1 Introduction

Indicators (http://www.who.int/hac/about/definitions/en/) on the state of health of the population and the health system are formed on the basis of raw data and the methodology of their collection and processing. The issue of basic data quality is one of the more important previous issues and it is important to bear in mind that some of them are more reliable than others - mainly because they do not represent a complex methodological task, but are collected within basic data sources (e.g mortality data) (Tulchinsky, Varavikova, 2014).

The following systems of international monitoring of health indicators can be identified, which also process data for Serbia:

- World Health Organization (WHO). WHO, as an organization that brings together 193 countries, in an effort to improve the health of the global population and coordinate epidemiological protection measures, is the undisputed authority and the main source of comparative health data. In terms of scope and impact, WHO's work in the field of health exceeds all other organizations described here, which also refers to the systematization and collection of health data. Therefore, for this CEVES work, WHO data is the most relevant international data source. We used three WHO databases: (1) the "European Health for All Database" is the oldest WHO database containing indicators: population health status, health determinants, health risk factors, and financial resource and cost factors health care; (2) the Global Health Observatory database provides a basis for comparing the rates of death and loss of health due to disease and injury in all parts of the world. The data of this database were formed as individual member states submitted them to the WHO; and (3) the "Mortality Database" is a source of disparate mortality data, by age, sex, and cause of death.
- "European Core Health Indicators" (ECHI - https://health.ec.europa.eu/indicators-and-data/european-core-health-indicators-echi_en). ECHI is a project of the European Commission (EC) and primarily observes different spheres of life of European residents, and the data is grouped according to several dividing criteria: urban/rural population, young/old. ECHI classifies its indicators into groups:

demographic and socio-economic indicators, indicators of population health status, indicators of factors influencing health status, indicators of health service quality and indicators of successful promotion of a healthier lifestyle. The ECHI database contains some data for Serbia taken from the WHO, but since its targeted research does not cover Serbia (but only members of the European Union), it has no added value for this research.

- European Health Consumer Index (European Health Consumer Index - EHCI). The EHCI was developed under the auspices of the agency "Health Consumer Powerhouse Ltd" as an independent monitoring of the health systems of 35 European countries, the results of which are reported to the European Parliament today (https://healthpowerhouse.com/). Unlike the other sources cited here, this is not just a set of comparative indicators, but rather they are combined into a single index that enables countries to be ranked according to their performance. In addition to relying on other sources described here, this organization also generates certain data through surveys and interviews. As its title emphasizes, this resource looks at the healthcare system from the point of view of the user as a consumer. Patients' rights and information, availability of health care (including waiting time), scope and reach of care have more weight than health outcomes and prevention measures. The authors explain that health outcomes are not emphasized - e.g. life expectancy is not included at all – as these depend to a large extent on environmental and lifestyle factors. A large number of observed indicators are evaluated by annual surveys of citizens.

The structure of this index does not correspond to the needs of monitoring health policies in a country like Serbia. Giving little weight to differences in outcomes may be justified in countries whose healthcare produces results that are close to the limits of the technical possibilities of medicine, but not where better organization of work and procedures could significantly improve them. For example, the range in life expectancy in 2015 in the most developed countries of the European Union (EU) extends from 80.5 years for Cyprus to 83 years for Spain. It is possible that in these countries the differences in outcomes are mainly conditioned by hard-to-change factors and that their health consumers are therefore more interested in the quality of softer aspects of care. However, life expectancy in all the other countries we are looking at, including all the new EU members that went through the transition (except for Slovenia, which belongs to the first group) is significantly shorter, ranging

from 73.6 to 78.8. years and is obviously not determined only by objective factors. For such countries, we think it makes sense to give more weight to system outcomes and the processes that produce them.

2 Measurement or assessment of health status

There is data that some vital demographic events were recorded even before our era in Egypt, Greece, Rome. It is known that such data were collected in Japan in the 8th century, in the Middle Ages the church in Spain, England, France and Sweden also records them (Milosavljević, 1984).

In the 17th century, two statistical schools existed and worked in Europe, one in Germany under the name "University Statistics" and another in England called "Political Arithmetic". The founder of this the other was John Grount, a man who, although not a doctor, came up with the idea that certain indicators evaluates the health situation and tries to solve the problem of "numerical representation health status of the population". As far as is known, he was the first to arrange certain statistical data and give it to someone presented. He did this in 1662 when he submitted a report to the British Scientific Society which referred to the movement of mortality for a period of 30 years. The report contained data on the intensity of this phenomenon and the structure of the causes of death (acute and chronic diseases, accidents, suicide). From the results of monitoring this phenomenon, he concluded that in this apparently chaotic phenomenon when viewed individually from case to case, certain regularities are encountered, if they are follows a long period of time.

A little later, the astronomer Edmund Halley made the first mortality tables in 1693 and was the first to study the probability of life expectancy. English physician William Farr, who is considered the first health statistician, began his studies in 1839 of mortality and morbidity in England and Wales, publishing their analyses. It is vital data began to treat statistics as legal documents and as valuable sources of health statistics. By grouping, classifying and tabulating this data, he issues "Reports" on the state of vital and health statistics in England and Wales which are beginning to serve as the first health assessments population conditions (Mićović, 1974).

The evolution of the assessment of the health status of the population has been immediate for the last hundred years associated with the evolution of community health problems. In the historical development of assessment of the health status of the population, four periods characteristic for development can be distinguished theoretical thought and practical approaches (Cilyer, 1983).

In the first period, which lasted until the end of the First World War, the dominant health the problem was infectious diseases with high mortality of the population, and for assessment health status, mortality indicators are used. The second period, until the end of the Second World War war, is characterized by the beginning of the use of morbidity indicators to measure the frequency of acute diseases and conditions without a fatal outcome, thanks to the solution of basic sanitary and communal services problems as well as successes in immunization and vaccination. Incidence and prevalence, as classic epidemiological indicators were added to the existing set of measures of health status. Third period begins after the Second World War, is characterized by an increase in chronic diseases and conditions aging of the population, so the health assessment includes indicators of time lost for time of incapacity and disability. This period lasted until the end of the eighties when the fourth phase occurs, i.e. the current period, characterized by knowledge that the way of life creates health problems, i.e. that risk factors contribute to the development of chronic non-communicable diseases. In the process of assessing the state of health, the psychological and social components of health are included, a not only its physical aspect, and increasing attention is paid to the issues of measuring well-being and quality of life, while there is still no agreement on the boundaries between health and non-health aspects of people's quality of life (Simić, 2000).

Approaches to assessing the health status of the population that are available to us can be classified into six categories (Shap, 1990):

1. using mortality data to assess the risk of dying in the population;
2. using mortality data to draw conclusions about the morbidity of the population;
3. using morbidity data to measure the incidence and prevalence of specific diseases;

4. the use of data on the use of health services and treatment as an absolute measure frequencies of specific diseases in a certain segment of the population;
5. using social indicators as a possible measure of health status (e.g. level education, income, living conditions, etc.);
6. using synthetic indicators of health status (e.g. DALY, YLL, YLD, etc).

In the absence of a single standard for measuring the health status of the population, the average life expectancy, prevalence of preventable diseases and deaths, availability of health services they serve as indicators of health status. Assessment of the level of health of a certain population is usually done it is obtained by comparing one population with another or by following the trends of indicators over time certain time (https://www.rice.edu/projects/HispanicHealth/).

Some of the most common indicators of the health status of the population are indicators of morbidity (such as sex-, age- and cause-specific morbidity rates, absence from work, disability, stiope hospitalizations from certain diseases, etc.), mortality indicators, general and specific rates mortality, standardized mortality rates, infant mortality, life expectancy and the second (Sokoya, Zhiu, Diaz, Law, Himawan, Lekey, Shi, Gimbel, Jing, 2022).

Measurement is a procedure that determines the value of objects, persons, responses, events including certain rules; that is, it is the process of applying the standard instruments or scales to the object (subject) of research or events (Jakovljević, Grujić, 1995).

3 Outcome indicators

We present indicators of the health status of the population through five roof indicators as well as through an integrated analysis of specific causes of mortality.

3.1 Roof outcome indicators

Among the roof indicators we show:

- life expectancy (LE), the most frequently used and most vivid indicator of the general health status of a country's population (the only indicator for which we investigate not only the comparative performance, but also the dynamics since 1990);
- years of lost life (YLF), which is based on the same information on the mortality of the population, but allows us to make more nuanced comparisons;
- maternal mortality (hereinafter maternal mortality) – a specific goal within the Sustainable Development Goals (SDG);
- child mortality (infants and up to 5 years of age) – a specific goal within the health SDG;
- self-assessment of the health status of the population, an indicator that provides information about the subjective experience of the health status.

Analysis of the health status provides information about the current health situation - indicates health problems. On the basis of the Analysis of the health condition, the identification and gradation of priorities in the health policy is carried out. The analysis of the state of health also provides an evaluation of the success of the measures taken to remedy certain health problems.

4 Case study of Serbia

The Institute for Public Health of Serbia "Dr. Milan Jovanović Batut" represents the largest system for collecting data on the health status of the population in Serbia, next to the Republic Institute for Statistics RZS. In addition to collecting data based on international methodology, it collects and systematizes data based on its own assessments with the instructions of the Ministry of Health. However, the lack of human and financial resources limited the system to display the entirety of the data.

4.1 Vital-demographic situation

4.1.1 Number and structure of the population

Table 1: Movement of the total number of inhabitants

N.	Territory	Population accirding census 1991	Population accirding census 2002	Population accirding census 2011.	Population based on the estimate 2020.
1.	Rebuplic of Serbia	9.778.991	7.498.001	7.186.862	6.899.126

Source: ZJZ, Serbia

In the observed time period, there was a reduction in the population of the Republic of Serbia (9.6% according to the 2011 Census, i.e. 29% according to the 1991 Census).

Table 2: Movement of the total number of inhabitants

N.	Population of Serbia		
1.	In total	6.899.126	100%
2.	Male gender	3.360.306	48,71%
3.	Female gender	3.538.820	51,29%

Source: ZJZ, Serbia

In the population of the Republic of Serbia, the female population predominates (2,58% more female than male). The masculinity rate is negative (950 men per 1,000 women).

Table 3: Life expectancy

N.	Time interval	Male gender	Female gender
1.	2001 - 2003	69,73	75,05
2.	2005 - 2007	70.42	75,82
3.	2007 - 2009	71,11	76,4
4.	2009 – 2011	71.6	76,8
5.	2012 - 2014	72,6	77,7
6.	2015	72,6	77,7
7.	2016	73	78
8.	2017	73	77,9
9.	2018	73,2	78,1
10.	2019	73,1	78,3
11.	2020	71,4	77,2

Source: ZJZ, Serbia

Life expectancy describes the quality of life. In the five-year period, the life expectancy of the population of the Republic of Serbia decreased (men by 1.6 years, women by 0.8 years).

The average age of the population of the Republic of Serbia is significantly above the threshold limit of the indicator (30 years), which indicates a progressive increase in the age of the population (2002 – 40,25; 2020 – 43,42).

The biological type of the population indicates the % share of certain age categories in the total number of inhabitants.

When talking about the biological type of the population and the age index, it can be concluded that in the period from 2016 to 2020, there was a more intensive aging of the population (Table 4).

Table 4: Age structure of the population – biological type of the population of the Republic of Serbia

N.	Time interval	Population 2015	%	Population 2019	%
1.	0 - 14	1.016.579	14	984.675	14
2.	15 - 49	3.147.961	45	3.048.045	44
3.	50 +	2.893.782	41	2.866.406	42
4.	Total	7.058.322	100	6.899.126	100

Source: ZJZ, Serbia

The population of Serbia with 14% of the population under the age of 15, as well as 432% of the population over the age of 50, belongs to the regressive type of population (a high proportion of the old population and a low proportion of the young population).

Comparison with 2015 indicates that the biological type of the population is identical.

The age index represents the ratio of the population over 60 years old to the population under 19 years old.

In 2016, the population of Serbia was very old, the age index was 1.40 (limit value of the indicator 0.4). In recent years, there has been an even more intensive aging of the population.

Maturity of the population indicates the share of residents over the age of 65 in the total population.

The population of the Republic of Serbia was still very old in 2002 - 16.54% (limit value of the indicator is 10%). In the following 18 years, there was a further deterioration of the age structure - the maturity index was 19.7 in 2016, and 21.11 in 2020.

Birth rate is the basic indicator of the positive natural movement of the population. The birth rate represents the number of live births per 1,000 inhabitants. The favorable rate has values of 13-20‰.

In the Republic of Serbia, the birth rate ranged from 9.17‰ in 2016, 9.24‰ in 2017, 9.16‰ in 2018, 9.27‰ in 2019, before falling to 8.94‰ in 2020.

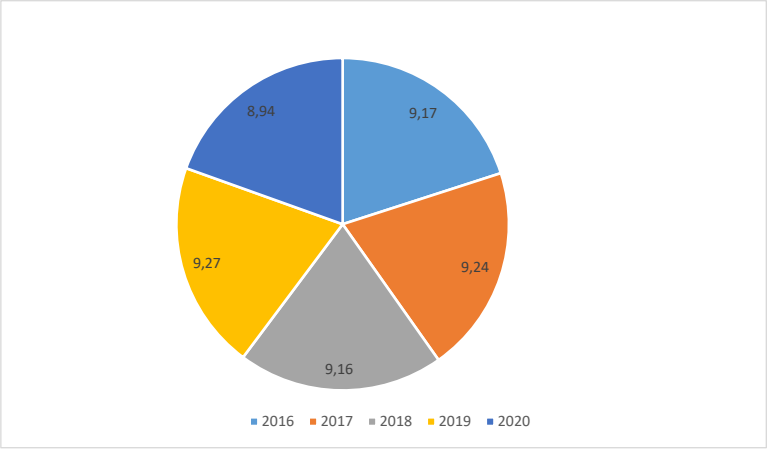

Figure 1: The Birth rate in R. Serbia 2016 – 2020

The data show that the birth rate of the Republic of Serbia has a tendency to decrease.

The general fertility rate represents the number of live births per 1,000 fertile women period (15-49 years). It is an indicator of positive natural population movement (marginal value is 50‰). The general fertility rate of R. Serbia has a declining rate. From 2000, when it was 41.88 (100% base index), to 2020, when it is 41.21 (98% base index). The general rate is reduced by 2%. The movement of the general fertility rate in the Republic of Serbia has downward trend. In the last 20 years, it has decreased by 2%.

The nuptial rate tends to fall to territory of the Republic of Serbia, as the divorce rate i tend to grow.

Mortality of the population represents a negative component of the natural movement population. The general mortality rate represents the number of deaths per 1,000 inhabitants (the threshold value for high mortality is 12). The general mortality rate in the Republic of Serbia in 2016 was 14.29, which gradually increased until 2019, and in 2020 it increased significantly and amounted to 16.94. The specific mortality rate by sex and age provides more precise information on mortality and represents the number of deceased persons of a certain gender and age per 1,000 or 10,000 inhabitants. According to gender, female mortality is higher than male mortality up to the age of 14, while mortality of the male population greater than 15 years to the end of life.

The average age of the deceased by gender indicates an increase in life expectancy for both men and women female population (slight reduction since 2019, which is a consequence of the Covid virus pandemic 19). On average, women live longer than men.

The average age of deceased women is significantly higher than the average age of deceased men. The average age in the period 2020-2000 increased by 5.10 years for men and 5.92 year for the female sex (five-year increase for the time period 2019-2015 for the male population is 0.13 years and 0.29 years for the female population).

The most common causes of death of the population of the Republic of Serbia are diseases of the circulatory system, tumors and Covid-19. An increase in mortality was recorded from symptoms, signs, pathological clinical and laboratory findings, diseases of the system for breathing, diseases of glands with internal secretion, nutrition and metabolism, diseases of the digestive system digestion, external causes of illness and death, and diseases of the nervous system.

The infant mortality rate has decreased compared to 2000 from 10.68 to 4.80 in 2020.

Natural increase is an indicator of the natural movement of the population. Represents the difference between the number of live births and deaths of a certain territory. The rate of natural increase represents the difference between live births and deaths per 1,000 inhabitants (threshold value is 5‰). In Serbia, the rate of natural increase is negative and amounts to -7.99.

The rate of natural increase in the Republic of Serbia is somewhat more favorable, but it also indicates depopulation of the population.

We can state that the structure of mortality in Serbia is similar to the basket of comparative countries, but mortality is in Serbia, it stands out especially in cerebrovascular diseases (2.5 times higher than in the EU) and in diabetes (2.25 times more). The analysis of specific causes of mortality confirms the important initial assumption of this report – yes there are particular similarities in the performances of Serbia and other former Yugoslav countries. Even though they are theirs mortality rates from specific causes are lower than in Serbia, either because the incidences are lower (lower number of new patients registered in one year), or the higher the survival rate, mainly the weaknesses and strengths are similar to them. First of all, among the significant causes of mortality in the former Yugoslav countries, they generally share a particular share high rate of from cerebrovascular diseases and diabetes and especially low rate from infections of the lower airways. The former Yugoslav countries generally have smaller due to causes related to alcoholism and drug abuse, but Serbia leads the way in relation to them as well.

4.2 Self-assessment

Data on self-assessment are obtained on the basis of the annual survey on living conditions conducted in the countries members and candidates of the European Union (SILC) (http://ec.europa.eu/eurostat/web/income-and-living-conditions/data/database). It is a far "softer" indicator than most we use in this analysis, but we have included them because we believe they are informative. Respondents answer the question 17 WHO and UNICEF in collaboration with the United Nations Population Fund (UNFPA) and the World Bank (WB) developed maternal mortality assessment methodology that corrects official data on women's deaths, since it is a common phenomenon that these causes deaths are misreported and misclassified.

The answers to such a question are subjective and obviously depend on both culture and expectations - it is inevitable that the answer to some extent reflects a more general satisfaction with one's own state of body and mind. Comparisons between countries are therefore less useful than comparisons for the same country over time (data for Serbia are available in the years when national population health surveys

were conducted - 2006 and 2013. years). Nevertheless, it is significant that Serbia has the highest rate of negative responses - "very bad or bad" (23% respondents) - of all the countries conducting the survey, and fewer positive responses ("very good or good") than Serbia (49%) has only Portugal, Latvia and Lithuania. It is interesting, however, that there are many respondents in Serbia rated their overall health better when answering the question "does your health seriously prevent you from doing what you do?" all desired jobs" (CEVES, 2017). Also, regarding the general evaluation of the health status, the differences between the quintiles of the respondents with the highest and lowest incomes is not as high as in other countries that have a high rate on average negative answers. There is not much doubt, therefore, that in Serbia, to a good extent, it is not only about the objective about the state of health, but about a more general dissatisfaction that is relatively evenly distributed.

4.3 Risk factors

With these indicators, we measure risk factors that can affect an individual's state of health, whether positive or negative. Understanding the causal relationship between risks and the outcomes they affect is essential so that decision-makers would formulate health policies aimed at prevention (prevention), and not only treatment of diseases. Today it is undoubtedly:

- that smoking contributes to the development of lung cancer;
- that excessive alcohol consumption contributes to liver diseases;
- that increased blood pressure and cholesterol increase the likelihood of a heart attack or stroke;
- that physical inactivity increases the probability of contracting many diseases, both directly and through the:
- excessive weight gain which also contributes to many diseases, e.g. hearts andblood flow or diabetes,
- and that air pollution contributes to diseases of the respiratory organs.

In the last few decades, significant funds have been invested in reducing these risk factors, especially in developed countries, which visibly contributed to the reduction (or slower increase) of related diseases diseases and improving the general state of health. Therefore, the goals of sustainable development deal with risks, especially by preventing substance abuse and treating the consequences of such abuse, as well as strengthening the application of the "Framework of the WHO Convention on Tobacco Control".

The causes of the disease are complex, and most of the time, without a deeper analysis, it is not possible to simply see the connection between risk and related diseases, since there is a wide range of possible influences of other factors - health effectiveness protection, the influence of other aspects of the environment or measurement errors. In former Yugoslav countries, this is the case the connection is evident only in the case of alcohol consumption and death from cirrhosis of the liver, both indicators in which Serbia stands out for its good performance. However, in this chapter we present the risk factors graphically, in relation to indicators of the causes of death that are the most common for all countries, and among them we highlight the former Yugoslav countries.

Among the analyzed risks, Serbia has the most negative impact on the share of the population that smokes (only behind Greece), and together with all other former Yugoslav countries, it also stands out for high blood pressure (i in men and women), although due to ischemic heart disease it is average in the group of countries with worse performance, and due to lung cancer in the better half among all countries. Among the risk factors Serbia also stands out negatively due to the very low level of physical activity of the population, but in terms of obesity, it is among them better countries, which means that it does not explain the high death rate from diabetes.

In any case, Serbia stands significantly better in terms of performance in the risk factors than in the umbrella ones outcomes.

Conclusion

Of the 19 groups of health care quality and effectiveness indicators monitored by the OECD that are not derived from mortality, data for Serbia are monitored only in 5 cases: three on children's vaccinations and old and two related to HIV and

tuberculosis. In the case of three indicators, Serbia collects data, but they are obvious very problematic - the OECD does not include them and we consider them as they are not worth following. In the case of four indicators - on prescription of antibiotics, mortality from heart attack and stroke in hospitals (lethality), as well as on hospital-caused infections, Batut collects similar but incomparable (mostly more detailed) data, for which we also feel are not reliable enough for immediate use. Finally, in 7 cases, data for the same or similar indicators for Serbia cannot be found without additional research.

To the extent that it is possible to conclude on the basis of such limited data, it is clear that in Serbia the most preventive protection in non-communicable diseases fails, and there are signs of weakening even in traditionally strong ones

protection against infectious diseases (protection is weak in childhood vaccinations and HIV monitoring, but still strong in case of tuberculosis). That the prevention of non-communicable diseases is failing is clear from the high death rate from cancer cervix and breast, which the OECD includes in its indicators, and in which Serbia has, respectively, the third the worst, and the worst, performance among the observed countries. High death rate from diabetes in Serbia also points to weak preventive protection, but the OECD follows a more immediate indicator of the process - the rate hospitalization, which for this and two other diseases should not be high if the diseases are adequately treated time treated. On the other hand, Serbia's performance is relatively better and somewhat inconsistent indicate the umbrella outcome indicators, when it comes to the two OECD indicators on "preventable mortality" (preventable and correctable mortality), which are still under development. Expert analysis is needed to explain this, but we believe that these are indicators that give greater proportional weight to health interventions in acute situations - for example, heart attack and the like, in which the ability of the Serbian is unquestionable medicine to provide highly specialized care plays an important role.

The recommendations that can be sent to the Ministry of Health and the Institute for Public Health "Batut" can be summarized in several key points:

- enrich the selection of readily available indicators by calculating and publishing indicators:

    - Hospitalization rate, at least for diabetes, but also for COPD and chronic heart failure
    - Assessment of the total consumption of antibiotics or medicines in general
    - Number of performed PAPA tests per 10,000 reproductively active women
    - Number of performed mammograms per 10,000 women
    - Total number of MRI and CT machines in the state and private sector per million inhabitants, as well as the number of inspections performed in each of the sectors
    - The survival rate of certain diseases
    - The number of employed doctors by specialist profile, as well as all the standards and norms based on which (should) make decisions on resource allocation

- significantly improve data on the quality of health in Serbia by:

    - extended coverage to the private sector;
    - authorized and trained Batut to make corrections/assessments when it is clear that the reported data is not reflect the target size, as well as to change the way of cooperation/communication between institutes for public health and health institutions in order to motivate and enable them to deliver regularly better quality data;
    - significantly narrowed the set of required data, and simplified their calculation.

It is very important that the wider social community and the entire public get involved dialogue about:

- A practical strategy for improving the quality of the population's health, which must be concrete, prioritized based on appropriate financial assessments.

- A package of measures ("reform plan") that would clearly separate the functions, purpose and boundaries of private and of the state health system.

Public-private partnership should be considered as one of the best options for solving a large number of problems that exist in the healthcare system of the Republic of Serbia.

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