Adult Mortality in Russian Rural Areas: Inter-regional Comparisons

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Abstract. Regions of the Russian Federation draw up purpose-oriented programs aiming at improving the health and reducing the mortality among the population. The task of decreasing the mortality among the rural population, especially overcoming the phenomenon of "excess mortality" among the people of the able-bodied age, is considered a priority in the federal and regional programs for social-economic development for the nearest future. In view of this, the task of this research is to develop taxonomy of regions of RF according to the structure of mortality among their rural population, analyze the inter-regional comparisons and regression equations that include demographic, economic, social and ecological explanatory variables for different types of the regions. The paper presents a comparative analysis of mortality structure dynamics for urban and rural population of RF. The inter-regional comparisons of the Russian rural mortality structure are made. The inter-regional differentiation in terms of the level of mortality of the population and the differences between the city and the countryside are substantiated by using a set of causes and factors of both demographic and social-economic nature. For the purpose of making a deeper analysis of the territorial aspects of rural mortality, the rural territories are classified according to the structure of mortality from basic causes of death. The description of the territorial features of mortality determinants for the regions of each typological group is given. The structure of the classification groups and average parameter values are presented in the form of cartograms and tables. The regression equations including the demographic, economic, social and ecological explanatory variables are considered for both the entire RF and different types of its regions. The models derived are described from the viewpoint of significance of the influence the chosen parameters produce on the level of mortality among the rural population belonging to each classified group of the regions. The territorial features of causes of death identified in the course of the research should be taken into account when substantiating regional programs aiming to decrease the rural mortality and increase the life expectancy, as well as when drawing up and implementing rural social development programs.

Problem statement

One of the challenges in the post-crisis development of Russia is the fall of labor supply from the part of the households and the growing structural "deficiency" of personnel on the agrarian labor market. Due to the fact that the working age is entered by the cohorts of the 1990's that are small in the number, and quit by those born in the period of high fertility (late 50's and early 60's), the increase in the number of rural population of the able-bodied age observed in the recent decades has come to an end. The resulting age structure of the countryside manifests that the trend of decrease in the number of rural population of the able-bodied age is long-term. At present the number of rural population in Russia constitutes 38.2 million people, including 22.9 million people (or 59.8% as on January 1, 2010) of the able-bodied age[1]. The alternative forecast scenarios of demographic development of the countryside for the 2012-2037 period generated at the Institute of Agrarian Problems of RAS show that the able-bodied rural population of RF will get by 17.9–25.6% smaller in the number by the end of the forecast period to reach 17.1-18.9 million people. It should be noted, that the rates of decrease in the number of the population of the able-bodied ages are higher (17.9-25.6 %) than that of the rural population in general (1.9-22.2 %) throughout the forecast period[2]. Such a dynamics induces economic and social risks related to "labor shortages", growth of the demographic burden and pension system instabilities. In response to the decreasing number of the population of the able-bodied age the state programs[3] contain measures that are first and foremost aimed at improving the productivity of labor, its motivation and efficient application. Moreover, the possibility of making up for the growing labor shortage by attracting migrant workers is under discussion. In addition to that, regional purpose-oriented programs are being developed that aim to improve the health and reduce the mortality of the population. The task of

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[1] Rosstat's official website. URL: http:// www.gks.ru

[2] T.Blinova, S.Bylina. Forecast and Alternative Scenarios of Demographic Development of the Russian Countryside // Sociology. 2009, #4. P. 14-27.

[3] Concept of the Long-term Social-Economic Development of the Russian Federation for the Period Ending 2020 approved by Decree of the President of the Russian Federation #1662-r of November 17, 2008: Concept of the Demographic Policy of the Russian Federation for the Period Ending 2025 approved by Decree of the President of the Russian Federation #1351of October 9, 2007.

decreasing the mortality among the rural population, especially overcoming the phenomenon of "excess mortality" among the people of the able-bodied age, is considered a priority in the federal and regional programs for social-economic development for the nearest future.

The Concept of the Long-term Social-Economic Development of the Russian Federation for the Period Ending 2020 and the Concept of the Demographic Policy of the Russian Federation for the Period Ending 2025 set out the stages of implementation of the measures that aim to stabilize (2011-2015) and gradually increase the number of Russian population (by 2025). One of the major Russian demographic policy tasks is to increase life expectancy up to 70 years by 2015 and to 75 years by 2025[4]. As a result of the first stage of implementation of the measures that ended in 2010, the rates of natural loss of the population slowed down, the birthrate grew and the mortality dropped. The overall mortality fell by 12 % (2005-2009), and the infant mortality – by 47 %. At the same time, the mortality rate remains high for the rural population. The main causes of death among the rural residents are cardiovascular diseases, external causes (car crashes, accidental alcohol intoxication, murder and suicide) and neoplasm. The rate of mortality from these causes in rural areas generally top the Russian average by 22.5 %. A considerable improvement of the health of the population will allow reduce the mortality by one third and increase the life expectancy. For tackling with these tasks the use a differentiated approach to developing and implementing regional programs with taking into account the territorial specific features is important.

Objectives and tasks of the research

Rural areas differ not only in the types of their economic, social and demographic development, specific features of reproduction and settlement of the population, migration intensity, but also in the structure of causes of death. In light of this, the use of a differentiated approach to analyzing the structure of causes of death among the rural population seems an important principle. The task of this research is to develop taxonomy of the subjects of RF according to the structure of mortality among the rural population, analyze the inter-regional comparisons and regression equations that include demographic, economic, social and ecological explanatory variables for different types of the regions. This will help figure out the specific features of the mortality determinants and develop regional programs for reducing the rural mortality and prolonging the healthy life.

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[4] Concept of the Demographic Policy of the Russian Federation for the Period Ending 2025 approved by Decree of the President of the Russian Federation #1351of October 9, 2007.

Mortality dynamics for Russian urban and rural population

There are certain differences in both the lifetime of the rural and urban population and the structure of causes of death. The comparative dynamics of mortality for the urban and rural population of RF (1998-2009) is presented in Table 1.

Table 1 – Mortality for individual age groups of the urban and rural population of RF, people per 1000 of the population

Years	Total mortality		Infant mortality		Deceased in able-bodied age	
	urban	rural	urban	rural	urban	rural
1998	12,8	15,7	15,7	18,3	5,9	7
1999	14	16,7	16,1	18,8	6,6	7,5
2000	14,6	17,1	14,7	16,8	7,1	7,8
2001	14,9	17,3	14	16,2	7,3	8
2002	15,4	18,2	12,7	14,9	7,5	8,5
2003	15,6	18,4	11,7	13,9	7,8	8,9
2004	15,2	18	10,8	13,4	7,8	9
2005	15,3	18,3	10,3	12,7	7,9	9,4
2006	14,4	17,3	9,4	12,1	7,1	8,6
2007	13,9	16,6	8,6	11,2	6,6	8,1
2008	13,9	16,6	7,8	10,1	6,5	8
2009	13,5	16,1	7,5	9,7	6	7,6

Although the rural mortality tops the urban one, between 1998 and 2003 the rates of growth of the latter would outpace that of the former. Thus, in the aforementioned period the total urban and rural mortality respectively increased by 21.9% and 17.2%. The fall of the urban mortality, making 15.6 % (2003-2009), would also outpace that of the rural one (14.3 %). Judging by the 2009 data, the rural mortality is generally 1.2 times higher than the urban one. The infant mortality is on the decrease since 1993, when the respective figures for the urban and rural population were 19.2 and 21.4 people per 1000 people born alive. By 2009 the number of the infants who died in the age up to 1 year fell more than 2 times (by 53.4 %) and by 48.4 % for the urban and rural population, respectively, as against the level of 1999. Despite the absolute decrease in the number of the infants who died in the age up to 1 year, the proportion of this population group in the total number of the deceased practically did not change, forming 0.7-0.71 %. As for the rural mortality structure, the number of the infants who died in the age up to 1 year grew from 0.76 % in 2005 to 0.83 % in 2009.

The research points at a considerable working-age mortality contribution to the mortality growth experienced between 1998 and 2005. The highest mortality among the rural population of the able-bodied ages in the period reviewed falls on 2005, constituting 7.9 and 9.4 people per 1000 of the urban and rural population, respectively. Owing to the demographic policy measures, the "Health" national project including, the mortality among this population category respectively dropped by 24.1 % and 19.2 % for the urban and rural population. Between 2005 and 2009 the proportion of the urban population of the able-bodied age in the total number of the deceased fell from 32.9 % to 28.3 %, while that of the rural population decreased from 30.4 % to 29.8 %.

The mortality structure broken down by major causes of death as in 2009 is presented in Table 2.

Table 2 – Mortality structure by major causes of death, 2009, people per 100000 of the population

Causes of death	Total population	Urban population	Rural population
Total number of the deceased	1416,8	1347,8	1604,1
Including:			
Cardiovascular diseases	801	759	915
External causes of death	158,3	143,8	197,5
Neoplasm	206,9	214,6	186,1
Respiratory diseases	56	48,9	75,3
Diseases of the digestive	62,7	64,1	58,9
Some infectious and parasitic diseases	24	23,9	24,4

The dominant cause of death among the Russian population is cardiovascular diseases making 56.5 % of the total number of deaths. The proportion of the rural residents, who died from these diseases, equals 57 %, topping the Russian average. Deaths from neoplasm rank second for the Russian urban population (15.9 %) and third for the rural population (11.6 %), yielding to the external causes of death (suicide, murder, alcohol poisoning, car crashes, etc.) and forming 12.3 %. For the urban population the external causes of death rank third and con-

stitute 10.7 % of the causes of death in general. Compared to the rural population, the urban residents have a greater proportion of those who died from diseases of the digestive (4.8 % and 3.7 %), this cause of death ranking fourth and fifth for the urban and rural population, respectively. The fourth place in the structure of rural mortality is taken by respiratory diseases: 4.7% compared to 3.6 % in the city. Some infectious and parasitic diseases respectively cause death in 1.8 % and 1.5% of the cases with the urban and rural population of RF. High mortality from cardiovascular diseases is a common feature. While for the urban population the mortality from neoplasm and diseases of the digestive is higher than the Russian average, deaths from external causes are predominant for the rural population.

The inter-regional differentiation, as well as that between the city and the countryside, in terms of the mortality rate, can be explained by a set of causes and factors of both the demographic and social-economic nature. First and foremost, the age structure differences should be taken into account. It is generally known that different age groups have different indicators, levels and causes of death. The present-day countryside is featured by a high rate of mortality among the people of the able-bodied age. Poor control over the hygienic state of the workplaces and working conditions leads to high rates of industrial injuries in the rural areas, and the low culture of consumption of alcoholic drinks conceals a high rate of surrogate alcohol poisoning. A certain contribution to the rural mortality increase was made by the falling level and quality of life, the crisis of incomes among the rural households that took years to overcome, the high unemployment rate and criminalization of the rural socium accompanying the crisis stage of development of the agrarian economy, and the weakening influence of the state on different spheres of the social life. As the functions of the culture in forming the meaning and healthy way of life and related styles of vital behavior eased off the impact of the alcohol and drug subculture on the everyday life of the countryside grew stronger.

Classification of the subjects of RF by basic classes of causes of rural mortality

It should be mentioned that the structure of rural mortality differs considerably by regions by basic classes of causes of death. With the view to make a more profound analysis of the territorial aspects of rural mortality, we classified the rural territories according to their mortality structures.

As the type-forming factors we use proportions of the basic classes of causes of death in the total rural mortality structure. Among the basic classes of causes of death we consider cardiovascular diseases, some infectious and parasitic diseases, neoplasm, respiratory diseases, that of the digestive, and external causes of death. As a result of the classification five

macro-groups of rural areas were distinguished. The classification procedures were preceded by aggregation of the indicators for reducing the dimension by using principal-factor analysis. Two principal components with the proportion of integrated explained variance equaling 62% were derived. These principal components were used in the classification that was made by employing hierarchical cluster analysis and the SPSS statistical processing software. Table 3 presents the classification results showing the number of the regions included and average parameter values for each typological group. On the basis of the resulting classification a map was drawn depicting the distinguished types of rural areas broken down by their structures of causes of death (Figure 1). In this way the nosological profile of rural mortality for the subjects of RF we studied allowed identify the territorial features of the structure of causes of death, which can be used when developing regional strategies for reducing the rural mortality.

Table 3 – Classification of the subjects of RF by basic classes of causes of death (average percentages of the total number of cases)

Classes	Subjects	Basic classes of causes of death					
		Some infectious and parasitic diseases	Neoplasm	Cardio-vascular diseases	Respiratory diseases	Diseases of the digestive	External causes
RF	84	1,52	11,60	57,04	4,69	3,67	12,31
1	23	1,81	13,31	57,13	3,45	3,96	11,47
2	30	2,56	11,33	46,37	5,18	4,49	19,97
3	3	1,15	9,64	49,77	11,64	3,87	15,86
4	25	0,96	10,36	62,59	4,05	3,28	11,06
5	3	0,78	10,47	53,17	4,07	2,74	9,25

* Calculated by using the Rosstat data. URL: http:// www.gks.ru

Like in the preceding years, in 2009 the dominating cause of rural mortality in RF was cardiovascular diseases. Therefore, when making the classification we took into account the combination of prevailing diseases differentiating the regions of the groups from each other.

The first group includes 23 regions of RF representing practically all of its Federal Okrugs: Moskovskaya, Jaroslavskaya, Leningradskaya, Murmanskaya, Astrahanskaya,Volgogradskaya, Rostovskaya, Orenburgskaya, Sverdlovskaya, Chelyabinskaya, Novosibirskaya Oblasti; Respubliks: Kareliya, Adigeya, Ingushetiya, Kabardino-Balkariya, Karachaevo-Cherkessiya, Nouth Osetiya-Alaniya, Chechenskaya; Kraya: Krasnodarskiy, Stav-

ropolskiy, Altaiskiy, Kamchatskiy; Hanti-Mansiiskiy Avtonomous Okrug. The regions of this group are featured by a high rate of rural mortality resulting from the majority of causes of death, that from neoplasm being especially high. Thus, the regions belonging to the first group show the highest rates of rural mortality from the entire range of causes of death, a specific feature of the regions of this group being the high mortality from cancer.
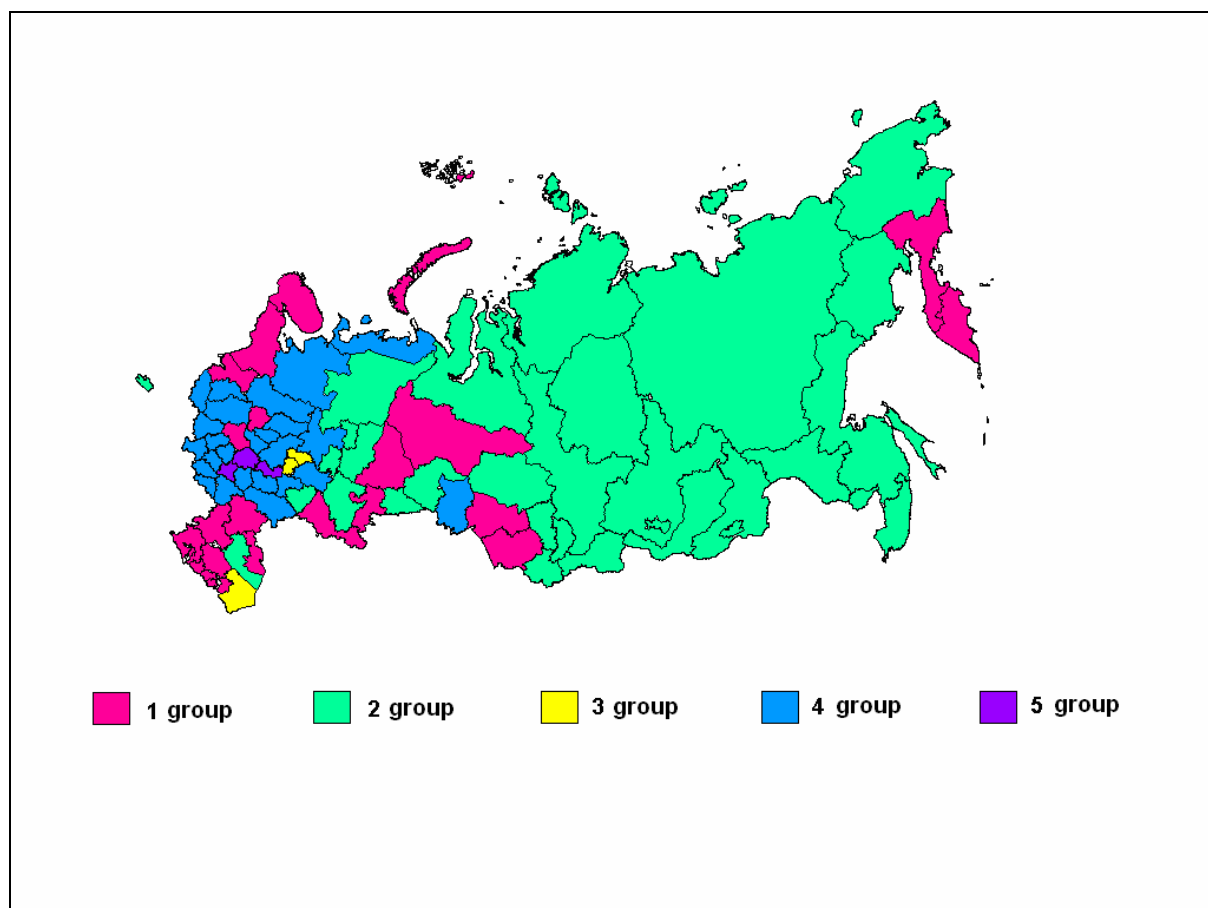

Figure 1. Typology of Russian regions by proportions of rural mortality by causes of death

The second group consists of 30 regions – mostly representatives of the Siberian and Far Eastern Federal Okrugs: Respubliks: Komi, Kalmikiya, Bashkortostan, Udmurtiya, Altai, Buryatiya, Tuva, Hakasiya, Saha (Yakutiya); Avtonomous Okrugs: Yamalo-Nenetskiy, Taimirskiy, Evenkiyskiy, Buryatskiy, Chukotskiy; Evreiskaya Avtonomous Oblast; Kraija: Zabaikalskiy, Permskiy, Krasnoyarskiy, Primorskiy, Habarovskiy; Kaliningradskaya, Samarskaya, Kurganskaya, Tumenskaya, Irkutskaya, Kemerovskaya, Tomskaya, Amurskaya, Magadanskaya, Sahalinskaya Oblasti. Mortality from external causes in all of these regions tops the Russian average. Thus, the regions of the second group experience the most unfavorable situation among the rural areas of RF in terms of causes of death having the social nature.

3 regions demonstrating the highest proportions of the deceased from respiratory diseases were placed in the third group, that being the Mari El, Chuvash and Dagestan Republics.

The fourth classification group is comprised of 25 regions with the core mostly consisting of the subjects of the Central and Northwest Federal Okrugs: Nenetskiy Avtonomous Okrug;, Respublik Tatarstan; Oblasti: Arhangelskaya, Novgorodskaya, Nizhegorodskaya, Belgorodskaya, Penzenskaya, Saratovskaya, Orlovskaya, Bryanskaya, Vladimirskaya, Tverskaya, Ulianovskaya, Kaluzhskaya, Kostromskaya, Pskovskaya, Tambovskaya, Ivanovskaya, Smolenskaya, Kirovskaya, Tulskaya, Voronezhskaya, Vologodskaya, Kurskaya, Omskaya. The regions of the fourth group show the highest rural mortality from cardiovascular diseases.

Three regions – the Ryazan and Lipetsk Oblasts and the Republic of Mordovia – were assigned to a separate group, since only these subjects of RF have rural mortality resulting from all the causes of death under consideration lower than the Russian average.

In addition to being an academic task, studying the territorial features of rural mortality is of a high practical significance. Taking these territorial features into account when developing and pursuing strategies aimed to improve the quality of public health will help use the respective resources of the state more efficiently. The classification made can be employed when developing priority state policy measures aimed at reducing the mortality among the rural population. The existence of inter-regional differentiation among the rural areas means that different approaches to selecting and implementing the respective regional strategies should be applied.

Results of evaluation of regression equations

For the first, second and fourth groups we evaluated the regression equation that includes explanatory variables (demographic, economic, social, ecological, behavioral). The majority of the models applied in empiric research comprise reference indicators, the most important of which are the level of economic development, social environment, spending on health care, age structure of the population, households' incomes, indicators of poverty, unemployment and etc. At the same time, when a research is targeted at some particular class of causes of mortality (or a narrower range of research tasks) the list of variables may be modified by either adding or excluding these or that features that are of interest (or not) within that particular research. Particularly, microeconomic studies imply making a more profound analysis of the individual and family characteristics related to the sample features. For in-

stance, Denisova[5] captures a wider range of variables as she studies the determinants of Russian adult mortality controlling for both individual and household heterogeneity. Although confirming the crucial role of excessive alcohol consumption in shaping adult mortality risks in Russia, the results are original in several other respects. They find empirical support for the importance of relative status measured in non-income terms in shaping mortality hazards. They find evidence of the influence of labor market behavior, and sectoral and occupational mobility in particular, on longevity.

Our regression equation includes five groups of indicators - ecological, demographic, economic, social and behavioral – that reflect the regional situation. For their approximation the following variables were used:

1. Percentage of pensioners in the population structure (demographic characteristics of the region), X_1;

2. Amount of Gross Regional Product (GRP) per capita, ln, (economic characteristics of the region), X_2;

3. Consolidated budget spending on health care, physical culture and sport (social sphere characteristics of the region), X_3;

4. Percentage of the population having incomes below the living wage (population social structure characteristics of the region), X_4;

5. Number of alcoholics on the books with health care settings per 100000 of population (different population groups' behavioral characteristics representing pernicious habits), X_5;

6. Number of reported crimes per 100000 of population (degree of safety of the region's social environment), X_6;

7. Unemployment rate in per cent as calculated by using the International Labor Organization (ILO) methodology (labor market characteristics of the region), X_7;

8. Polluted wastewater discharges into surface water bodies, X_8, and emissions of air pollutants, X_9 (ecological characteristics of the region).

Income differentiation was additionally considered. It was assumed that considerable (excessive) inequality can lead to a decrease in the rate of investments in human capital re-

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[5] Denisova, Irina (2010). Economics of Transition, Vol. 18, Issue 2, pp. 333-363. Walberg, Peder, Martin McKee, Vladimir Shkolnikov, Laurent Chenet and David A. Leon. (2009). "Economic Change, Crime, and Mortality Crisis in Russia: Regional Analysis." British Medical Journal 317:312–318. Deaton, Angus (2003). "Health, Inequality, and Economic Development," Journal of Economic Literature, 41, 1, pp.113-58.

stricting economic access to high-tech health services, quality food products and increasing the risk of morbidity and mortality.

Mortality rate regression dependencies on the chosen indicators were constructed. Models with regression coefficients of 5% relevance and multiple determination coefficients above 0.7 were picked out. Parameters of the resulting dependencies are presented in Table 4. Models were made for RF as a whole, and individually for the groups of regions formed when classifying the rural areas according to major causes of death. For the third and fifth groups that are small, including just 3 regions each, models were not made.

Table 4 – Parameters of models of multiple linear regression of rural mortality dependence on regional social-economic data, 2009

Group number	Constant	X_1	X_3	X_4	X_5	X_6	X_8	R^2
RF	2,826	0,697	0,820	–	0,002	0,001	–	0,862
1	-2,912	0,612	–	–	0,001	0,001	–	0,949
2	14,651	0,345	0,877	0,093	0,002	–	0,004	0,792
4	1,823	0,927	1,408	–	–	0,003	–	0,779

Analyzing the dependencies derived we can draw the following conclusions. The rate of spending by the state on health care, physical culture and sport appears to be the parameter exerting the most critical influence on the level of mortality among the rural population of RF in general. The existing demographic structure and proportion of rural pensioners rank second in terms of their impact on mortality. A minor contribution to the rural mortality rate can be seen from the side of "different population groups' behavioral characteristics" and "degree of safety of the social environment".

For the regions of the first group experiencing high rural mortality from most of the causes of death, the most important factor of influence turned out to be just the demographic characteristics of the region. "Different population groups' behavioral characteristics" and "degree of safety of the social environment" also produce a certain influence on the rural mortality rate in the regions of the group. The rest of the parameters considered do not produce any noticeable influence.

For the regions of the second group showing high rural mortality from the causes of death having a social nature, the most significant factor of influence is the social sphere characteristics of the region. A considerable contribution to the rural mortality rate is made by the

demographic structure of the population of this group of regions. In addition to that, such factors of influence like population social structure characteristics, behavioral characteristics representing pernicious habits and ecological disturbances in the form of polluted wastewater discharges into surface water bodies can be observed.

Budget spending on health care and maintenance of the healthy way of life affects the rural mortality the most in the case with the fourth group of regions demonstrating the highest rural mortality from cardiovascular diseases. An important role from the viewpoint of the mortality rate is also played by the proportion of pensioners in the total rural population. Another parameter included in the model is the degree of safety of the social environment.

Linking rural mortality rates with social, economic, demographic and ecological characteristics on the level of both RF and groups of its regions classified according to the rates of mortality from major causes of death, these models allow define approaches to choosing and implementing regional strategies aimed to improve the health of the rural population, reduce the mortality rate and increase the longevity.

Conclusion

The existing trends and structure of causes of mortality among the rural population, on the one hand, reflect drawbacks in the health care system and rural social development strategies and, on the other hand, are clear indications of the quality of life of the population, which is proven by the derived dependencies of mortality on factors of social-economic development of the countryside. Developed countries efficiently apply measures designed to reduce the avertable mortality. Radical improvement of the health care system, prophylaxis and diagnostics of endogenous diseases, formation of healthy-way-of-life attitudes, provision of safe labor conditions and improvement of the quality of life are among the measures that can help reduce the mortality. Since a considerable part of the loss is contributed by social groups living on the verge of poverty and marginal population strata that have lost their life chances, the challenge of overcoming the poverty comes to the fore. It is important to encourage the population to live a healthy life and to consolidate health promotion institutions and infrastructures. At the same time, the social policy for improving the quality of human resources should not be aimed at providing a better access to free medical aid and improving the quality of paid services alone, but at creating safe living conditions for the people as well. Drastic improvement of the system of emergency health care for those involved in car accidents, formation of healthy-way-of-life attitudes, provision of safe labor conditions, improvement of the level and quality of life and pursuance of efficient rural social development strategies on the regional

level can be instrumental in reducing the mortality from external causes. Taking into account the regional features of the structure of causes of death when working out active demographic policy measures would enable to apply a differentiated approach to drawing up and implementing rural social development programs.