

PREVENTIVE MEDICINE. URGENT ASPECTS OF RISK ANALYSIS

UDC 614.3/4

DOI: 10.21668/health.risk/2017.3.02.eng

ON ASSESSMENT OF ROPOTREBNADZOR SURVEILLANCE AND CONTROL ACTIVITIES EFFICIENCY IN REGIONS: ASSESSMENT CRITERIA BEING PREVENTED ECONOMIC LOSSES CAUSED BY POPULATION MORBIDITY AND MORTALITY AND ASSOCIATED WITH NEGATIVE IMPACTS EXERTED BY ENVIRONMENTAL FACTORS

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The paper outlines the results of calculating actual and prevented economic losses caused by population mortality and morbidity and associated with negative impacts by environmental factors the prevention of which resulted from surveillance and control activities. Rospotrebnadzor bodies and organizations efficiency was assessed in Leningrad region, Bashkortostan, and Chelyabinsk region, and we give the results of this assessment. Not less than 25 environment parameters were examined in each region (air in rural and urban settlements, drinking water, soils in settlements); we examined population morbidity parameters both for children and adults in terms of death causes and morbidity as per 16 diseases categories (as per ICD-10); we also took not less than 20 features of surveillance and control activities. All regions had apparent and measurable risk factors for population health related to environment quality which didn't conform to hygienic requirements and standards. All risks caused additional deaths and diseases among children and adults. In 2015 additional mortality and morbidity cases associated with environmental factors caused economic losses of regional gross product in each region and they were equal to 1-2.5 billion rubles. Surveillance and control activities performed by the Federal Service for Surveillance over Consumer Rights Protection and Human Well-being helped to prevent deterioration of air, drinking water and soils in settlements. As a result, approximately 700 additional deaths and from 70

Ó Kiryanov D.A., Tsinker M.Yu., Istorik O.A., Stepanov E.G., Davletnurov N.Kh., Efremov V.M., 2017

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to 16 thousand additional diseases among children and adults were prevented in each region. Prevented economic losses in the examined regions varied from 1.0 billion rubles in Chelyabinsk region to 2.3 billion rubles in Bashkortostan. Economic efficiency of surveillance and control activities in the sphere of providing sanitary and epidemiologic safety of the population varies from 18 to 27 rubles per 1 ruble of costs in the examined year.

Key words: Rospotrebnadzor, surveillance and control activities, population health, environment, efficiency, mortality indexes, losses of regional gross product.

State authorities in the RF are now being reformed and issues of assessing control and surveillance efficiency are considered to be especially vital in the process. It is proven by regulations which are included into "A concept of increase in efficiency of surveillance and control activities performed by state and local authorities for 2014-2018: a project" [6], "On improving efficiency of surveillance and control activities performed by federal executive bodies: A project of the Presidential Order (worked out by the RF Ministry of Economic Development on October 04, 2016)" [10], and other state strategic documents [12].

A transfer to a risk-oriented approach requires not only lowering administrative barriers for business but above all preventing losses of public values which are protected by the state [4,5]. A trend in improving assessments of surveillance authorities activities in Russia fully corresponds to international practices and proves there is evolution both in getting greater insights into state control (surveillance) efficiency and its role in achieving socially significant results and in state authorities being ready to take on responsibility for risk levels in the spheres under surveillance and their minimization [3, 9,14].

From the point of view of the Federal Service for Surveillance over Consumer Rights Protection and Human Well-being, control and surveillance efficiency first of all entails lowering risks of human environment contamination and improving population health [11,13]. New methodical approaches have been recently created and implemented into Rospotrebnadzor practic-

es; these approaches enable assessing medical and demographic losses which become preventable due to the Service activities and it has become a very important result in solving tasks on assessing efficiency of its activities. "Calculation of actual and prevented economic losses caused by population mortality, morbidity and disability and associated with negative impacts exerted by environmental factors which were prevented due to surveillance and control activities: Methodical guidelines" [8] were created allowing for "The methodology for calculating the economic cost of mortality, morbidity and disability in the working population: Guidelines" (approved by the Order of the RF Ministry for Economic Development, RF Public Healthcare Ministry, RF Ministry of Finance, and Federal Statistics Service on April 10, 2012 No. 192/323n/45n/113) [7] and approved by the RF Chief Sanitary Inspector on October 23, 2014. The documents grants sanitary-epidemiologic surveillance authorities a possibility to assess final results and to show real significance of its functioning to state authorities, business, and civil society.

Methodical guidelines are even more vital as economic efficiency assessment is based on the calculation of prevented GDP losses and GDP growth is one of the state strategic goals. Consequently, assessment results as per actual and preventable losses can be of interest for decision-makers from regional executive bodies, local authorities, territorial authorities, and any other federal executive bodies [16].

Calculation of regional economic losses caused by population morbidity and mortal-

ity which were prevented by control and surveillance activities aimed at providing sanitary and epidemiologic welfare entails sequential consideration and parameterization of several sections in one chain: assessment of correlation between living environment quality and population health parameters; assessment of correlation between measuring environmental objects quality and Rospotrebnadzor control and surveillance activities results; calculation of a number of health disorders prevented due to Rospotrebnadzor bodies and offices control and surveillance activities and economic assessment of such cases based on the detected dependencies.

Our research goal was to assess efficiency of control and surveillance activities accomplished by Rospotrebnadzor bodies and offices in regions similar as per social and economic development and sanitary-hygienic problems; our assessment criteria were economic losses caused by population mortality and morbidity which were associated with negative impacts exerted by environmental factors and which were prevented due to Rospotrebnadzor activities.

Our research objects were Republic of Bashkortostan, Leningrad region, and Chelyabinsk region, all three being the RF regions with developed industries, apparent problems with environmental contamination and considerable population (totally about 10 million people live in these regions).

Data and methods. We determined calculated economic damage related to population mortality and morbidity as a part of GDP or GRP which was not produced due to a share of economically active population who dropped out of production processes [2,8]. Losses related to mortality were calculated on the basis of 0.5 year of economic activities per each case; losses related to morbidity were calculated on the basis of an

average duration of one temporary disability case which was equal to 14 days.

We used the following initial data for our calculations: environment parameters in the regions registered in statistic forms on economic branches accounting No. 18 "Data on sanitary situation in the RF regions" and in databases of the Federal fund for social and hygienic monitoring ("Environment" section); demographic and medical statistics data (forms 1-C; 1-health, 32-health, etc.); "Data on the results of accomplishing Federal state surveillance by Rospotrebnadzor territorial offices" reports; and other data taken from the official statistics (regional population, gross regional products values, etc.).

We allowed for not less than 25 environment parameters as per each region (atmospheric air in urban and rural settlements, drinking water, soils in settlements); adults and children mortality as per causes and morbidity with 16 diseases categories (as per ICD-10); not less than 20 properties of surveillance and control activities.

We applied unified mathematical dependencies in "environment - health - control and surveillance activities" system for all the examined regions; these dependencies were obtained as a result of processing all the aggregated data collected in the whole country over 3 previous years. Thus, for example, relative mortality of children aged 0-17 and retired people was authentically related to a share of atmospheric air samples taken in urban and rural settlements with nitrogen dioxide, suspended substances, and aromatic hydrocarbons contents exceeding MPC ($p < 0.05$, $R^2 = 0.233$ for children and 0.249 for retired people). We determined and parameterized correlations between circulatory system diseases both in children and adults and frequency of drinking water taken from communal drinking water supply not conforming to hygienic

standards as per sanitary-chemical parameters ($p < 0.05$, $R^2 = 0.118$). We revealed that increased water hardness, increased concentrations of iron, manganese, aluminum, chlorine, and chlorine-organic compounds were related to diseases of digestive organs, circulatory system, skin and subcutaneous tissue, musculoskeletal system, blood, blood-making organs, and certain disorders involving immune mechanisms. Violation of sanitary standards as per microbiological factor is authentically related to infectious diseases frequency, including epidemics ($p < 0.05$, $R^2 = 0.102 \div 0.472$).

If we take the RF as a whole, we can see that the most efficient research is that during which sanitary legislation violations

were detected; unscheduled inspections; inspections involving laboratory and instrumental research techniques. Decrease in a share of atmospheric air samples and water samples not conforming to standards is authentically related to frequency of initiated proceedings on administrative offences and passed rulings on administrative punishments imposed on industrial enterprises and water supply facilities etc.

Basic results. Analysis of data on environment quality in the examined regions revealed that there were common problems in all of them related to it being not corresponding to hygienic requirements and standards (Table 1).

Table 1

Basic parameters of environmental quality in the regions and its conformity to hygienic requirements and standards, 2015

Environmental quality parameter	Bashkortostan	Leningrad region	Chelyabinsk region
A share of the examined samples taken from centralized water supply and not conforming to hygienic standards as per microbiological parameters	2,5	4,1	3,0
A share of the examined samples taken from centralized water supply and not conforming to hygienic standards as per sanitary-chemical parameters	6,1	42,5	21,0
A share of the examined atmospheric air samples taken in urban and rural settlements with admixtures in them exceeding MPC, totally	1,1	0,4	1,1
A share of the examined atmospheric air samples taken in urban and rural settlements with suspended substances concentrations in them exceeding MPC	0,9	0,5	1,2
A share of the examined soils samples taken in settlements and not conforming to hygienic standards as per microbiological parameters	0,3	6,8	15,7

The greatest frequency of obligatory requirements violations was registered in all three regions in relation to sanitary-chemical parameters of drinking water quality (from 6.1% in Bashkortostan to 42.5 in Leningrad region). Also we observed increased manganese concentrations in drinking water in all three regions (from 0.8 to 4.3% violations). Increased

iron concentrations were detected in Leningrad and Chelyabinsk regions (18.7 and 18.6% of samples not conforming to standards correspondingly). There were certain peculiarities registered in the regions: increased aluminum concentrations in Leningrad region (2.2% samples not conforming to standards); increased nickel concentrations, in Chelyabinsk region

(0.9% violations); sulfates, in Bashkortostan (2.5% samples with concentrations higher than standards). There were peculiarities in atmospheric air contamination which were caused by specific industrial objects located in the regions. Thus, a share of the examined atmospheric air samples taken in rural and urban settlements which contained benzpyrene concentrations higher than MPC exceeded 20% in Chelyabinsk region in 2015. Phenol contents in atmospheric air samples were higher than MPC in 0.9% samples taken in Bashkortostan. The highest level of soils microbiological contamination was detected in Chelyabinsk region and it was certainly due to the fact that this region was more densely populated.

However, all three regions had apparent and measurable risk factors for population health. These risks cause additional death cases and diseases among children

and adults and substantial economic losses related to these medical and demographic ones. Thus, approximately 290 additional death cases (mostly among adults) and more than 129,5 thousand morbidity cases were likely to be related to unfavorable environmental quality in Bashkortostan in 2015. Overall, additional death cases and morbidity cases caused economic losses of the gross regional product equal to 1.2 billion rubles. Almost 280 death cases and 43 thousand morbidity cases as well as 900 million rubles of economic losses can be related to poor quality of air, water, and soils in Leningrad region settlements; more than 2.6 billion rubles, in Chelyabinsk region. But still, our analysis of correlation between the results of surveillance and control activities and environmental quality and - indirectly - medical and demographic parameters in the regions proved that these losses could be

Table 2

Environmental parameters not conforming to hygienic standards which were prevented due to control and surveillance activities accomplished by Rospotrebnadzor in 2015

Environmental quality parameter	Bashkortostan	Leningrad region	Chelyabinsk region
A share of drinking water samples not conforming to hygienic standards as per microbiological parameters,%	2,6	2,3	0,8
A share of drinking water samples not conforming to hygienic standards as per sanitary and chemical parameters,%	46,0	31,6	25,1
A share of drinking water samples not conforming to hygienic standards as per aluminum content,%	4,5	3,8	4,3
A share of atmospheric air samples taken in urban and rural areas with contaminations higher than MPC (totally),%	3,7	6,9	2,2
A share of atmospheric air samples taken in urban and rural areas with benzpyrene concentrations higher than MPC (totally),%	14,5	19,7	9,5
A share of atmospheric air samples taken in urban and rural areas with suspended substances concentrations higher than MPC (totally),%	3,1	6,2	1,0
A share of samples taken in settlements and not conforming to hygienic standards as per heavy metals contents, %	2,3	2,5	1,7
A share of the examined samples taken in settlements and not conforming to hygienic standards as per sanitary-chemical parameters, %	7,8	7,5	4,9

considerably higher if there was no sanitary and epidemiologic control.

Thus, Rospotrebnadzor bodies and offices activities prevented a considerable number of violations related to requirements to sanitary and chemical parameters of drinking water quality and soils in urban and rural settlements in Bashkortostan in 2015. If not for controlling activities of the Federal Service for Surveillance over Consumer Rights protection and Human Well-being regional office in Leningrad region, drinking water quality would be much lower, atmospheric air would be gravely contaminated with benzpyrene and suspended substances, and sanitary state of soils would also deteriorate significantly. Table 2 contains only several parameters characterizing potential negative environmental properties which were eliminated due to the Service activities.

Prevented contamination helped to avoid approximately 700-800 additional death cases caused by respiratory organs diseases, cardiovascular diseases, and neoplasms, in all three regions. And here about 35% of all the prevented death cases can be related to economically active pop-

ulation who take part in creation of the gross regional product. A number of prevented morbidity cases amounted to approximately 71 thousand in Leningrad region; 83 thousand, in Chelyabinsk region; and more than 160 thousand, in Bashkortostan. Morbidity structure in the context of diseases prevented by control and surveillance activities was as follows: respiratory organs diseases both among children and adults (from 35 to 50%); digestive organs diseases (about 20% in children and 7.5% in adults); cardiovascular system diseases (about 4% in children and 6-8% in adults), infectious and parasitic diseases, endocrine system diseases, and other disorders.

Children morbidity in 20-22% cases lead to economically active citizens taking sickness certificates to take care of them [1]; morbidity of economically active population in regions (about 78% of employable population and about 25% people older than this age) directly causes temporary disability of population. It results in direct economic losses in the RF regions and the country as a whole.

Table 3

Economic losses caused by population mortality and morbidity associated with negative impacts exerted by environmental factors which were prevented due to control and surveillance activities in 2015 and efficiency of these activities

Parameter	Bashkortostan	Leningrad region	Chelyabinsk region
Total population, thousand.	4071,99	1778,86	3497,27
Costs on control and surveillance activities aimed at providing sanitary and economic welfare, million rubles.	82,20	54,66	55,79
Gross regional product per 1 employed, million rubles.	0,79	1,06	0,67
Prevented economic losses based on gross regional products values, million rubles:	2 256,66	1 381,12	1 004,47
– due to mortality	65,87	114,40	77,22
– losses from diseases	2 190,79	1 266,72	927,25
Economic efficiency based on prevented GRP losses, rubles per 1 rubles of costs	27,45	25,27	18,01

As per our research results, we determined that prevented economic losses in the examined regions in 2015 ranged from 1.0 billion rubles in Chelyabinsk region to 2.3 billion rubles in Bashkortostan (in 2015 prices) (Table 3).

If we calculate a ratio between prevented economic losses and actual costs which Rospotrebnadzor bore in the regions on surveillance and control activities aimed at providing sanitary-epidemiologic safety it will allow us to assess economic efficiency of these activities as being equal to from 18 rubles/1 ruble of cost in Chelyabinsk region to 27.5 rubles/per 1 ruble of costs in Bashkortostan. The obtained data prove that the Service activities are relevant and highly efficient.

Conclusions:

- assessment of economic efficiency of control and surveillance activities as per their final results, namely lower population morbidity and mortality caused by reasons authentically related to unfavorable environmental factors is a correct and

objective criterion for assessing the service activities;

- high efficiency of surveillance and control activities in specific regions should underlie the analysis of the service activities as a whole and should be considered a reference point for other RF regions;

- results of assessing prevented medical-demographic and economic losses should be used as an information-analytical base for working out decisions aimed at minimizing population health risks related to environmental quality.

Further development of the Service activities economic assessments should entail application of these methodological approaches in assessing parameters related to consumer goods quality; in improving data collection and processing techniques for determining correlations within "environment - health" system; in developing systems of detecting, proving and registering cases of damage to population health caused by negative impacts exerted by environmental factors.

References

1. Aleksandrova O.Yu. Zaboлеваemost' detei kak prichina trudopoter' rabotayushchikh: avtoref. diss. ... kand. med nauk [The Incidence of Child Labor Losses as a Cause of Work]. Ryazan', 1995, 21 p. (in Russian).
2. Goleva O.I. Ekonomicheskaya otsenka poter' ot smertnosti, zaboлеваemosti i invalidizatsii naseleniya v Rossiiskoi Federatsii: problemy i perspektivy [Economic assesment loss from population's mortality, morbidity and disability: problems and prospects]. *Zdorov'e naseleniya i sreda obitaniya*. 2014, vol. 261, no. 12, pp. 7–9 (in Russian).
3. Kontrol'no-nadzornaya deyatelnost' v Rossiiskoi Federatsii: Analiticheskii doklad [Control and Supervisory Activities in the Russian Federation: Analytical Report]; 2-nd ed. Moscow, MAKS Press, Publ., 2014, 320 p. (in Russian).
4. Zaitseva N.V., May I.V., Kir'yanov D.A., Sboev A.S., Andreeva E.E. Kontseptual'nye i metodicheskie aspekty povysheniya effektivnosti kontrol'no-nadzornoj deyatelnosti na osnove otsenki opasnosti ob"ekta s pozitsii riska prichineniya vreda zdorov'yu naseleniya [Conceptual and methodological aspects of improving the effectiveness of control and supervisory activities based on hazard and risk assessment and estimation of harm to health of the population]. *Zdorov'e naseleniya i sreda obitaniya*, 2014, vol. 261, no. 12, pp. 4–7 (in Russian).

5. Kontsepsiya povysheniya effektivnosti kontrol'no-nadzornoj deyatel'nosti organov gosudarstvennoj vlasti i organov mestnogo samoupravleniya na 2014–2018 gody: Proekt [A concept of increase in efficiency of surveillance and control activities performed by state and local authorities for 2014–2018: a project]. 2013, 21 p. Available at: <http://www.vcci.ru/vtpp/adinf/andetail.php?ID=24141> (20.07.2017) (in Russian).

6. Zaitseva N.V., Shur P.Z., Babushkina E.V., Gusev A.L. Metodicheskie podkhody k opredeleniyu vklada organov i organizatsii Rospotrebnadzora v upravlenie riskom zdorov'yu naseleniya [Methodical approaches to determining the contribution of institutions and services of the federal state service for surveillance in the sphere of consumers protection and human well-being to health risk management]. *Zdorov'e naseleniya i sreda obitaniya*, 2010, no. 11, pp. 11–13 (in Russian).

7. Popova A.Yu., Zaitseva N.V., Mai I.V., Kir'yanov D.A. Metodicheskie podkhody k raschetu fakticheskikh i predotvrashchennykh mediko-demograficheskikh i ekonomicheskikh poter', assotsirovannykh s negativnym vozdeistviem faktorov sredy obitaniya [Methodological approaches to the calculation of actual and prevented as a result of the control and supervisory activities, medical-demographic and economic 95 losses, associated with the negative impact of environmental factors]. *Gigiena i sanitariya*, 2015, vol. 94, no. 7, pp. 95–99 (in Russian).

8. Metodologiya rascheta ekonomicheskikh poter' ot smertnosti, zaboлеваemosti i invalidizatsii naseleniya: Metodicheskie rekomendatsii [The methodology for calculating the economic cost of mortality, morbidity and disability in the working population: Guidelines]. utv. Prikazom ot 10 aprelya 2012 goda № 192/323n/45n/113 Ministerstva ekonomicheskogo razvitiya Rossiiskoi Federatsii, Ministerstva zdravookhraneniya i sotsial'nogo razvitiya Rossiiskoi Federatsii, Ministerstvom finansov Rossiiskoi Federatsii i Federal'noi sluzhby gosudarstvennoj statistiki. Moscow, 2012, 16 p. Available at: https://rg.ru/pril/73/43/77/23983_metodologija.pdf (20.07.2017) (in Russian).

9. MR 5.1.0095–14. Raschet fakticheskikh i predotvrashchennykh v rezul'tate kontrol'no-nadzornoj deyatel'nosti ekonomicheskikh poter' ot smertnosti, zaboлеваemosti i invalidizatsii naseleniya, assotsirovannykh s negativnym vozdeistviem faktorov sredy obitaniya: Metodicheskie rekomendatsii [MR 5.1.0095–14. Calculation of actual and prevented economic losses caused by population mortality, morbidity and disability and associated with negative impacts exerted by environmental factors which were prevented due to surveillance and control activities: Methodical guidelines]. Moscow, Federal'nyi tsentr gigeny i epidemiologii Rospotrebnadzora, Publ., 2015, 65 p. (in Russian).

10. MR 5.1.2133-06. Byudzhetirovnie, orientirovannoe na konechnyi rezul'tat v usloviyakh srednesrochnogo finansovogo planirovaniya v Federal'noi sluzhbe po nadzoru v sfere zashchity prav potrebitel'ei i blagopoluchiya cheloveka: Metodicheskie rekomendatsii [MP 5.1.2133-06. Budgeting oriented at eventual result in average-term financial planning by the Federal Service for Surveillance over Consumer Rights protection and Human Well-being: Methodical guidelines]. Moscow, Federal'nyi tsentr gigeny i epidemiologii Rospotrebnadzora, Publ., 2006, 32 p. (in Russian).

11. O sovershenstvovanii rezul'tativnosti i effektivnosti kontrol'no-nadzornoj deyatel'nosti federal'nykh organov ispolnitel'noi vlasti: Proekt Ukaza prezidenta (podgotovlen Minekonomrazvitiya Rossii 04.10.2016) [On improving efficiency of surveillance and control activities performed by federal executive bodies: A project of the Presidential Order (worked out by the RF Ministry of Economic Development on October 04, 2016)]. Available at: <http://www.garant.ru/products/ipo/prime/doc/56592505/> (28.06.2017) (in Russian).

12. Ob utverzhdenii metodicheskikh rekomendatsii «Sistema otsenki deyatel'nosti organov i uchrezhdenii Federal'noi sluzhby po nadzoru v sfere zashchity prav potrebitel'ei i blagopoluchiya cheloveka»: Prikaz Rospotrebnadzora ot 03.10.2008. № 355 [On approving me-

thodical guidelines "A system of assessing bodies and organizations of the Federal Service for Surveillance over Consumer Rights protection and Human Well-being": Order by Rospotrebnadzor issued on October 03, 2008. No. 355]. Moscow, 2008. Available at: <http://www.garant.ru/products/ipo/prime/doc/4087342/> (22.07.2017) (in Russian).

13. Poslanie Prezidenta Rossiiskoi Federatsii k Federal'nomu sobraniyu Rossiiskoi Federatsii [The RF President message to the RF Federal Assembly]. Available at: <http://kremlin.ru/news/47173> (10.05.2017) (in Russian).

14. Rakhmanin Yu.A., Mikhailova R.I. Okruzhayushchaya sreda i zdorov'e: priority profylakticheskoi meditsiny [Environment and Health: Priorities for Preventive Medicine]. *Gigiena i sanitariya*, 2014, vol. 93, no. 5, pp. 5–10 (in Russian).

15. Chislennost' pensionerov i srednii razmer naznachennykh pensii po vidam pensionnogo obespecheniya i kategoriyam pensionerov [Number of retired employees and average pension as per pension provision types and retired employees categories]. Available at: http://www.gks.ru/free_doc/new_site/population/urov/urov_p2.htm (18.07.2017) (in Russian).

16. Shestopalov N.V., Simkalova L.M., Mitrokhin O.V. Byudzhetirovanie, orientirovannoe na rezul'tat, dlya spetsialistov Rospotrebnadzora: uchebnoe posobie [Result-oriented budgeting for Rospotrebnadzor experts: a manual]. Moscow, GEOTAR-Media, Publ., 2007, 256 p. (in Russian).

Kiryanov D.A., Tsinker M.Yu., Istorik O.A., Stepanov E.G., Davleturov N.Kh., Efremov V.M. On assessment of rospotrebnadzor surveillance and control activities efficiency in regions: assessment criteria being prevented economic losses caused by population morbidity and mortality and associated with negative impacts exerted by environmental factors. Health risk analysis, 2017, no. 3, pp. 12–20. DOI: 10.21668/health.risk/2017.3.02.eng

Received: 17.05.2017

Accepted: 20.09.2017

Published: 30.09.2017