

HEALTH STATUS INDEXES OF BULGARIAN POPULATION.

WOULD SOCIAL DEVELOPMENT PRESERVE MORE LIVES THAN MEDICINE?

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SUMMARY

Assessing the health status of a population is a complex task. Health status depends on many factors, including the level of development of clinical care, health behaviour, genetics, and the socioeconomic and physical environment.

In many countries, governments recognise population health status models as a tool to identify weaknesses in health policy, to support decisions to revise health policy, and to evaluate its implementation - whether it has achieved the expected results. Population health status (SDOH) models could improve health behaviour by focusing the public's attention on important aspects of their health. In addition, stakeholders can identify new opportunities for development and improvement, not only for policy but also for business opportunities. The use of these models can facilitate the identification of inequalities, leading to the implementation of effective measures to address and overcome existing inequalities.

At present, there is no model in Bulgaria that uses statistical analysis of empirical data to determine the health status of the population. There is also a lack of empirical research that assesses the contribution of factors such as health behaviour, clinical care, socioeconomic and physical environment to public health. Collecting useful information for the 28 administrative districts to build a health status model is quite a challenge. Many Bulgarian institutions, such as the National Centre of Public Health and Analyses, collect a considerable amount of information and analyse risks to the population's health. However, they lack a tool to support the decision-making process.

The monograph outlines the process of developing the **first population health status index for the Bulgarian population, presenting a comprehensive ranking of all 28 administrative districts based on** health indicators related to **key health factors**, including **health behaviour, clinical care, socioeconomic and physical environment**.

The monograph is divided into **five chapters**, the **first** of which focuses on a **systematic review of existing frameworks and models** for population health assessment. The analysis covers publications from 1960 to 2024, ensuring that trends can be derived and significant gaps in the approaches adopted to population health assessment can be identified. The analysis shows that there is a lack of complete, publicly available, high-quality information on the methodologies used to construct population health models. This highlights the need for the dissemination of clear and precise construction procedures to ensure the reliability of methodological results and conclusions. The analysis shows that the **Population Health Index** is a **highly effective and efficient evaluation tool** due to its ease of interpretation, intuitiveness and broad appeal.

Another key element of the construction process is a comprehensive understanding of the input data – dynamics and trends. This ensures an accurate ranking of Bulgaria's 28 administrative districts. A wide range of indicators is needed to define the context of the districts, in addition to the health indicators included in the index scoring. **The second chapter** presents a **comprehensive list of health indicators that define the health determinants of the health status of the population**. As mentioned above, the current research focuses on the following **health factors: health behaviour, clinical care, socioeconomic and physical environment**. The analysis includes indicators such as premature mortality, life expectancy, etc. *The conclusions drawn highlight the need for action to improve the health status of the population in Bulgaria, including reducing smoking, improving preventive and prophylactic clinical care services and improving air quality.*

The third chapter presents the **complex methodology** for the construction of a population health index for the Bulgarian population in the 28 administrative districts. The approach used is based on the best practices in composite index construction and the methodology includes four main steps:

- **Construction of a panel dataset** for the building of the population health index.
- Selection of the **weighting method** for the health indicators – linear regression and principal component analysis (PCA).
- Choice of **aggregation method** for the health indicators – linear, geometric aggregation and Borda's rule (a simple and outlier-independent method based on ordinal information that does not require weighting).
- **Sensitivity analysis** to ensure that it is the most accurate with consistent results from several population health indices.

The fourth chapter describes the construction process of the first index for assessing the health of the Bulgarian population. Between 2010 and 2022, data were collected and processed for 53 health indicators in 28 administrative districts. Min-max normalisation and transformation of the data were used to ensure that the values of all indicators fall between 0 and 1 and that they all follow the same direction: closer to 1, better for the health of the population.

An iterative process is used to identify statistically significant health indicators and their contribution to the health status of the population. This process uses two statistical methods (linear regression and principal component analysis) and Cronbach's alpha coefficient (the most common estimate of the internal consistency of items). The application of these methods identifies seventeen statistically significant health indicators with their weights in the health status of the population. The weighted results of the applied method were then used to determine the contribution of each of the four health factors: **health behaviour (30%), clinical care (20%), socioeconomic environment (40%) and physical environment (10%)**.

The constructed population health index (BG health index) incorporates health indicators in various ways. Health indicators that significantly affect health status, as increasing the likelihood of its deterioration, include *adult smoking (10%), adult obesity (7%), teenage births (7%), unemployment (7%), poor diet (6%) and young people who are neither studying nor working (6%)*. Conversely, health indicators related to public security, including *injury deaths (4%), suicides (4%), homicides (5%), juvenile arrests (3%), and air pollution (4%)*, exert a similar effect but with much less impact. Among all health indicators that reduce the likelihood of health status deterioration, *mammography*

screening stands out as the most impactful, with a score of 8%. All other indicators contribute 6% to the index, including *flu vaccinations, completion of higher education, median household income, access to the Internet, and primary outpatient care physicians.*

The next step in the process is the aggregation of the health indicators data. There are three aggregation methods that are applied: linear, geometric aggregation and Borda rule. Then, the sensitivity analysis is applied. **The results indicate that the most accurate and consistent index for ranking the 28 administrative Bulgarian districts is the one based on linear aggregation of the weighted results of the applied methods (linear regression and PCA).**

The fifth chapter presents the **ranking of Bulgarian administrative districts** based on the **constructed BG health index**, which demonstrates an improvement in the population health status of Bulgaria during the analysed period. *Sofia-grad is the healthiest district, with a significant lead over the others throughout the period 2011 to 2023.* The districts of Varna, Ruse, Haskovo, and Veliko Tarnovo experienced the highest dynamic in the ranking, overtaking Gabrovo, Plovdiv, and Dobrich due to significant changes in health behaviours. The dynamic of the BG health index highlights the necessity to analyse clusters according to groups of districts. The districts are *divided into four groups* based on their BG health rank in 2023:

- *Group 1* includes **economically developed districts with access to healthcare**, such as Sofia-grad, Varna, Blagoevgrad, Smolyan, Ruse, Veliko Tarnovo, and Haskovo.
- *Group 2* consists of **districts with developed industry, logistics centres, and agriculture**, mainly in the **southern part of Bulgaria**, including Stara Zagora, Pazardzhik, Kardzhali, Kyustendil, Plovdiv, Yambol, and Pernik.
- *Group 3* consists of **districts with comparatively lower economic development and the poorest self-rated health status**, including Burgas, Lovech, Dobrich, Gabrovo, Shumen, Sofia, and Pleven.
- *Group 4* comprises **districts with the least economic development**, such as Vidin, Targovishte, Silistra, Vratsa, Montana, Razgrad, and Sliven.

The population health analysis of each group of districts clearly demonstrated **the necessity for new measures and policies at both the national and district levels.**

The monography includes recommendations for **new national policies**, such as measures to improve *health behaviours*, including reducing smoking and obesity and improving diets. It also includes *clinical care* needs measures that will ensure there are enough medical and healthcare professionals. The study identifies the need for a deep analysis of the population morbidity in Bulgaria, which will allow policymakers to derive prevention policies and programs. Mammography screening and flu vaccinations are key components of the prevention policies applied in Bulgaria, and it is recommended that they be popularised and their scope widened. Analysis of the *socioeconomic environment* indicates the necessity to augment the proportion of the population that has completed higher education, whilst the Bulgarian labour market dynamics necessitate the advancement of vocational and continuing education to ensure the maintenance of employees' knowledge and skills. Furthermore, enhancing household income is imperative to boost the population's well-being and mitigate the migration of the workforce to Western Europe. Regarding the *physical environment*, there is a pressing need to enhance the quality and quantity of data collected on air pollution and other relevant indicators, the latter of which will facilitate the

implementation and evaluation of appropriate policies and strategies. The analysis of health indicators reveals concerning trends and the necessity for prompt action to enhance the *health status* of the Bulgarian population. Addressing gender disparities in life expectancy is also crucial, with the objective of increasing the average from 68.39 years for men to a more sustainable level.

The analysis of health indicators by the district group has highlighted the following needs:

- *Group 1*: Motivation to increase the population's physical activity is required, as well as addressing the high number of individuals driving with more than 0.5 alcohol level. Initial measures should focus on analysing the reasons behind such behaviour, followed by increasing the control and collection rate of the fines imposed.
- For *Group 2*, measures should be implemented to address the following: decrease in sexually transmitted infections, teen births, preventable hospital stays, and the poor population share, the highest among the groups.
- *Group 3* requires measures to boost population physical activity, like those implemented in Group 1 districts. The most economically underdeveloped districts could benefit from policies that facilitate the integration of the young population into the labour market, enhance broadband internet access, and provide training to equip the population with the skills to capitalise on emerging opportunities. The fact that a significant proportion of the population rates their health status as poor or very poor highlights the imperative for enhanced living conditions in these areas.
- *Group 4* districts require measures to broaden access to broadband internet and socioeconomic improvement initiatives to reduce the population living in material deprivation. Improving the health status in these districts necessitates motivating the population to complete secondary and higher education and enter the labour market, and it is also crucial to implement measures to reduce the rate of teenage births. These measures will positively impact the current high rate of uninsured people. The most pressing issue in these districts pertains to the mental health of the population, which is further compounded by a shortage of professionals providing mental health services.

An analysis of the Bulgarian health status dynamics reveals significant developments between 2010 and 2023. However, the analysis also identifies critical trends in certain indicators that necessitate urgent action. Furthermore, **it is essential that these activities are implemented at the national level, with others being executed at the district level**, to enhance the health status of the Bulgarian population.

During the construction process of the BG health index, it was identified that **indicators needed to be developed**. This involved **improving some existing indicators and collecting new ones** with the aim of enhancing health evaluation and the effectiveness and efficiency of applied policies. It is **crucial that these indicators are collected district by district and yearly where possible**.

In terms of *health behaviour*, it is necessary to broaden the analysis of healthy diets. In *clinical care*, preventable hospital stays are a key indicator. To improve this indicator, a deeper analysis of diagnoses is required to provide a clearer picture. In addition, it would be beneficial to collect information to assess patient trust in doctors and satisfaction with the clinical service provided. The *socioeconomic environment* information should be expanded to include more indicators that measure poverty, as the analysis indicates that the *physical environment* exerts a significant

influence on public health, underscoring the necessity for comprehensive assessments. With regard to air pollution, it is imperative to establish consistent measurement points at a minimum of one location per district, encompassing PM10 and PM2.5 at each site. Additionally, it is crucial to incorporate other indicators at the district level, including nitrogen dioxide levels, ozone, solar radiation, and an assessment of access to clean drinking water. Furthermore, expanding indicators related to material deprivation will provide a more comprehensive picture of the health of the local population. Furthermore, it is essential to emphasise that the indicators that assess the *health status* as the dependent variable should be developed further by adding self-assessments of physical and mental health, collecting data on the number of people per 100,000 diagnosed with diabetes and cancer, and the relative proportion of cancer survivors five years and older.

The population health status index should be **maintained and improved systematically** in the future, to ensure optimal decisions for all stakeholders. *This will allow the BG health index to evolve and to be an adequate decision support tool because activities regarding socioeconomic advancement, implementation of policies to preserve the physical environment, and promotion of healthy behaviour could preserve infinitely more lives than medicine.*

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