RISK ASSESSMENT IN HYGIENE

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Research article

METHODICAL APPROACHES TO ASSESSING SUBJECTIVE HEALTH RISK PERCEPTION BY POPULATION UNDER EXPOSURE TO AMBIENT AIR POLLUTION

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There is a growing demand by the civil society for relevant information on the environment quality and related health risks. The state should be able to satisfy this demand and this makes the present research truly vital. It concentrates on correlating expert and non-expert opinions expressed when perceiving risk quantification.

Our goal was to answer two following questions: 1) How does an average unprofessional person quantify a probability and severity when he or she hears certain verbal expressions that denominate them? 2) How can we possibly identify the assessment of health risks associated with environmental pollution factors given by the population in general or specific social groups?

To find answers to these questions, we applied quantitative methods for data collection and analysis. The first stage involved collecting data on subjective correlation of a verbal probability scale with its numeric expression among people living in industrial cities. The second stage focused on testing the methodology for studying assessments of health risks associated with ambient air pollution given by the population/social groups. This methodology relied on the results obtained at the previous stage.

We established that only 70 % of people actually correlated words with figures. We determined that experts tended to rate probabilities approximately by 10 % higher than "average people" did when it came down to such words as "Virtually certain" and "Very likely". Such words as "Likely", "Similarly likely" and "Unlikely" were also rated differently but with a smaller gap between the opinions. The study also provides a method for determining the public assessment of health risks associated with ambient air pollution. The research results give an opportunity to solve a practical task related to informing the population about health risks and to overcome a so-called language barrier between experts and ordinary people. For example, messages aimed for decision-makers can be adapted considering all the identified perception peculiarities.

Keywords: *risk perception, risk assessment, risk rate, probability assessment, subjective risk assessment, probability of risk realization, health risk, informing.*

Most contradictions that are associated with informing people about health risks and their assessment as well as with establishing a relevant level of social acceptability arise due to ambiguity of risk perception and language used to describe this risk within various groups. These groups involved into a risk situation are experts, decision-makers, economic entity, mass media, and population at large. Experts use a language of science when they consider probabilistic nature of coming adverse events; supervisors at different levels rely on socioeconomic and political senses[1]. Mass media retranslate information coming from other sub-

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[1] O sostoyanii i ob okhrane okruzhayushchei sredy Rossiiskoi Federatsii v 2015 godu: gosudarstvennyi doklad [On the ecological situation and environmental protection in the Russian Federation in 2015: the State Report]. Moscow, the RF Ministry of Natural Resources and Environment, NIA-Priroda, 2016, 639 p. (in Russian).

jects and process it trying to attract their audience with striking headings [1]. People more often appeal to the emotional component in risks, fears and anxieties; they do not understand expert language [2, 3] and, as a rule, do not trust decision-makers and mass media [4]. This induces growing social tensions and leads to further mismatch between opinions and managerial decisions [5]. As it was noted in the WHO report on health and the environment, *"In general, people do not understand probability. Public reaction to risk often appears to be at odds with scientific estimates. … the suggestion that a hazard poses an annual risk of death of 'one chance in x' may cause anything from panic to virtual indifference"* [6]. The necessity to consider perception and needs of various subjects within the risk space has been discussed for the last 20 years and substantial work has been done in the field. Thus, the Climate Change 2001: Synthesis Report by the Intergovernmental Panel on Climate Change (IPCC) suggested using certain words and expressions to discuss uncertainties and probabilities. The authors created the following definitions for authenticity: virtually certain (a probability that the result is authentic exceeds 99 %); very likely (a probability is 90–99 %); likely (a probability is 66–90 %); about as likely as not (33–66 %); unlikely (10–33 %); very unlikely (1–10 %); and exceptionally unlikely (a probability is less than 1 %) [7]. This gradation relies on collective judgment made by the authors about authenticity of a conclusion and the judgment is based on data produced by observations, modeling results and theories analyzed by them.

In 2004, the IPCC suggested testing uncertainty descriptors on target audiences prior to using them [8], and this might be affected by the scale being tested by other researchers. For example, A.G. Patt and D.P. Schrag performed their experiment on students attending natural sciences faculties and concluded that their respondents understood the suggested verbal scale a bit differently. Nevertheless, the authors noted the procedure had a lot of potential [9].

Research goals and tasks. Our major goal was to answer two questions. The first one was how an average unprofessional person quantified a probability and severity when he or she heard certain verbal expressions that denominated them. An answer to this question solves a task related to informing people about health risks. This task is associated with certain difficulties people meet when they try to perceive numeric data. If we determine what words correlate with these or those quantitative (numeric) ranges, any messages about risks aimed for a broad audience can be formulated in such a way so that they are understood correctly by it. In other words, this makes it possible to join expert language and language used by "ordinary people". The second question was how to identify the assessment of health risks associated with environmental pollution factors given by the population in general or specific social groups. Finding an answer to this question provides an instrument for identifying public risk assessment that is considered by management when population health risks are regulated.

Materials and methods. The study consisted of two stages. At the first stage, we collected data on subjective correlations between the verbal likelihood scale and its numeric expression. The data were collected by performing formalized questionings among people living in industrial cities. Overall, three questioning were performed over several years (2014[2], 2016[3] and 2020[4]). Each questioning suggested the respondents answer seven questions: "How

[2] The formalized questioning of Perm region population aged 18 years and older "Risk communications within the environmental risks sphere" (the grant provided by the RHSF No. 14-16-59011) was performed by the experts from Federal Scientific Center for Medical and Preventive Health Risk Management Technologies in 2014, a phone survey, quota sampling (n = 1041).

[3] The formalized questioning of workers employed at PJSC Uralkalii (town of Berezniki) was performed by the experts from Federal Scientific Center for Medical and Preventive Health Risk Management Technologies in 2016, handout questionnaires filled in at workplaces, target sampling (n = 119).

[4] The formalized questioning of people living in large industrial cities in Russia was performed by the experts from Federal Scientific Center for Medical and Preventive Health Risk Management Technologies in 2020 by handout and on-line questioning, opportunity sampling (n = 163).

do you estimate a probability of an event in %, if this event is …". Each question had various endings corresponding to the verbal likelihood scale suggested in the IPCC Report (virtually certain; very likely; likely; about as likely as not; unlikely; very unlikely; exceptionally unlikely) (n = 1324). These data represent opinions of working age population aged from 18 to 60 years living on territories with high anthropogenic loads.

The second stage involved testing the procedure for examining health risk assessments given by population / social groups. The focus was on health risks associated with ambient air pollution and the assessments relied on the results produced at the previous stage. We performed an online survey in Perm and Krasnoyarsk in 2021; the link to it was located on SurveyMonkey, a specialized survey platform for online surveys. The city population was questioned without any limitations imposed on social and demographic features (except age, 18 years and older; convenience sampling). In addition, targeted advertising was placed in virtual social networks "VKontakte" and "Odnoklassniki" to attract their users to participate in the survey (they should be 18 years or older and live in Krasnoyarsk or Perm; opportunity sampling) (n = 1334). Then, we applied simple random sampling to "remove" redundant respondents to create a sampling that reflected the actual structure of urban working age population in Russia (n = 677).

The procedure involved reducing subjective assessment of health risks associated with ambient air pollution by people living in an industrial city to the standard risk assessment formula:

$$R = P \cdot g,$$

where P is probability, g is gravity.

Likelihood of risk realization (likelihood to fall sick) was established by using two questions. The first one was, "Here you can see a list of diseases, which, as some people think, are associated with ambient air pollution. In your opinion, how likely are ***those*** people from your microdistrict who do not have these diseases to fall sick with them?" The second question was, "In your opinion, how likely are ***you*** to fall sick with these diseases if you do not have them now?" The list included such diseases as bronchial asthma, bronchitis, ischemic heart disease, stroke, chronic obstructive pulmonary disease, and lung cancer. The scale was taken from the procedure: Virtually certain; Very likely; Likely; About as likely as not; Unlikely; Very unlikely; Exceptionally unlikely. To analyze the suggested verbal likelihood scale, we transformed the respondents' answers into percents according to the data obtained at the first stage in the study[5]. These two questions for measuring subjective assessments of how likely a disease was are determined by risk perception being combined with multiple prejudices and opinions; people's inclination to believe they are somehow immune to risk is one of them [10]. A task was to get an insight into the difference between how people assessed likelihood of risk realizations for themselves and for others. This was necessary to make conclusions, first, about this prejudice influencing assessments made by people regarding likelihood of diseases associated with ambient air quality and, second, how great a mismatch was between these assessments.

Gravity of health outcomes associated with the analyzed risks was assessed by using the following question, "How severe do you think the enlisted diseases are?" The scale suggested the following estimates: Severe; Average; Mild. Therefore, to assess a certain risk, respondents first had to assess likelihood of a specific nosology and then they had to assume how grave health outcomes would be if the risk was realized[6].

Next, a risk assessment matrix was created (Table 1)[6, 7] showing shares of popula-

[5] At the first stage, the respondents were suggested to correlate a verbal expression of likelihood and its percent expression according to their conceptions.

[6] State Standard GOST R 58771-2019. The National Standard of the Russian Federation. Risk management. Risk assessment technologies; approved and introduced by the Order of the Federal Agency on Technical Regulation and Metrology on December 17, 2019 No. 1405-st. Moscow, Standartinform, 2020, 86 p. (in Russian).

[7] State Standard GOST R 51901.1-2002. The State Standard of the Russian Federation. Dependability management. Risk analysis of technological systems; approved and introduced by the Order of the RF Gosstandart on June 7, 2002 No. 236-st. Moscow, Gosstandart of Russia, 2002, 23 p. (in Russian).

tion who assessed a risk as high, average, or low.

Obviously, the matrix is created according to the "traffic light" rule and based on how individuals see a certain situation [11, 12]. We can determine an element in the matrix that corresponds to a cross point between likelihood and gravity and determine a risk rate established by different groups of respondents. The matrix included three risk rates (H meant high risk (red color); A, average risk (yellow color); and L, low risk (green color)). Quantitative estimates of an event likelihood that were obtained at the first stage showed numeric ranges of likelihood corresponding to its quantitative characteristics.

All the obtained data were statistically analyzed using SPSS 16.0 software package for Windows.

Results and discussion. Data on how people understand likelihood and how its different levels are reflected in their minds when they hear different verbal expression describing them made it possible to establish that only 70 % of the respondents correlated a text with a number. The remaining 30 % had certain difficulty in doing it since they either omitted a difficult question or put the same values in all their answers.

Overall, 1324 people were questioned at different times. After we deleted incorrect data (396 completely omitted answers), we got the combined data array with 928 observation units in it (70 % of the initial data array). We included those respondents who answered at least one of seven questions assuming that if an answer was given, then this word or expression had its reflection as a number in a person's mind. Two ± one % of the respondents as per each specific variable failed to cope with the task and omitted the question. We established that transformation of words into numbers was not influenced by any sociodemographic characteristics of the respondents. Statistical significance of differences between the variables as per sex, age, incomes and education was checked in every survey (2014, 2016 and 2020); it was also checked as per combined data produced by all the surveys and in this case a year of a specific survey was added as another parameter. We did not detect any authentic differences.

The gradation suggested by the IPCC was established not to correspond to the senses existing in mass perception of the respondents from Russia. For example, experts believe that words "virtually certain" should correspond to likelihood that exceeds 99 %; still, our analysis revealed that only 14.1 % of the respondents understood this expression in the same way. This concerned also the expression "very likely", which, according to the IPCC experts, means a likelihood higher than 90 %, but only 8.3 % of the respondents are of the same opinion (Table 2).

The highest percent of opinion matches is observed for the average likelihood (about as likely as not) and low likelihood (unlikely) since 83.8 % and 70.3 % of the respondents' opinions accordingly matched expert estimates. The category "likely" is perceived similarly by experts and "ordinary people" in 41.6 % of the cases. The highest likelihood ("Virtually certain" and "Very likely") and the lowest one ("Very unlikely and "Exceptionally unlikely") are estimated differently; therefore, it is necessary to determine how they are interpreted by population in order to interact with people more effectively when informing them about risks.

Our analysis of mean values[8] revealed that the verbal expression "Virtually certain" was associated with likelihood within the range of 85–88 % in the respondents' minds; "Very likely", 77–79 %; "Likely", 64–66 %; "About as likely as not", 48–49 %; "Unlikely", 23–25 %; "Very unlikely", 13–15 %; and "Exceptionally unlikely", 5–7 % (Table 3).

We used the mean model due to the data being expressed as per metric scales; "a measure of the central trend for nominal variables can be only the modal value, that is, the most

[8] Quality of the mean value as a model was estimated by analyzing the standard error of the mean and comparing values with general mathematical expectation ((mean value ± 2) · the standard error of the mean).

Table 1

A model matrix showing health risk assessment by population

	Qualitative characteristic of an event likelihood						
	Virtually certain	Very likely	Likely	About as likely as not	Unlikely	Very unlikely	Exception-ally unlikely
	Quantitative characteristic of an event likelihood						
Gravity of outcomes	n–n %	n–n %	n–n %	n–n %	n–n %	n–n %	n–n %
Severe	H	H	H	H	H	A	A
Average	H	H	A	A	A	L	L
Mild	A	A	L	L	L	L	L

Table 2

Expert and ordinary people's opinions on numeric expression and verbal description of likelihood

Verbal expression / word	Numeric expression of a verbal expression / word suggested by the IPCC (%)	A share of respondents with the opinion matching the IPCC gradation (%)
Virtually certain	> 99	14.1
Very likely	> 90	8.3
Likely	> 66	41.6
About as likely as not	33–66	83.8
Unlikely	< 33	70.3
Very unlikely	< 10	25.5
Exceptionally unlikely	< 1	17.9

Table 3

Mean values of a numeric expression for a verbal likelihood description

Verbal expression	Mean value	The standard error of the mean
Virtually certain	86.6	0.57179
Very likely	77.7	0.53538
Likely	65.1	0.63818
About as likely as not	48.6	0.44188
Unlikely	24.2	0.44748
Very unlikely	13.8	0.39453
Exceptionally unlikely	6.0	0.30225

common number in a data set. The modal value does not have any spread" [9]. The median is used as a measure of the central trend for variables given as per the ordinal scale. Therefore, when testing the procedure for establishing group assessments of health risks associated with ambient air pollution, we used ranges of mean values of numeric equivalents determined for verbal likelihood description to analyze the results.

Subjective perception of health risks associated with ambient air pollution was determined through the respondents' ideas about what *diseases could occur* due to this factor and *how grave and likely* those diseases would be (that is, risk assessments made by the respondents).

In the respondents' opinion, ambient air can be a risk factor of bronchial asthma since 78.1 % of them mentioned it. This opinion was

[9] Kryshtanovskii A.O. Analiz sotsiologicheskikh dannykh s pomoshch'yu paketa SPSS: uch. posobie dlya vuzov [Sociological data analysis with SPSS software: the manual for higher education institutions]. Moscow, HSE Publ., 2006, 281 p. (in Russian).

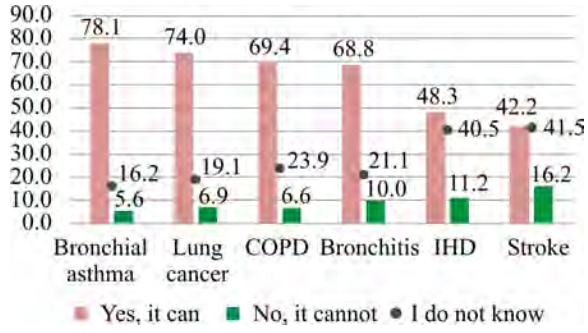

Figure 1. Distribution of the respondents' answers to the question "Do you think these diseases can occur due to ambient air pollution in those people living in your microdistrict who do not have them now?" (a % of the total number of the respondents)

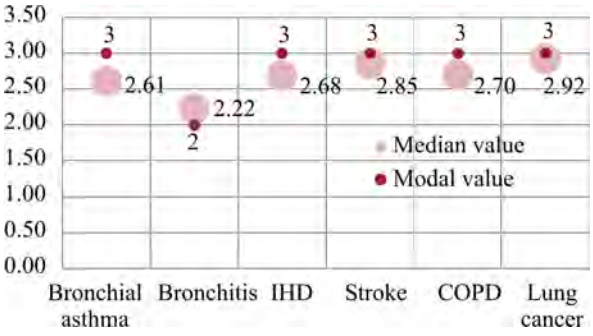

Figure 2. Measuring central trends in subjective assessments of disease severity

more typical for people with higher education[10] and from older age groups[11]. Most respondents think that ambient air pollution creates risks of lung cancer (74.0 %), chronic obstructive pulmonary disease (COPD) (69.4 %), and bronchitis (68.8 %). A bit less than a half of the respondents believe ambient air pollution to cause risks of such diseases as ischemic heart disease (IHD) (48.3 %) and stroke (42.2 %) (Figure 1).

In general, severity of a disease is estimated by experts as a ratio between its prevalence and mortality caused by it. All the diseases are divided into three groups: severe, average and mild. Accordingly, each disease has its severity depending on a group. This is usually called severity of illness index (SOI) and it varies from 0 to 1. Thus, diseases from the "mild" group tend to have average SOI that is equal to 0.0000055 (the range is 0.000001–0.00001); diseases from the "average" group, 0.0042 (the range is 0.000011–0.0085); diseases from the "severe" group, 0.50 (the range is 0.0079–0.099). When SOI equals 1, it means death. Bronchitis, IHD, stroke and bronchial asthma are known to belong to the average group whereas COPD and lung cancer fall within the severe category[12]. The respondents were suggested to subjectively estimate severity of each disease using a three-score scale where 1 means a disease is mild and 3 means it is severe (Figure 2).

Obviously, the research results indicate that most respondents believed practically all the enlisted diseases were severe, bronchitis excluded.

We identified risks of each enlisted disease according to the respondents' opinions using the risk assessment matrix and showed shares of the respondents who determined a specific likelihood and severity of a disease. A calculation example is provided in Table 4.

We can conclude that in general risks of bronchial asthma associated with ambient air pollution were characterized as mild by 11.0 % of the respondents (this zone is colored green in Table 4); risks were assessed as average (the yellow zone) by one third of the respondents (35.3 %); and the remaining 53.6 % of the respondents believed those risks were high (the red zone).

[10] We detected statistically significant differences in the variable "Do you think ambient air pollution can cause bronchial asthma in those people living in your microdistrict who do not have this disease now?" depending on the respondents' education (the Kruskal – Wallis test; the significance equals 0.015).

[11] We detected statistically significant differences in the variable "Do you think ambient air pollution can cause bronchial asthma in those people living in your microdistrict who do not have this disease now?" depending on the respondents' age (the Kruskal – Wallis test; the significance equals 0.000).

[12] Methodical guidelines MR 2.1.10.0033-11. 2.1.10. Sostoyanie zdorov'ya naseleniya v svyazi s sostoyaniem okruzhayushchei sredy i usloviyami prozhivaniya naseleniya. Otsenka riska, svyazannogo s vozdeistviem faktorov obraza zhizni na zdorov'e naseleniya [Population health under exposure to the existing ecological situation and living conditions. Assessment of health risks associated with effects produced by lifestyle-related factors on population health]. Moscow, Rospotrebnadzor's Federal Center for Hygiene and Epidemiology, 2011, 62 p. (in Russian).

Table 4

Assessing risks of bronchial asthma associated with ambient air pollution in Perm and Krasnoyarsk (% of the total number of the respondents)

	Qualitative characteristic of event likelihood						
	Virtually certain	Very likely	Likely	About as likely as not	Unlikely	Very unlikely	Exceptionally unlikely
Gravity of outcomes	Quantitative characteristic of event likelihood (%)						
	85–88	77–79	64–66	48–49	23–25	13–15	5–7
Severe	6.9	9.3	12.7	13.4	8.3	5.3	5.8
Average	1.2	1.8	7.2	10.5	6.2	4.1	4.3
Mild	0.3	0.0	0.3	0.6	0.4	0.4	0.9

Table 5

Assessing risks of the enlisted diseases associated with ambient air pollution in Perm and Krasnoyarsk (% of the total number of the respondents)

		Bronchial asthma	Bronchitis	IHD	Stroke	COPD	Lung cancer
Assessing risks for oneself	High	53.6	37.2	59.5	69.9	58.8	74.9
	Average	35.3	44.2	30.7	25.8	33.2	23.0
	Low	11.0	18.6	9.7	4.3	8.0	2.1
Assessing risks for others	High	62.3	38.1	63.8	74.6	67.2	85.5
	Average	32.3	46.1	26.6	22.0	26.6	12.7
	Low	5.3	15.8	9.6	3.4	6.2	1.8

Table 5 provides the results produced by assessing risks of all the enlisted diseases associated with exposure to ambient air pollution.

It was foreseeable that the respondents assigned the highest risk (74.9 %) to lung cancer. Interestingly, most respondents also perceived risks of stroke and IHD as high (69.9 % and 59.5 % accordingly). Although less than a half of the respondents believed that these two diseases were associated with ambient air pollution, their outcomes were considered grave by 88.2 % and 71.5 % of the respondents. Quite a high share of the respondents thought these diseases to be likely with their likelihood being 48–66 % (this share exceeded 45.0 %). Obviously, we should question an instrument applied to measure estimates of disease likelihood. Although the question included a special instruction that likelihood should be estimated considering a health risk factor associated with ambient air pollution, we cannot possibly be sure that this instruction was truly taken into account by the respondents when they gave their assumptions on the matter. Stroke and ischemic heart disease are widespread; if initially respondents state that these diseases are not associated with ambient air pollution and then claim that they are highly likely to appear, we can clearly see that the risk factor itself, ambient air pollution in our case, has been lost by the respondents. We checked correlations between the variables to identify any possible correlation of the risk factor and the health outcome with likelihood estimate and failed to confirm this doubt. People who do not associate stroke[13] and IHD[14] with ambient

[13] We established statistically significant differences in the variable “In your opinion, how likely are ***you*** to have stroke?” depending on answers to the question “Do you think ambient air pollution can cause stroke in those people living in your microdistrict who do not have it now?” (the Kruskal – Wallis test; the significance equals 0.000. Cramer’s V is 0.308, $p = 0.000$ (a moderate correlation)).

[14] We established statistically significant differences in the variable “In your opinion, how likely are ***you*** to have IHD?” depending on answers to the question “Do you think ambient air pollution can cause IHD in those people living in your microdistrict who do not have it now?” (the Kruskal – Wallis test; the significance equals 0.000. Cramer’s V is 0.342, $p = 0.000$ (a moderate correlation)).

air pollution actually tend to estimate their likelihood due to this pollution as low. Therefore, these results can be due to gravity of outcomes ascribed to a given disease.

Risks of bronchitis are most often (62.8 % of the respondents) estimated as low or average due to outcomes of this disease being perceived as mild (10.6 %) or average (59.8 %). Although its likelihood is estimated as high (starting from 64 % and higher in 72.2 % of the cases), the risk, as a whole, is considered permissible.

The risk characteristics outlined above are based on estimating likelihood of falling sick with a certain disease and gravity of its outcomes for the respondents themselves. When the respondents estimated this likelihood and gravity for other people, their estimates tended to be higher. For example, a risk of COPD in estimated by the respondents as high by 8.7 % more frequently for other people than for themselves; COPD, by 8.4 % more frequently; and lung cancer, by 10.6 %. This different subjectively estimated likelihood indicates there is a typical cognitive distortion here associated with risk perception and likelihood estimates. We can call it "an illusion of invulnerability" when a person or a group of people believe that "bad things" more often happen to others and not to them.

The results produced by cluster analysis showed that the analyzed sampling was divided into three clusters. The first one was made of people with their risk estimates being closer to average and they accounted for almost half of the respondents (48.8 %). The second cluster included people who more often estimated risks as high (approximately one third of the respondents or 29.5 %). The third cluster was made of respondents who tended to estimate risks of diseases associated with ambient air pollution as being low (one fifth of the respondents or 21.7 %).

Conclusion. "Non-experts" usually have certain difficulty perceiving numeric expressions of likelihood. Bearing this in mind, we attempted to correlate qualitative likelihood characteristics, that is, its verbal descriptions, with ranges of its numeric values that came to people's minds when they heard certain words or expressions. We found out that only 70 % of people actually correlated words with figures while the remaining 30 % failed to accomplish the task. We determined that some people among those who correlated verbal descriptions of likelihood with their quantitative expressions preset values for them that fell out of the ranges estimated by experts.

Experts tend to estimate likelihood approximately by 10 % higher than "ordinary people" when it comes down to such words as "Virtually certain" and "Very likely". "Likely", "About as likely as not" and "Unlikely" are also estimated in a different way, but the gap between the opinions is smaller in this case. "Very unlikely" and "Exceptionally unlikely" are estimated by experts approximately by 5 % lower than by "ordinary people". Certain differences were also detected regarding estimates of disease severity. According to expert estimates, only two out of six enlisted diseases are severe, namely lung cancer and COPD; the remaining ones have average severity. In contrast, most people tend to think that all the enlisted diseases, except bronchitis, are severe.

Our results make it possible to solve a practical task related to informing people about health risks and to overcome a so-called language barrier between experts and ordinary people. This includes, among other things, messages aimed for decision-makers that can be adapted considering all the detected peculiarities of risk perception. For example, when experts have ready results produced by risk assessment, they can correlate likelihood values exactly with the words that reflect them correctly in "ordinary people's" minds and use these words to create information texts for people or decision makers.

It is necessary to know how people assess risks to make relevant decisions on how to manage them. This necessity calls for identifying what instruments can be used to get this knowledge. In this research, we have considered the procedure for identifying public assessments of health risks associated with am-

bient air pollution. This procedure includes using such variables as likelihood and severity of outcomes thereby making it possible to create risk assessment matrices. Such matrices make for faster distribution of response strategies and "it is easier for decision-makers to fill in a risk matrix when they operate with specific response strategies and not with abstract generalized risk categories" [14]. If risk managers know how people assess this or that risk, they have better understanding what strategy should be developed considering both experts' opinions and public expectations. Health risk management activities are aimed at a) a factor that creates a risk [15–17], ambient air pollution in our case, and they should reduce its effects on health, in other words, ambient air quality should be improved; b) at influencing risk consumers, that is, communicating with them about this risks [18]. In the first case, managerial decisions are mostly based on expert risk assessments; in the second case, on public ones. When people assess health risks as high and significant, communications should be built on a dialogue-based model. Bearing in mind, that risk perception and its subjective assessment includes two components, emotional and cognitive one [19], these activities should be aimed at increasing people's trust in decision-makers (working with irrational components in an ordinary mind) and at developing the cognitive component, that is, providing people with more knowledge about ambient air quality.

The suggested procedure helps determine approximate proportions regarding distribution of risk assessments in the analyzed group. This pilot research has established that almost half of the respondents tend to estimate health risks associated with ambient air pollution as being average and one third consider them high. The created matrix of public health risk assessment indicates that emergency activities are redundant but certain urgent communications are required since most people tend to estimate the analyzed risks as average or high. Should the risks be estimated only as average, only scheduled communications with people would be necessary without any pressure or speeding up. When people estimate risks as low (and experts are of the same opinion), such a situation does not require any specific risk communications. However, if people estimate risks as low but experts consider them high, additional risk communications should be introduced since subjective health risk assessments underlie choices on risk-associated behavior (self-preservation or self-destruction) [20].

We have developed an approach to identifying assessment of health risks associated with ambient air pollution by a large social group. The approach is universal and can be applied to identify assessment of other health risks.

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