

Public health as the indicator of regional socioeconomic development

Elena Pastukhova

Kemerovo State University
Institute of Economics and Management
Kemerovo, Russia
peau.13@yandex.ru

Elena Morozova

Kemerovo State University
Institute of Economics and Management
Kemerovo, Russia
morea@inbox.ru

Anna Mukhacheva

Kemerovo State University
Institute of Economics and Management
Kemerovo, Russia
oblakko@mail.ru

Natalia Egorova

Kemerovo State University
Institute of Economics and Management
Kemerovo, Russia
gukkkk@nextmail.ru

Abstract — Improving public health and increasing life expectancy is the priority policy of many developed countries. The current model of Russian regional economic development aimed at exploring natural resources creates multiple negative consequences for socioeconomic development and public health. The aim of this research is to analyze the condition and dynamics of populational health in Kemerovo Oblast, to find correlation between health and socioeconomic development indicators. In order to do this, we have applied comparative analysis, synthesis, statistical and correlation analysis. We have studied demographical indicators of populational health in Kemerovo Oblast in 2002-2017. We discovered the main problems of public health in the regions: low life expectancy of men (45-64 years); high infant mortality rate in countryside areas; high suicide rate among employable citizens. The correlation analysis revealed a stable correlation between health indicators and gross regional product, average per capita income. Social development and health indicators demonstrate a moderate positive (related to birth rate) and moderate negative (related to crime rate) correlation.

Keywords — *populational health, mortality rate, economic development, social development, region, correlation analysis*

I. INTRODUCTION

Maintaining and increasing public health and life expectancy is the priority policy of many developed countries. Populational health is one of the main sources of both regional and national socioeconomic development. However, the current model of Russian regional economic development aimed at exploring natural resources creates multiple negative consequences: environmental deterioration, increase of general and occupational diseases, high mortality rate caused by cardiovascular diseases, cancer, workplace accidents, road accidents, suicides, etc.

Western and Russian scientists study the influence of socioeconomic development on populational health. Brown J. [1], Marmot M. G. [2], Wilkinson R. G. [3], Pickett K. E. [3] analyzed the correlation between socioeconomic development and diseases and mortality rate. Rimashevskaya N. [4], Tapilina V. [5] studied the impact of welfare on public health. Kislitsyna O. concluded that health level and absolute and relative deprivation are correlated [6]. Authors studying the influence of real income, poverty and unemployment rates estimate the impact of deprivations on health directly through financial decline and subjective perception of low income [7, 8]. Scientists claim that reduced mortality rate and increased average life expectancy and life expectancy at birth are closely related to positive dynamics of national and regional socioeconomic development [9, 10].

Our work will study populational health as socioeconomic development indicator using one Russian region as an example. Kemerovo Oblast is the largest industrial region in Russia, with 56% of national coal and 80% of national coke mining, 13% of steel and cast-iron production, 23% of rolled steel production, over 11% of aluminum and 19% of coke production [11]. This large-scale industrial production has a huge negative impact on the environment, mortality rate and life expectancy, especially among men.

The aim of this research is to analyze the condition and dynamics of populational health in Kemerovo Oblast and to estimate correlation between health and socioeconomic development indicators. Doing this requires fulfilling the following objectives:

1. To analyze the dynamics and condition of public health in Kuzbass in 2002 – 2017;
2. To reveal problems with populational health in Kemerovo Oblast;

3. To carry out a correlation analysis for distinguishing a correlation between health indicators and socioeconomic development in Kuzbass.

II. MATERIALS AND METHODS (MODEL)

The informational basis of the search was the Federal State Statistics Service data on Kemerovo Oblast for 2002-2017. The criteria for selecting statistical indicators were: 1) the ability of the indicator to characterize regional socioeconomic development and living standards; 2) compatibility and availability of data for the studied period.

The selected statistical indicators characterizing health condition and regional socioeconomic development were divided into following groups.

- regional economic development: gross regional product per capita (GRP per capita), average income per capita, unemployment level estimated using MOT methods;

- regional social development: crude birth rate, the amount of population with income below living wage (poverty level), crime rate;

- regional environmental condition: the amount of air pollution, discharge of pollutants into surface water sources.

Public health in the region was described basing on official statistical data: life expectancy at birth, infant mortality rate, suicide rate, employed population mortality rate.

This article used general scientific, statistical and econometric methods: comparative analysis synthesis, statistical analysis, correlation analysis between Kemerovo Oblast health indicators and socioeconomic development indicators. For analyzing the correlation, we have applied Pearson coefficient that differed significantly from zero on $p < 0.05$ value.

III. RESULTS AND DISCUSSION

Table I demonstrates the values of health and socioeconomic development indicators of Kemerovo Oblast in 2002-2017.

First, we analyze the condition and dynamics of main demographic indicators according to state statistical data on Kuzbass [12]. Life expectancy at birth (LEB) is the key indicator of socioeconomic development. In Kuzbass, LEB of all population groups increased by almost 13% from 61.4 years in 2002 to 69.3 years in 2017. Mostly it became possible due to a reduction of mortality rate caused by cardiovascular diseases and unnatural reasons. However, in Kemerovo Oblast LEB of all population groups is lower than average Russian LEB by 3.4 years. Among men, the difference is even bigger 3.8 years, while among Kemerovo Oblast women LEB is lower by 2.7 years compared to average Russian indicators.

TABLE I. REGIONAL HEALTH AND SOCIOECONOMIC DEVELOPMENT INDICATORS IN 2002 – 2017

Indicator	Minimal value for 2002-2017	Maximal value for 2002-2017
Life expectancy at birth, years	61.4	69.3
Infant mortality coefficient	6.9	13.8
Suicide coefficient	25.6	54.0
Employed suicide coefficient	682	1115
Childbirth coefficient	10.0	13.8
GRP per capita, thousand rubles	46.9	316.3
Average income per capita, rubles	3994	21849
Unemployment level, %	6.0	9.8
Poverty level, %	9.7	23.0
Registered crime rate	1586	2501
Emissions of pollutant in the atmosphere, kgs per capita	409	511
Discharge of pollutants into surface water sources, m3 per capita	161	262

Infant mortality rate is one of the main medical and demographical indicators for the region and the country in general. In 2017, compared to 2002, infant mortality rate in Kuzbass decreased in double, from 13.8 to 6.9 cases of infant deaths per one thousand of infants born alive. Urban infant mortality dropped more significantly compared to village territories. But still, regional indicator is below average national indicator. In 2017, average Russian infant mortality rate was 5.6 cases of death per one thousand infants born alive, while in Kuzbass it was 6.9 and in Kemerovo Oblast villages the indicator was 9.5, i.e. urban areas demonstrate better dynamics of infant mortality reduction [13].

Suicide rate is the indicator of national, regional and social instability [14]. In Russia and Kemerovo Oblast suicide is listed as the most common unnatural cause of death unless other unnatural causes are not generalized. In Kemerovo Oblast, suicide rate, despite its active decline in the last 15 years, remains very high. In 2002-2017 regional suicide rate decreased by over 50%, from 54.0 to 25.6 cases of suicide per 100 000 people. However, in 2016 Kuzbass suicide indicator was 1.8 times bigger than average Russian suicide rate.

Mortality of Kuzbass residents capable to work was unstable during 2002-2006. In 2002 this indicator dropped down, while in 2003-2006 it increased. In the recent years mortality rate was decreasing. The main causes of death for this population group are unnatural reasons and cardiovascular diseases. The most common unnatural causes of death in the region are suicides (21% from the total number of unnatural deaths), accidental alcohol poisoning (13%), road accidents (10%) and fatal workplace accidents. In 2002-2010, approximately 400 people died in 30 accidents in coal industry. Starting from 2010, mortality of Kuzbass residents capable to work has been actively decreasing and according to 2017 data, 682 employable people died per 100 000 people of

this population group. However, this indicator remains very high in Kuzbass, exceeding average national one by 41% as of 2017 [13].

The comparative analysis of main demographic indicators for Kuzbass populational health demonstrates there was a positive dynamic in 2002-2017. However, the analysis reveals that regional indicators are significantly behind average Russian indicators. This means that populational health in Kemerovo Oblast is on a low level.

The analysis enabled to point out the most typical problems in Kemerovo Oblast related to populational health:

- long-term depopulation of Kuzbass, caused primarily by the fact that mortality rate exceeds birth rate;
- low life expectancy of Kuzbass men determined by the high number of unnatural deaths. The most significant prevalence of men's mortality rate over women's mortality is for 45-64 age group (in 2.6 times);
- relatively high infant mortality rate in countryside territories of the region. The most significant difference between urban and countryside areas was in 2014 (56%), 2016 (47%), 2017 (46%);
- high suicide rate in Kemerovo Oblast are both a demographic and economic problem. Cases of suicide among people capable to work are very common and exceed tolerable limits estimated by the WHO almost by 30%;
- mortality rate among Kuzbass people capable to work exceeds average Russian indicators by 41%. Such high values greatly damage the socioeconomic development of the region, due to negative consequences of early mortality. Kuzbass men aged 40-54 die in 2.6 times more often than women of the same age. This creates additional risks for negative regional development.

TABLE II. CORRELATION BETWEEN HEALTH AND REGIONAL SOCIOECONOMIC DEVELOPMENT INDICATORS

Socioeconomic development indicator	Health indicator			
	LEB	Mortality rate of population capable to work	Suicide rate	Infant mortality rate
GRP per capita, thousands rubles	.964	-.912	-.977	-.951
Average income per capita, rubles	.977	-.927	-.975	-.955
Unemployment, %	-.519	.468	.493	.557
Birt rate per 1 thousand people	.516	-.477	-.508	-.670
Poverty level, %	Weak correlation	Weak correlation	Weak correlation	.502
Crime rate	-.676	.628	.686	.831

All these problems of Kemerovo Oblast populational health are demographical, economic and social. The third part of this research was the analysis of correlation between health indicators and socioeconomic development. We have studied the correlation between LEB, mortality of population capable to work, suicide rate, infant mortality and socioeconomic development indicators. Table II includes only those Pearson correlation coefficients that differed significantly from zero on $p < 0.05$ level.

The biggest positive influence on all health indicators is provided by average income and gross regional product per capita. When these indicators increase, so do LEB, while suicide rate, infant mortality rate and mortality rate among population capable to work decrease. The economic growth indicators greatly improve populational health.

Unemployment level as an economic development factor has a negative impact on LEB and all mortality-related indicators.

Among the social development factors we have selected, the most significant negative correlation was found between crime rate and health indicators. Birth rate increases significantly when LEB rises and infant mortality and suicide rates decline.

Poverty level in Kemerovo Oblast has a moderate impact on infant mortality increase. Lack of sustainable correlation between poverty and other health indicators can be explained by lowered value poverty criterion that makes unable to provide normal reproduction.

The research revealed no correlation between health indicators and environmental condition.

IV. CONCLUSION

We have analyzed the main health problems of Kuzbass population. The most important of them are low LEB among men; men mortality rate exceeding women mortality in 45-64 age group; high infant mortality rate in countryside areas;; suicide rate exceeding WHO limits by 30%; high mortality rate among Kuzbass people capable to work. All these problems have a negative impact on the socioeconomic development of the region.

The study revealed high correlation between all health indicators and GRP and per capita income in Kemerovo Oblast. Unemployment level has a moderate impact on LEB, mortality of people capable to work, suicide and infant mortality rates.

Regional socioeconomic development indicators (birth rate, crime rate) have a moderate impact on health condition.

Basing on the research results, the priority objectives of Kemerovo Oblast socioeconomic development are the following:

- increase of GRP, average per capita income, living wage;
- reduction of poverty level and crime rate;

– reduction of mortality rate of people capable to work, men mortality caused by cardiovascular diseases and unnatural reasons;

– prevention of suicides, which share in general unnatural death rate exceeds 20;

– reduction of infant mortality rate, especially in countryside and non-urban areas.

The sustainable regional development requires improvement of all socioeconomic factors: social, economic and demographic. The increase of life expectancy reduction of mortality among infants and people capable to work, growth of economic indicators should be the foundation of Kuzbass regional development.

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