Research article

REGIONAL ASPECTS IN ASSESSMENT OF PERFORMANCE AND EFFECTIVENESS OF THE RISK-BASED MODEL FOR CONTROL AND SURVEILLANCE ACTIVITIES IN PROVISION OF SANITARY-EPIDEMIOLOGICAL WELLBEING OF THE POPULATION

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This research is relevant since it is important to assess performance and effectiveness of activities performed by Rospotrebnadzor bodies and organizations in RF regions.

The aim of this study was to assess performance and effectiveness of control and surveillance activities performed by a territorial office of Rospotrebnadzor given the current reduction in scheduled inspections.

Control and surveillance activities performed by the Rospotrebnadzor Rostov Regional Office in 2023 were selected as the research object. They were aimed at improving the quality of the environment for the region population and indirectly at reducing population incidence and mortality associated with exposures to harmful risk factors represented by ambient air, water, and soil pollution etc.

The study was accomplished relying on methodical instruments developed by the Federal Scientific Center for Medical and Preventive Health Risk Management Technologies and approved by the RF Chief Sanitary Inspector. The basic methodology establishes rules for calculating economic losses associated with population mortality and incidence (children, working age population and population older than working age) caused by environmental exposures. Calculations were based on the results of instrumental measurements of the environment quality in cities in the Rostov region and the results of scheduled and off-schedule control activities performed by the Rospotrebnadzor Rostov Regional Office in 2023.

It was established that control and surveillance activities performed by the Service managed to prevent approximately 1760 deaths and more than 152.4 thousand diseases, which could actually occur should the Service fail to perform its regulatory actions. The total prevented economic losses equaled approximately 2.1 billion rubles in 2023. Economic effectiveness was established relying on prevented losses of the gross regional product and equaled 7.25 rubles per 1 spent ruble in 2023 prices.

There are several promising trends in the scientific and methodical support provided by practical activities performed by Rospotrebnadzor. They include development and implementation of methodical approaches to assessing effectiveness of prevention activities; searching for new approaches to assessing performance and effectiveness of other activities accomplished by the Service (licensing, registration of new and hazardous chemicals and products, etc.).

Keywords: Rospotrebnadzor, control and surveillance activities, environment, mortality, incidence, economic losses, performance, effectiveness.

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One of the key goals of public administration at all levels is to achieve satisfactory performance and efficiency as regards protection of basic social values, citizens' life and health being among them [1, 2]. Performance, as a rule, is measured by achievement of preset social goals; efficiency is the ratio of the total socially significant results to overall expenses on activities performed by federal executive authorities in money terms [3]. Development of the public administration system implies that performance of state agencies should be assessed similarly to assessing social efficiency of these organs. That is, such assessment should meet social demands. It is performance indicators employed to describe minimization or reduction of damage to citizens' lives and health that should be considered key ones in the hierarchy of indicators describing performance and efficiency of control and surveillance activities [4–6]. An important aspect in assessing performance and efficiency of state agencies is that performance should be given priority over efficiency [7], but without overlooking the necessity to make use of budgetary funds more expedient, targeted and economical (ultimately, achieving efficiency) [8].

In full conformity with global trends, the Russian administrative reform sets the tasks to implement complex assessment of performance and efficiency of activities conducted by control (surveillance) agencies and their orientation at reducing losses borne by the state. This postulate is fixed in the strategic document Basic Trends in the Activities Performed by RF Government for the Period up to 2024[1]. Performance indicators are also considered eligible criteria to assess maturity of systems for management of control and surveillance activities performed by executive agencies[2].

The Federal Service for Surveillance over Consumer Rights Protection and Human Well-being was among the first state agencies that made minimization of risks for basic protected values, including lives, health, and sanitary-epidemiological welfare of the population, a top priority in its control and surveillance activities[3] [10]. The Service pays special attention to quality and safety of environmental objects for population: ambient air, natural and drinking water, soils, food products, working and rest conditions, etc., since environmental contamination is proven to cause medical and demographic losses as additional population incidence, mortality and disability [11–14].

Human impacts on the environment tend to be high in the Rostov region, just as in many other industrially developed RF regions. Regional environmental protection services report[4] that approximately 125–170 thousand tons of contaminants are annually emitted into ambient air from stationary sources in the region; mobile sources emit approximately 130 thousand tons. Emissions contain a wide range of hazardous chemicals including nitrogen oxides, sulfur dioxide, volatile organic compounds, soot, etc. As a result, violation of safety standards is registered at posts for ambient air quality monitoring as regards chemicals that affect population health. For example, in Azov in 2022, levels higher than safety ones were detected for particulate matter (up to 2.4 average daily MPL); in Rostov-on-Don, for particulate matter (up to 1.92 average

[1] Osnovnye napravleniya deyatel'nosti Pravitel'stva Rossiiskoi Federatsii na period do 2024 goda; utv. Pravitel'stvom RF 29.09.2018 № 8028p-P13 [Basic Trends in the Activities Performed by RF Government for the Period up to 2024; approved by the RF Government on September 29, 2018 No. 8028p-P13]. *KonsultantPlus*. Available at: https://www.consultant.ru/document/cons_doc_LAW_307872/ (April 13, 2024) (in Russian).

[2] Standart zrelosti upravleniya rezul'tativnost'yu i effektivnost'yu kontrol'no-nadzornoi deyatel'nosti; utv. protokolom zasedaniya proektnogo komiteta ot 13.02.2018 № 1 [The maturity standard for managing performance and efficiency of control and surveillance activities; approved by the Report of the Project Committee Meeting on February 13, 2018 No. 1]. *KODIFI-KATSIYA.RF*. Available at: https://rulaws.ru/acts/Standart-zrelosti-upravleniya-rezultativnostyu-i-effektivnostyu-kontrolno-nadzornoy-deyatelnosti/ (May 01, 2024) (in Russian).

[3] Shestopalov N.V., Simkalova L.M., Mitrokhin O.V. Byudzhetirovanie, orientirovannoe na rezul'tat, dlya spetsialistov Rospotrebnadzora [Results-based budgeting for Rospotrebnadzor experts]: manual. Moscow, GEOTAR-Media, 2007, 256 p. (in Russian).

[4] Ekologicheskii vestnik Dona «O sostoyanii okruzhayushchei sredy i prirodnykh resursov Rostovskoi oblasti v 2022 godu» [Don Ecological Bulletin On the State of the Environment and Natural Resources in the Rostov Region in 2022]. Available at: https://cloud.mail.ru/public/4YkA/PawdgNAoU (June 01, 2024) (in Russian).

daily MPL), nitrogen dioxide (up to 1.6 single maximum MPL), phenol (up to 1.8 single maximum MPL), formaldehyde (up to 3.7 average daily MPL); in Taganrog, up to 5 single MPL for particulate matter, up to 3.4 single MPL for carbon oxide, up to 1.6 MPL for hydrogen chloride. Deviations from safe standards set for ambient air quality are detected in Shakhty, Novocherkassk, Millerovo, Novoshakhtinsk, Slask, and Gukovo.

P. Klimov and others [15] mention impermissible health risks caused by ambient air pollution in cities in the region. High levels of population health risks also occur due to poor quality of drinking water[5]. Rospotrebnadzor experts consider water supply to be of low quality in Aksai, Bataisk, Donetsk, Kamensk Shakhtinskii and other areas in the region. Overall, approximately 26.8 % of drinking water samples taken in settlements in the Rostov region do not conform to safety standards as per sanitary-chemical indicators. Basic risk factors are ammonia, manganese and its compounds, iron, and hydrogen sulphide. Samples that deviated from safety standards as per microbiological factors accounted for 1.7 % in urban areas and 2.9 % in rural ones.

Certain problems have been found in the region as regards quality of soils in settlements and its conformity with safety standards: approximately 1.7 % of taken soil samples deviated from them as per sanitary-chemical indicators and approximately 1.9 % as per microbiological ones.

The share of food products that did not conform to sanitary-epidemiological requirements was approximately 2.8 % in 2023. Basic groups of food products with detected violations of safety requirements included milk and milk products, fruits and vegetables, fish and other seafood; all these products tend to be in high demand by population.

All the foregoing problems as well as some issues associated with other unsafe levels of environmental exposures (urban noise, electromagnetic radiation etc.) were considered when organizing the risk-based model of control and surveillance activities. Since 2017, this model has been used as a basic one by the Federal Service for Surveillance over Consumer Rights Protection and Human Wellbeing,

Overall, 784 scheduled inspections were conducted by Rospotrebnadzor Regional office in the Rostov region in 2023. The number is much lower than in previous years. Still, the scheduled inspection covered objects of extremely high risk that included food producers, providers and sellers (223 objects overall), economic entities operating in the sphere of water supply and sewage (43 objects) or dealing with waste disposal (26 objects), etc. Therefore, a considerable proportion of objects able to create extremely high health risks was covered by the Service activities in one way or another.

The aim of this study was to assess performance and efficiency of control and surveillance activities performed by a territorial office of Rospotrebnadzor in the Rostov region given the current reduction in scheduled inspections.

Materials and methods. The assessment was performed in conformity with the algorithm and methods stipulated in the Methodical Guidelines MR 5.1.0095-14 Calculation of Actual Economic Losses and Those Prevented due to Control and Surveillance Activities …[6].

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[5] Doklad o sostoyanii sanitarno-epidemiologicheskogo blagopoluchiya naseleniya Rostovskoi oblasti v 2022 g [The Report on Sanitary-Epidemiological Welfare of the Population in the Rostov Region in 2022]. *Rospotrebnadzor Regional Office in Rostov.* Available at: http://www.rpndon.ru/index.php?option=com_content&view=article&id=12028:-q-2022-q&catid=96:2009-12-30-08-03-55&Itemid=116 (June 01, 2024) (in Russian).

[6] MR 5.1.0095-14. Raschet fakticheskikh i predotvrashchennykh v rezul'tate kontrol'no-nadzornoi deyatel'nosti ekonomicheskikh poter' ot smertnosti, zabolevaemosti i invalidizatsii naseleniya, assotsiirovannykh s negativnym vozdeistviem faktorov sredy obitaniya; utv. rukovoditelem Federal'noi sluzhby po nadzoru v sfere zashchity prav potrebitelei i blagopoluchiya cheloveka, Glavnym gosudarstvennym sanitarnym vrachom RF A.Yu. Popovoi 23 oktyabrya 2014 g. [Calculation of Actual Economic Losses and Those Prevented due to Control and Surveillance Activities in case Such Losses Are Caused by Mortality, Incidence and Disability among Population Associated with Exposure to Harmful Environmental Factors; approved by A. Yu. Popova, the Head of the Federal Service for Surveillance over Consumer Rights Protection and Human Wellbeing, the RF Chief Sanitary Inspector on October 23, 2014]. *KODEKS: electronic fund for legal and reference documentation.* Available at: https://docs.cntd.ru/document/1200129398 (June 02, 2024) (in Russian).

The methodology fixes the rules for calculating economic losses associated with environmental factors: mortality and incidence among population (children, adult working age population and people beyond working age). The approaches are based on research findings reported in the works by A.Yu. Popova, N.V. Zaitseva and others [16–18] and allow estimating both medical-demographic losses that occur on a given territory as deaths and diseases authentically associated with the quality of the environment and demographic losses prevented by control and surveillance activities of a relevant regulating service. The methodology has been tested in practice and is in high demand [19–20].

Economic losses due to population mortality and incidence associated with harmful environmental exposures are considered taking into account losses in the gross domestic product caused by a citizen's inability to work.

Calculations are based on science-intense mathematical modeling of relationships within the Environment – Health system and Control and Surveillance Activities – Environment system and performed by using multiple regressions as the basic method.

Table 1 provides some example parameters used in models that describe the Environment – Health relationship. The models have been developed by experts of the Federal Scientific Center for Medical and Preventive Health Risk Management Technologies; they are employed in calculations within this study.

Data of interdepartmental statistics and social-hygienic monitoring per RF regions over three years were used as initial data for building relationship models. In this study, we used results obtained by modeling that covered 2010–2022 data.

Similar multiple regression models that describe relationships between control and surveillance activities and environmental factors were employed to estimate changes in levels of risk factors over the analyzed period. Example models are provided in Table 2.

The proportion of disease cases that led to a person being unable to work was determined based on regional statistical data collected in the Rostov region (Labor and Employment in Russia, the statistical data collection issued by the Federal State Statistic Service). This value was compared to the proportion of working population when we estimated economic losses due to deaths. When estimating economic losses due to diseases, we took the proportion of cases when official sick leaves were issued due to short-term disability.

T a b l e 1

Regression coefficients for the relationship between population incidence and changes in an indicator that describes quality of environmental objects (cases/100 thousand people per one-unit change in an indicator)[7]

Dependent variable (incidence)	Independent variable (an object, deviating indicator)	Group	Regression coefficient
Certain infectious and parasitic diseases	Tap water, microbiological indicators	Whole population	10.66
	Soils, microbiological safety indicators		32.52
Diseases of the respiratory system	Ambient air, NO_2 MPL	Children	1667.6
	Ambient air, NO MPL		25.09
	Ambient air, phenol MPL		1514.4
Diseases of the respiratory system	Ambient air, NO_2 MPL	Working age adults	281.97
	Ambient air, NO MPL		709.3
	Ambient air, phenol MPL		6.5
Endocrine diseases	Drinking water, arsenic MPL	Whole population	19.12

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[7] Zaitseva N.V., May I.V., Kiryanov D.A., Babina S.V., Chigvintsev V.M., Tsinker M.Yu., Kamaltdinov M.R., Kleyn S.V. [et al.]. Modeli zavisimostei obrashchaemosti naseleniya za meditsinskoi pomoshch'yu ot soderzhaniya khimicheskikh veshchestv v atmosfernom vozdukhe dlya kolichestvennoi otsenki i prognozirovaniya riskov zdorov'yu naseleniya [The models to describe relationships between the number of requests for healthcare and levels of chemicals in ambient air for health risk quantification and prediction]: database; the registration certificate: RU 2022623021, 22.11.2022; application No. 2022622884 dated November 08, 2022 (in Russian).

Table 2

Regression coefficients for the relationship between quality of environmental objects and Rospotrebnadzor performance indicators (in 1 % per one-unit change in an indicator)[8]

Environmental object	Performance indicators of Rospotrebnadzor organs and institutions, which aim to manage quality of the environment	Regression coefficients
% of ambient air samples with nitrogen oxide (NO) level above MPL	The number of inspections at objects that involved using laboratory methods (per the total number of inspected industrial enterprises)	-661.706
% of ambient air samples with sulfur dioxide level above MPL	The number of inspections that were followed by issuing recommendations, scheduled (per 1000 people)	-0.507
% of ambient air samples with sullfuric level above MPL	The number of orders to inflict administrative punishments (per the total number of inspected industrial enterprises)	-0.749
	The number of inspections at objects that detected violations of the sanitary legislation (per the total number of inspected industrial enterprises)	-0.188
	The number of inspections at objects that detected violations of the sanitary legislation (per the total number of inspected processing enterprises)	-3.336
% of tap water samples deviating from safe standards per microbiological indicators	The number of inspecitons at obejcts for water collection and tretament	-80.346
% of tap water samples deviating from safe standards per sanitary-chemical indicators	The number of issued orders to eliminate violations (per the total inspected objects operating in healthcare, provision of public utilities, social and personal services)	-6.361
	The number of court cases when a decision was made to inflict an administrative punishment (per the number of violations detected in water distribution)	-34.548

For children, the proportion of diseases that required issuing a sick leave for parents was identified using the Form 16-VN Data on Reasons for Short-Term Disability as the ratio of short-term disability cases due to 'Patient Care' to the total number of all short-term disability cases due to all reasons.

Average duration of one disease that made a person unable to work was taken as equal to:

– for deaths: half of the calendar year (L = 183 days);

– for diseases: average duration of a disease with short-term disability.

Data necessary to estimate duration of one disease were taken from the Unified Interdepartmental Information Statistical System.

Economic efficiency of control and surveillance activities performed by Rospotrebnadzor bodies and organizations was estimated per the ratio of expenses on accomplishing control and surveillance activities aimed at providing sanitary-epidemiological wellbeing to the total economic losses associated with health issues (incidence and mortality) that were prevented due to activities performed by Rospotrebnadzor bodies and organizations.

The adjusted 2023 gross regional product, which was equal to 1.41 million rubles per one employed person, was used in calculations for the Rostov region.

Expenses borne by Rospotrebnadzor bodies and organizations in the Rostov region on

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[8] MR 5.1.0095-14. Raschet fakticheskikh i predotvrashchennykh v rezul'tate kontrol'no-nadzornoi deyatel'nosti ekonomicheskikh poter' ot smertnosti, zabolevaemosti i invalidizatsii naseleniya, assotsiirovannykh s negativnym vozdeistviem faktorov sredy obitaniya; utv. rukovoditelem Federal'noi sluzhby po nadzoru v sfere zashchity prav potrebitelei i blagopoluchiya cheloveka, Glavnym gosudarstvennym sanitarnym vrachom RF A.Yu. Popovoi 23 oktyabrya 2014 g. [Calculation of Actual Economic Losses and Those Prevented due to Control and Surveillance Activities in case Such Losses Are Caused by Mortality, Incidence and Disability among Population Associated with Exposure to Harmful Environmental Factors; approved by A. Yu. Popova, the Head of the Federal Service for Surveillance over Consumer Rights Protection and Human Wellbeing, the RF Chief Sanitary Inspector on October 23, 2014]. *KODEKS: electronic fund for legal and reference documentation.* Available at: https://docs.cntd.ru/document/1200129398 (June 02, 2024) (in Russian).

accomplishing control and surveillance activities aimed at providing sanitary-epidemiological safety were determined as the share of the total financial resources allocated on performance of control (surveillance), which equaled 295.55 million rubles (Form No. 1-control Data on Accomplishment of State Control (Surveillance) and Municipal Control, section 3, line 61). The share of the total financial resources allocated on control (surveillance) functions aimed at providing sanitary-epidemiological safety is determined as per the share of inspections performed by Rospotrebnadzor bodies and organizations within providing sanitary-epidemiological wellbeing of the population (Form No. 1-18 Data on the Results of Accomplishing Federal State Surveillance by Rospotrebnadzor Regional Offices). Considering this, the total financial resources used in calculations equaled 289.94 million rubles.

Economic losses due to population mortality and incidence associated with harmful environmental exposures over 2021–2023 were calculated in 2023 prices.

Results. The results obtained by instrumental research of quality and safety of environmental objects were represented by proportions of samples that deviated from safety standards and violated sanitary-epidemiological requirements. In general, though frequency of violations was established to be quite low in the region, there were still cases of inconformity with safety standards as regards quality of the environment.

In 2023, several chemicals were identified in levels higher than single and / or average daily MPL including particulate matter, sulfur dioxide, nitrogen oxides, ammonia, hydrogen sulphide, aromatic hydrocarbons, and aliphatic hydrocarbons.

Safety standards were seriously violated as regards drinking water quality and permissible noise levels; several safety standards to soil quality were also violated.

Table 3 provides some examples of indicators with the most frequent violations of safety standards and requirements established for them in 2023.

T a b l e 3

The proportion of indicators describing quality of the environment in the Rostov region that do not conform to sanitary-hygienic requirements and safety standards

An indicator to describe quality of an environmental object	% of samples with violation
Ambient air	
Toluene	3.70
Xylene	0.99
Phenol	0.89
Hydrogen chloride	0.68
Particulate matter	0.49
Aromatic hydrocarbons	0.46
Chlorine and its compounds	0.36
Aliphatic saturated hydrocarbons	0.27
Hydrogen sulphide	0.19
Nitrogen dioxide	0.14
Drinking water	
Water supply systems, sanitary-chemical indicators	50.92
Magnesium and its compounds	66.67
Chlorine	45.83
Chlorides (per Cl)	39.13
Sulfates (per SO_4)	30.23
Nitrates (per NO_3)	9.20
Ammonia and ammonia ion	7.73
Aluminum	2.38
Iron (including chloric iron)	2.41
Bromdichloromethane	1.67
Chloroform	0.62
Soils in settlements	
Microbiological indicators	4.02
Parasitological indicators	0.57
Physical environmental factors	
Noise	22.16
Vibration	2.41
Electromagnetic radiation	1.25

The results obtained by instrumental measurements within control and surveillance activities and social hygienic monitoring were used as a basis for determining the number of cases associated with poor quality of the environment.

Violations of safety standards established for the environment led to probable 1760 additional deaths.

Most deaths associated with quality of the environment were established among working age adults (874 deaths or 49.7 % of the total number) and people older than working age (866 deaths or 49.2 %).

The causes of the associated mortality included diseases of the circulatory system (approximately 36 %), diseases of the digestive system (approximately 39 %), neoplasms (7.2 %), certain infectious and parasitic diseases, and diseases of the respiratory system.

According to the modeling results, the number of diseases that were likely associated with poor quality of the environment in the region exceeded 152.4 thousand cases in 2023.

Approximately 53.1 thousand diseases (34.8 %) were detected in children; they were mostly represented by diseases of the respiratory and digestive systems (13.3 and 12.4 thousand cases accordingly). Complex combined exposure to several adverse environmental factors causes various diseases in children including diseases of the blood and blood-forming organs (7.4 thousand cases in 2023); diseases of the skin and subcutaneous tissue (4.65 thousand cases); certain infectious and parasitic diseases (3.1 thousand cases); diseases of the genitourinary, musculoskeletal, endocrine system, etc.

Diseases associated with risk-inducing environmental factors accounted for 65.6 thousand cases among adult working age population in 2023. Diseases of the digestive system, genitourinary system and respiratory system were priority ones. Diseases from these three classes account for more than a half of the associated incidence (34.6 thousand cases or 52.7 % of diseases among working age people). Among other classes, we should mention diseases of the blood and blood-forming organs (6.7 thousand cases), endocrine diseases (3.3 thousand), neoplasms (3.1 thousand), and some others.

Diseases associated with environmental exposures accounted for 33.7 thousand cases among elderly people beyond working age in 2023.

Economic losses caused by the mortality and incidence that were associated with the foregoing factors and resulting losses of the gross regional product were higher than 4.1 billion rubles in the region (567.98 million rubles due to mortality and 3557 million rubles due to additional incidence of the population).

These losses could have been avoided if economic entities, transport and public services, citizens and other concerned parties did not violate the existing sanitary-hygienic requirements to economic activities.

However, it is noteworthy that the foregoing losses could have been much higher if the sanitary service failed to perform its regulatory actions.

Despite some limitations that were imposed on scheduled control and surveillance activities, regional Rospotrebnadzor bodies and organizations conducted approximately 1630 inspections in the Rostov region in 2023. Special attention was paid to objects with extremely high and high risks of damage to protected values in full conformity with the principles of risk-based control (surveillance). Violations of the mandatory requirements were detected in the course of 772 schedules inspections and 660 unscheduled ones.

Certain legal actions were taken following the results of 1389 inspections. Administrative cases were initiated; materials were submitted to file cases to court; information was submitted to law enforcement agencies about violations of the valid legislation to initiate criminal cases; materials were submitted to other authorized bodies to take actions stipulated in the legislation.

As a result, regulatory activities performed by the Service allowed preventing higher levels of ambient air pollution. Rospotrebnadzor experts managed to prevent almost 5.2 % of violations per some aromatic hydrocarbons; 1.6 % per hydrogen chloride; 1.2 % per particulate matter; they also prevented violations of MPL per sulfuric acid (1.3 %); compounds of fluorine and its derivatives (2.3 %); per some other pollutants.

If the Sanitary Service had failed to perform its control activities, predicted proportions of drinking water samples deviating from safety standards would grow by 1.5–5 % as per variable risk-inducing factors. Likely inconformity with safety standards would be by 10.3 % higher per microbiological indicators than its actual levels.

Bearing a time lag in mind, we can expect that the effects of regulatory actions will manifest themselves in 2024. Actions taken by the Service in 2023 prevented medical and demographic losses equal to 757 deaths and more than 57.6 thousand diseases in the region (Tables 4 and 5).

Prevented economic damage represented by losses of the Rostov gross regional product amounted to 2.1 billion rubles in 2023 solely due to those activities of Rospotrebnadzor that prevented deterioration of the environment quality.

It is noteworthy that prevented deaths are going to bring economic benefits for several more years or even decades, that is, for a period during which a person is able to work and can participate in economic activities.

T a b l e 4

The number of deaths prevented due to control and surveillance activities by Rospotrebnadzor with their aim to minimize effects of risk-inducing environmental factors in 2023

Population group	Cause of death	Prevented deaths
Children	Certain infectious and parasitic diseases	3
	Diseases of the digestive system	104
Working age adults	Certain infectious and parasitic diseases	79
	Neoplasms	5
	Diseases of the circulatory system	13
	Diseases of the respiratory system	84
	Diseases of the digestive system	126
Retired adults	Certain infectious and parasitic diseases	17
	Neoplasms	26
	Diseases of the circulatory system	48
	Diseases of the respiratory system	165
	Diseases of the digestive system	87
Total		757

T a b l e 5

The number of diseases prevented due to control and surveillance activities by Rospotrebnadzor with their aim to minimize effects of risk-inducing environmental factors in 2023

Population group	Class of diseases	Prevented cases
Children	Certain infectious and parasitic diseases	7963
	Neoplasms	26
	Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	572
	Diseases of the nervous system	485
	Diseases of the eye and adnexa	28
	Diseases of the circulatory system	53
	Diseases of the respiratory system	7626
	Diseases of the digestive system	3272
	Diseases of the skin and subcutaneous tissue	809
	Diseases of the musculoskeletal system	241
	Diseases of the genitourinary system	173
	Congenital malformations, deformations	70
Working age adults	Certain infectious and parasitic diseases	6033
	Neoplasms	122
	Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	667
	Endocrine, nutritional and metabolic diseases	130
	Diseases of the nervous system	965

Population group	Class of diseases	Prevented cases
	Diseases of the eye and adnexa	56
	Diseases of the respiratory system	5673
	Diseases of the digestive system	7327
	Diseases of the skin and subcutaneous tissue	668
	Diseases of the musculoskeletal system	711
	Diseases of the genitourinary system	966
Retired adults	Certain infectious and parasitic diseases	1637
	Neoplasms	65
	Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	249
	Endocrine, nutritional and metabolic diseases	114
	Diseases of the nervous system	290
	Diseases of the eye and adnexa	33
	Diseases of the circulatory system	2772
	Diseases of the respiratory system	2765
	Diseases of the digestive system	3948
	Diseases of the skin and subcutaneous tissue	443
	Diseases of the musculoskeletal system	468
	Diseases of the genitourinary system	258
Total		57,679

Efficiency of control and surveillance activities performed by Rospotrebnadzor bodies equaled approximately seven rubles per one spent ruble in the Rostov region in 2023.

Discussion. The study findings indicate that sanitary services did their work efficiently. Lower pollution of environmental objects and prevented medical-demographic losses give evidence of targeted and relevant expenditure of budget resources. The number of prevented deaths and diseases can be considered an eligible indicator for estimating efficiency of control and surveillance activities performed by Rospotrebnadzor [21]. In-depth analysis of performance and efficiency of specific control and surveillance activities in dynamics can be and should be used as grounds for planning activities the Sanitary Service has to perform in RF regions [22]. This analysis is assumed to be region-specific given specific pollution of environmental objects, the structure of objects under surveillance and health outcomes in exposed population in each region.

Administrative measures such as laboratory inspections aimed at assessing adverse effects on the environment, recommendations and orders, administrative punishments, penalties etc., turned out to be the most effective and yielded the best results. However, since emphasis is being shifted from scheduled inspections as the basic components of control and surveillance activities to unscheduled ones and some prevention activities, new instruments should be found to organize efficient work with economic entities in order to achieve full conformity with the sanitary-epidemiological requirements and minimize population health risks [23]. Another relevant task is to assess performance and efficiency of prevention measures since the further development of Rospotrebnadzor activities primarily involves expanding and intensifying prevention when working with economic entities.

Conclusion. The study findings indicate that sanitary services did their work efficiently. Lower pollution of environmental objects and prevented medical-demographic losses give evidence of targeted and relevant expenditure of budget resources. Both scheduled and unscheduled control and surveillance

activities by Rospotrebnadzor helped prevent approximately 1760 deaths and more than 152.4 thousand diseases that would have occurred in case no regulatory actions were taken by the Service.

In 2023, prevented economic losses were approximately 2.1 billion rubles. Economic efficiency, judging by prevented losses of the Rostov gross regional product, equaled approximately 7.25 rubles per one spent ruble in 2023 prices.

There are several promising trends in the scientific and methodical support provided for practical activities performed by Rospotrebnadzor. They include development and implementation of methodical approaches to assessing efficiency of prevention activities; searching for new approaches to assessing performance and efficiency of other activities accomplished by the Service (licensing, registration of new and hazardous chemicals and products, etc.).

References

1. Manzoor A. A Look at Efficiency in Public Administration: Past and Future. *SAGE Open*, 2014, vol. 4, no. 4, pp. 1–5. DOI: 10.1177/2158244014564936

2. Grandy C. The "efficient" public administrator: Pareto and a well-rounded approach to public administration. *Public Administration Review*, 2009, vol. 69, no. 6, pp. 1115–1123. DOI: 10.1111/j.1540-6210.2009.02069.x

3. Kislyakov A.S., Chernysheva T.K. On the efficiency and performance of Federal Executive Authorities. *Gosudarstvennaya vlast' i mestnoe samoupravlenie*, 2019, no. 10, pp. 26–29. DOI: 10.18572/1813-1247-2019-10-26-29 (in Russian).

4. Yuzhakov V.N., Dobrolyubova E.I., Spiridonov A.A. Methodological approaches to the assessment of state control and inspection system by the citizens as its beneficiaries. *Vestnik Rossiiskogo universiteta druzhby narodov. Seriya: Sotsiologiya*, 2019, vol. 19, no. 2, pp. 337–351. DOI: 10.22363/2313-2272-2019-19-2-337-351 (in Russian).

5. Sheburakov I. Development and implementation of key performance indicators at the regional level. *Gosudarstvennaya sluzhba*, 2014, no. 5 (91), pp. 85–90 (in Russian).

6. Hak M., Devčić A. Measuring the Efficiency of the State Administration Through the Key Performance Indicators. *European Scientific Journal*, 2016, sp. ed., pp. 128–138.

7. Surilov M. Podkhody k otsenke effektivnosti publichnogo upravleniya: analiz i perspektivy razvitiya [Approaches to assessing the efficiency of public administration: analysis and development prospects]. *Trendy i upravlenie*, 2017, no. 3, pp. 92–103 (in Russian).

8. Chazova I.Yu., Israilov M.V. Estimation of efficiency of state authorities' activity. *Vestnik Udmurtskogo universiteta*, 2019, vol. 29, no. 6, pp. 776–785. DOI: 10.35634/2412-9593-2019-29-6-776-785 (in Russian).

9. Belev S.G., Mamedov A.A., Moguchev N.S., Tischenko T.V. International experience in assessing the long-term budgetary impact of programs at the federal, regional and municipal level. Moscow, 2016, 76 p. DOI: 10.2139/SSRN.2812132 (in Russian).

10. Aidinov G.T., Pravdyukova E.A., Sofyanikova L.V. O podgotovke k perekhodu na byudzhetirovanie, orientirovannoe na konechnyi rezul'tat [On preparing to the transition to results-based budgeting]. *Sanitarnyi vrach*, 2008, no. 3, pp. 63–64 (in Russian).

11. Kleyn S.V., Nikiforova N.V., Vekovshinina S.A. Assessing influence exerted by ambient air pollution on public health in the Russian Federation. *Siberian Journal of Life Sciences and Agriculture*, 2023, vol. 15, no. 5, pp. 306–321. DOI: 10.12731/2658-6649-2023-15-5-943

12. Beyer K.M.M., Namin S. Chapter 12 – Chronic environmental diseases: burdens, causes, and response. In book: *Biological and Environmental Hazards, Risks, and Disasters (Second Edition).* In: R. Sivanpillai, J.F. Shroder eds. Elsevier, 2023, pp. 223–249. DOI: 10.1016/B978-0-12-820509-9.00030-7

13. Zaytseva N.V., May I.V., Balashov S.Yu. Medical and biologic parameters of the population health state in conditions of inhabitancy complex natural-technogenic pollution. *Izvestiya Samarskogo nauchnogo tsentra Rossiiskoi akademii nauk*, 2009, vol. 11, no. 1–6, pp. 1144–1148 (in Russian).

14. Luzhetskiy K.P., Ustinova O.Yu., Vandysheva A.Yu., Vekovshinina S.A. The disorders of physical development of children residing in the conditions of low-level contamination of the atmospheric air and drinking water by metals (lead, manganese, nickel, chrome, cadmium) on the example of the Perm Region. *Gigiena i sanitariya*, 2017, vol. 96, no. 1, pp. 70–75. DOI: 10.18821/0016-9900-2017-96-1-70-75 (in Russian).

15. Klimov P., Basilaia M. Estimation of atmospheric air pollution and health risk for Rostov-on-Don population. *Science Almanac of Black Sea Region Countries*, 2017, vol. 10, no. 2, pp. 46–51. DOI: 10.23947/2414-1143-2017-10-2-46-51

16. Popova A.Yu., Bragina I.V., Zaitseva N.V., May I.V., Shur P.Z., Mitrokhin O.V., Goryaev D.V. On the scientific and methodological support of the assessment of the performance and effectiveness of the control and supervision activity of the Federal Service for Surveillance on Consumer Rights Protection and Human Wellbeing. *Gigiena i sanitariya*, 2017, vol. 96, no. 1, pp. 5–9. DOI: 10.18821/0016-9900-2017-96-1-5-9 (in Russian).

17. Popova A.Yu., Zaytseva N.V., May I.V., Kiryanov D.A. 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).

18. Zaitseva N.V., May I.V., Klein S.V., Kiryanov D.A. Methodological aspects and results of estimation of demographic loss associated with harmful influence of environment factors and preventive activities of Rospotrebnadzor in regions of the Russian Federation. *ZNiSO*, 2018, no. 4 (301), pp. 15–20. DOI: 10.35627/2219-5238/2018-301-4-15-20 (in Russian).

19. Istorik O.A., Kiryanov D.A., Tsinker M.Yu. Opredelenie effektivnosti kontrol'no-nadzornoi deyatel'nosti organov i organizatsii Rospotrebnadzora v Leningradskoi oblasti na osnove rascheta predotvrashchennykh ekonomicheskikh poter' ot smertnosti i zabolevaemosti naseleniya, assotsiirovannykh s negativnym vozdeistviem faktorov sredy obitaniya [Determination of the effectiveness of control and surveillance activities of Rospotrebnadzor bodies and organizations in the Leningrad region based on the calculation of prevented economic losses from population mortality and morbidity associated with the negative impact of environmental factors]. *Aktual'nye voprosy obespecheniya sanitarno-epidemiologicheskogo blagopoluchiya naseleniya na urovne sub"ekta Federatsii: materialy mezhregional'noi nauchno-prakticheskoi internet-konferentsii*. In: A.Yu. Popova, N.V. Zaitseva eds. Perm, 2017, pp. 29–45 (in Russian).

20. Mehantiev I.I., Masaylova L.A., Tsinker M.Yu., Lastochkina K.S. The evaluation of efficiency of Rospotrebnadzor's control supervision activity based on the risk estimation of medical demographic losses exemplified by the Voronezh region. *Nauchno-meditsinskii vestnik Tsentral'nogo Chernozem'ya*, 2017, no. 70, pp. 95–99 (in Russian).

21. Roy N., Mishina E. Demographic indicators as indicators of the efficiency of public administration. New economy, business and society. Collection of materials from the April scientific and practical conference of young scientists. *Novaya ekonomika, biznes i obshchestvo: sbornik materialov aprel'skoi nauchno-prakticheskoi konferentsii molodykh uchenykh ShEM, nauchnoe elektronnoe izdanie*. In: A.B. Kosolapov ed. Vladivostok, 2017, pp. 833–838 (in Russian).

22. Zaitseva N.V., Kiryanov D.A., Tsinker M.Yu., Kostarev V.G. Methodical approach to the investigation of reserves in performance and management in the system of Federal Service for Surveillance over Consumer Rights Protection and Human Well-Being (Rospotrebnadzor) as according to prevented health losses in the population of the Russian Federation. *Gigiena i sanitariya*, 2019, vol. 98, no. 2, pp. 125–134. DOI: 10.18821/0016-9900-2019-98-2-125-134 (in Russian).

23. Buletova N.E., Zolotko T.A. On assessing the efficiency of executive authorities in achieving the national development goals. *Aktual'nye problemy ekonomiki i prava*, 2020, vol. 14, no. 4, pp. 733–750. DOI: 10.21202/1993-047X.14.2020.4.733-750 (in Russian).