

SCIENTIFIC AND METHODOLOGICAL APPROACHES TO RISK ANALYSIS IN HYGIENE AND EPIDEMIOLOGY

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ASSESSMENT OF ECONOMIC LOSSES ASSOCIATED WITH RISK FOR LIFE AND HEALTH OF INCAPACITATED PERSONS

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There are some general approaches to assessment of economic losses associated with mortality and morbidity. However these methods are utilitarian and population is considered as labor forces. That is why incapacitated persons are not frequently included in such calculations.

Authors offer to take Russian methodology as a basis and correct it taking into account a fact that population is not only a present day labor forces. In prospect an individual is able to renew labor forces. Other words not only future work but "future children" should be considered in economic assessment of losses associated with child mortality. Besides individuals not only "produce" but "consume". Growth of consumption increases demand and leads to GDP growth. In the same time expenditures increase production volume more than amount of expenditures. Ripple effect activates – ability of expenditures to induce returns growth more than expenditures associated with this growth.

Key words: economic losses associated with mortality and morbidity, economic assessment of risk for life and health, incapacitated persons, GDP, taxes.

In terms of stable social development the accounting of losses (prevented losses) for the health and life of population is the necessary condition for assessing the efficiency of the activity of governmental authorities. The state is able to assess the cost of the human economic activity period (more specifically, the reduction of this period) through the impact of the economic activity period value on the main social and economic indicators (gross domestic product for the country and gross regional product for the region) [1, 4, 5].

The existing methods for economic assessment of losses (risk) to the life and health of population in general and methodology for calculating the economic losses from the mortality, morbidity and disablement of population in particular are based on the cost evaluation of disability period, excluding actually from the category "population" its disabled part [4]. At the same time, the social function of state provides the creation of conditions for all the members of society.

The clear understanding of effects from the "presence" of human in economy is of great importance for the economic assessment of (prevented) losses associated with risk for health, including prevented one, for any categories of population. Accordingly, having determined them, it will be possible to make the conclusions on how the losses (consequences) will be if the human is excluded from economy as the subject of relations, temporary or due to death. Such effects can be deferred. In this relation it is necessary to assess the consequences of disease (death) of human, including the prevented one.

For this it is necessary to have clear understanding of the role of human in the economic relations. And, regardless of the common and stable hypothesis on that the "life of human is priceless" the demand for cost evaluation exists, in particular, for the state social policy. The necessity to compare the expenses and results (first, for the governmental authorities [3]) stipulates the need of

such assessment.

The theory of assessment proposes three main approaches: income, cost and comparative. Thus, the approach which considers the population as the state labor forces, i.e. in relation to the future money flows generated by them, became the most apparent. The assessment is based on the disability period (disability period reduction), and it is proposed to assess namely this period (through the losses in the production of gross domestic or regional product). Therefore, this approach can be applied in full only for the working population.

To assess the possible losses from the mortality and morbidity among the population of unemployable age it is necessary to determine which function in economy is performed by this category of citizens [2]. The definition of category "population of unemployable age" differs in the different countries, but in general having generalized its sense it is possible to say that the incapacitated persons (by age) included the people which are younger than the legislatively established working age (as a rule, up to 16 years old) – children, as well as the people older than the working age (from 55-70 years and more) – pensioners. Children are the future working population which will create the GDP in future periods, incur the certain expenses associated with life activity, and generate the consumer demand in economy as well as form and diversify the GDP structure. But, in addition to the direct participation in the "GDP production" "today's children" are "future parents", i.e. it is important to understand that human acts not only as labor force but also reproduces this labor force. It is feasible to consider the "future children" for assessing the losses in case of death of female population younger than the working age. The pensioners are an inactive part of population which created GDP in the past periods. But in the current period the pensioners are getting the pensions of different types using which they generate the consumer demand in economy. The pensions as the form of inter-budgetary transfers perform not only the social function (care of society, well-deserved honour for work) but are also reproduced in GDP through the everyday expenses.

Thus, the human in economy is a labor resource, resource for the reproduction of labor resources and consumer of the results of economic activity (which ensures the demand). Therefore, the exclusion of human as the subject of economic activity will result in the exclusion of human as

labor resource, participant of reproduction and consumer in economy.

Currently, the assessment of losses from the mortality and morbidity of population uses the approach (within the income approach in the theory of assessment) which considers the population as the state labor resources, i.e. in relation to future money flows generated by them. The methodology for calculating the economic losses from the mortality, morbidity and disablement of population is used as the normative basis for calculation (Order of the Ministry of Economic Development of the Russian Federation, Ministry of Health and Social Development of the Russian Federation, Federal State Statistics Service No. 192/323n/45n/113 dd. April 10, 2012).

It is feasible, having taken the methodology adopted in the Russian Federation, to correct it taking into account the distinguished additional deferred effects in the economy, namely, to consider the fact that the population today is not only the labor resources. In perspective, the human is able to reproduce the labor resources. In other words, not only the future work for the benefit of the state but also the "future (potential) children" shall be taken into account during the economic assessment of losses from the children population mortality. In addition, the human not only "produces" but also "consumes". That is to say, in addition to that the human produces the social product contributing by this to its total volume he acts as consumer in the economy (that is especially urgent for understanding of economic role of the nonworking population). The increase in consumption increases the demand and results in the GDP growth. Herewith the expenses increase the volume of production by value bigger than the volume of expenses. The multiplier effect works – ability of expenses to cause the increase of incomes bigger than the expenses caused this increase.

The algorithm for assessing the economic losses associated with the risk for the life and health of population is based on the methodology for calculating the economic losses from the mortality, morbidity and disablement of population. The approaches proposed in the methodology (predominantly for working population) are supplemented by the assessment of deferred effects for economy. Schematically the existing approaches and approaches proposed within the study are shown in fig. 1.

The proposed approaches to the economic assessment of losses from the mortality and morbidity

ty of incapacitated persons does not contradict to the adopted guidances but supplement the range of the assessment objects (incapacitated persons) for the state management of risks to the health and life of population.

Fig. 1 demonstrates the additional components (in relation to the methodology for calculating the economic losses from the mortality, morbidity and disablement of population) in the economic assessment of losses associated with the risk for the life and health of population. The degree of detailing in the calculations can be different, depending on the available information (taking into account the peculiarities of statistical observation in the Russian Federation under the separate governmental authorities and structures) and comparability of data (from different sources). If there is no data on the sex-age structure (by the mortality or morbidity under the classes of diseases) it is possible to carry out the simplified calculation for

the whole population with division into children population, working population and population of pension age (available grouping under the open data).

The algorithm for assessing the economic losses from the mortality and morbidity of incapacitated persons based on the methodology for calculating the economic losses from the mortality, morbidity and disablement of population taking into account the supplements is shown in fig. 2. As the first stage the algorithm provides the assessment of losses under GDP (GRP) from the mortality and morbidity of incapacitated persons under the methodology for calculating the economic losses from the mortality, morbidity and disablement of population in relation to the assessment of losses from morbidity for the share of working population among the incapacitated persons and assessment of losses from mortality for all the categories of population.

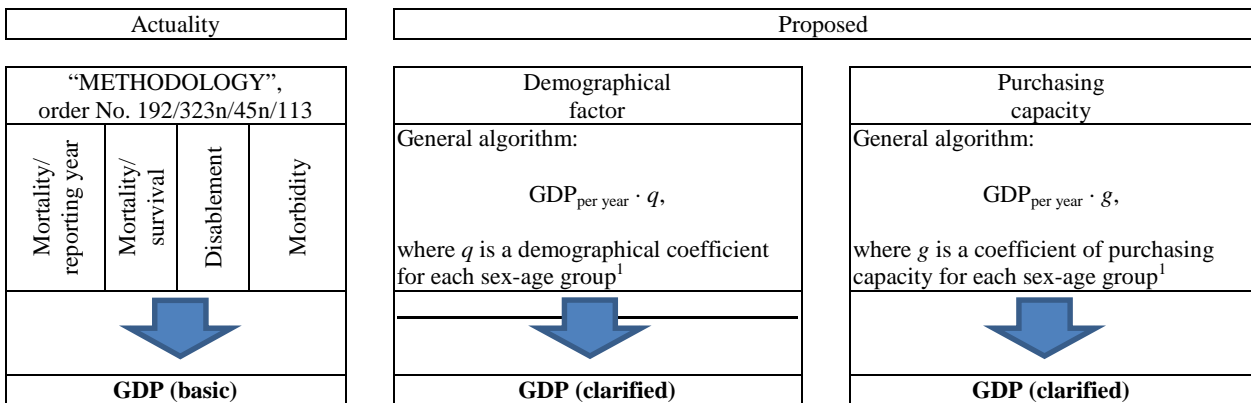


Fig.1. Scheme of correction of methodology for calculating the economic losses from the mortality, morbidity and disablement of population

¹ If the demographical factor and consumption are taken into account, it shall be performed not only for the children and pensioners, but also for the other sex-age groups

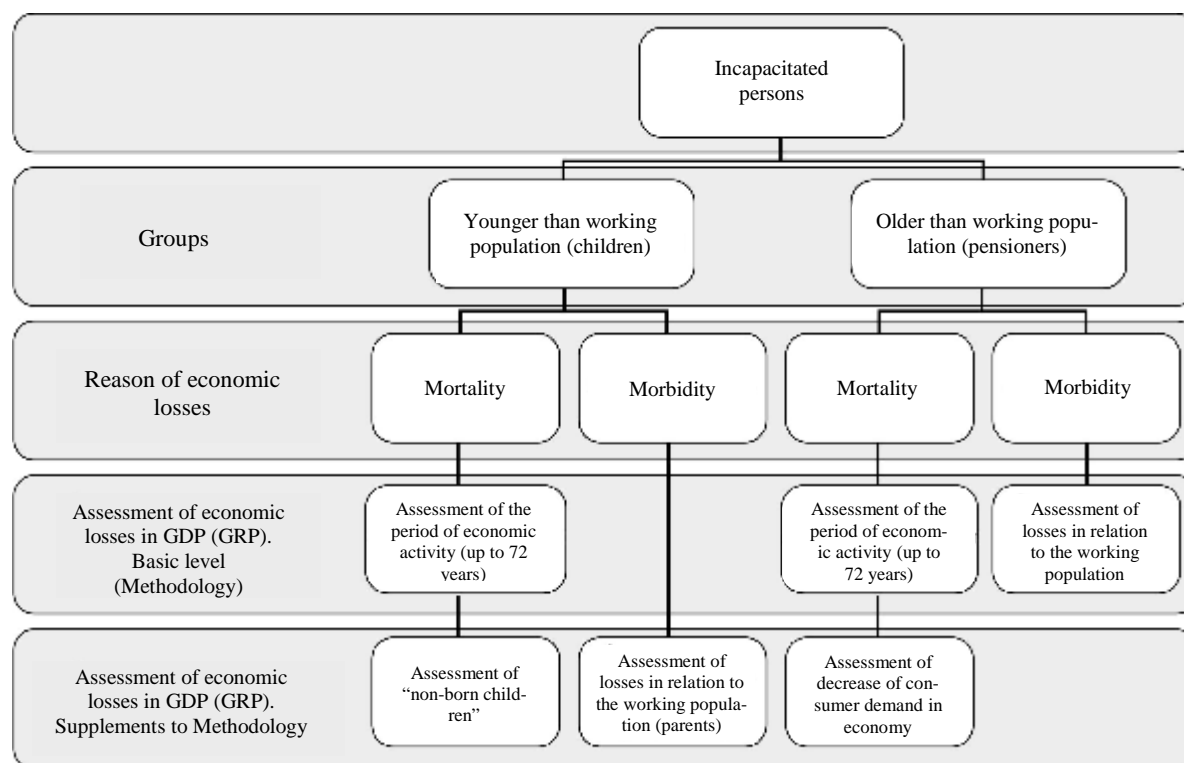


Fig. 2. Algorithm for assessing the economic losses from the mortality and morbidity of incapacitated persons based on the methodology for calculating the economic losses from the mortality, morbidity and disablement of population [6]

The losses in GDP (GRP) in relation to evaluating the disability period of their parents (in the share of executed sickness certificates) are evaluated to assess the losses from the morbidity of children population.

The next step is the correction of the specified parameters, taking into account the demographical factor and consumption in economy:

- to assess the lossess of GDP (GRP) from the mortality of female children population the correction is performed by the childbearing rate;

- to assess the lossess of GDP (GRP) from the mortality of population older than working age the correction is performed by the coefficient of consumption in economy.

The algorithm for assessing the economic losses from the mortality and morbidity of incapacitated persons based on the methodology for calculating the economic losses from the mortality, morbidity and disablement of population provides the complete “picture” of existing (adopted in the Russian Federation) approaches to the assessment and its components proposed within this study for incapacitated persons.

The logic for the calculation of losses in GDP from the mortality of children population, taking into account the participation of human in the reproduc-

tion is as follows: the calculation is based on the sum of geometric progression (conventional produced GDP is a member of progression, the demography coefficient is a ratio of progression).

The simplified assessment of economic losses in GDP, taking into account the participation in reproduction provides the accounting of one “non-born” generation, and the calculation will be as follows;

$$BB\Pi_{\text{д}}^* = BB\Pi_{\text{pac}} \times q, \quad (1)$$

where $GDP_{\text{д}}^*$ is the potential losses in GDP for “non-born” children; GDP_{calc} is a rated calculated GDP (the whole life for “survival”) for this sex; q is a ratio of the number of born children per one person (per one woman) in accordance with age group. For example, if in average the woman in the Russian Federation during her life gives birth to 1.5 children, the coefficient q for category “children” (females) will be equal to 1.5.

This correction by demographical factor is performed only for the female children population.

The logic for assessment of losses in GDP, taking into account the participation of human in the consumer demand, is built according to one of the GDP calculation methods (in accordance with Rosstat methodology).

The income use method provides that the following is taken into account during the GDP calculation: final consumption, investment, government expenditures and net export. The final consumption includes the expenses for satisfying the final needs of individuals or society performed by the following institutional sectors: household sector, sector of governmental authorities (governmental sector), sector of private nonprofit institutions servicing the households. Accordingly, the incapacitated persons, even not manufacturing new product, affect the size of GDP ensuring the consumption in economy (in certain relation).

The simplified option, taking into account the peculiarities of statistical observation in the Russian Federation, can be as follows:

$$\text{BBП}_{\Pi}^* = \text{BBП}_{\text{расч}} \times g, \quad (2)$$

where GDP_p^* is the potential losses in GDP “taking into account the consumption in economy”; GDP_{calc} is a rated calculated GDP¹.

$$g = \frac{\text{Расх. на конеч. потреб.}}{\text{BBП}} \cdot \frac{\text{Расх. на конеч. потребл. д/х}}{\text{Расх. на конеч. потреб.}} \cdot \frac{\text{Расх. потр. ПВгр}}{\text{Расх. на конеч. потребл. д/х}} \quad (3)$$

g is calculated under the statistical data for the last 5 years.

$\frac{\text{Расх. потр. ПВгр}}{\text{Расх. на конеч. потребл. д/х}}$ is a ratio of expenses for final consumption of the certain sex-age group to the expenses for final consumption of households.

The correction for participation in consumer demand is applied only to assess the losses in GDP (GRP) from the mortality of population (including the incapacitated persons) since this approach is not appropriate for the cases of diseases – the decrease of consumption does not occur, but the consumption structure is changed (expenses for medications and treatment).

Thus, in general, the economic losses in GDP, taking into account the probability of survival, participation of human in reproduction and consumer demand in the economy can be clarified:

$$\begin{aligned} \text{YBC}(\Delta, n)_{x,s,d} &= \\ &= \text{YBC}_{x,s,d} + \text{YBC}(\Delta)_{x,f,d} + \text{YBC}(n)_{x,s,d}, \end{aligned} \quad (4)$$

where $\text{UVS}(d, n)_{x,s,d}$ is a lost profit (prevented losses) in the GDP production as a result of mortality of persons in the age (x) of sex (s) due to the death (d) in the Russian Federation in the reporting year, taking into account the probability of survival, birthrate, level of employment and level of consumption in the economy resulted from the mortality of persons;

$\text{UVS}_{x,s,d}$ is a lost profit (prevented losses) in the GDP production as a result of mortality of persons in the age (x) of sex (s) due to the death (d) in the Russian Federation in the reporting year, taking into account the probability of survival and the level of employment resulted from the mortality of persons (according to the methodology, order No. 192/323n/45n/113 dd. April 10, 2012);

$\text{UVS}(d)_{x,f,d}$ is a lost profit (prevented losses) in the GDP production as a result of mortality of persons in the age (x) of sex (s) due to the death (d) in the Russian Federation in the reporting year, taking into account the probability of survival, birthrate and the level of employment resulted from the mortality of persons

$$\text{YBC}(\Delta)_{x,f,d} = \text{YBC}_0 \times q_x, \quad (5)$$

where UVS_0 is a lost profit (prevented losses) in the GDP production as a result of the death of human in the Russian Federation in the reporting year, taking into account the probability of survival (during the whole life) and the level of employment resulted from the mortality of persons (according to the methodology, order No. 192/323n/45n/113 dd. April 10, 2012);

q_x is a ratio of the average number of the born children per one woman during the period of life starting from the age (x). For $x \leq 16$ the coefficient q is equal to the birthrate in the Russian Federation, for $16 < x < 55$ the coefficient q is equal to the birthrate in the Russian Federation multiplied by 0.5 where 0.5 is a coefficient which takes into account the distribution of periods for delivering of children during the reproductive period;

$\text{UVS}(n)_{x,s,d}$ is a lost profit (prevented losses) in the GDP production as a result of mortality of persons in the age (x) of sex (s) due to the death (d) in the Russian Federation in the reporting year, taking into account the probability of survival and the level of employment and level of consumption

¹ GDP per 1 person.

in the economy resulted from the mortality of persons.

$$YBC(n)_{x,s,d} = YBC_0 \times g_x, \quad (6)$$

where g_x is a ratio of expenses for final consumption of persons in the age (x) to GDP in the reporting year. For $16 < x < 60$ in men and $16 < x < 55$ in women the coefficient g is equal to the ratio of the average annual sum of expenses for the final consumption of households to GDP in the reporting year. For $60 \leq x$ in men and $55 \leq x$ in women the coefficient g is equal to the ratio c of the average annual sum of expenses for the final consumption

households the heads of which are in the age of 60 years and more to GDP in the reporting year.

Therefore, taking into account the effects (consequences) from the mortality and morbidity of population (including the nonworking population), the assessment of losses in GDP (GRP) can be corrected considering the demographical factor and participation of population in the consumer demand. In addition, the proposed approaches extend the tools for assessing the losses by the indicators of the assessment of losses under the tax revenues associated with mortality and morbidity of population or the risk of disease and death.

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