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Causal Effects between the Biological Pollution of the Environment and Sickness Rate of the Population with Infectious Pathology

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Abstract

The presence of the causal effects between the pollution of the environment of the urbanized territories and the population morbidity with enteric infections was confirmed from the evidence collected by calculating the positive meanings of the Odds Ratio (OR) and Relative Risk (RR) with trusted confidential borders, Identified Density Ratio (IDR) and associated risks, as well as the participating degree (X%) of bacterial pollution of the territories with respect to the sickness rate compared with the control territories.

Key words: *urbanization; pollution; biological factors; environment; population morbidity; enteric infection; causal effects.*

Introduction

Our research, conducted in the Republic for the first time in 2010-2011, had revealed that the urbanized territories differed one from another in the degree of environment pollution with the associated biological risk factors and the incidence indicator of population disease with Acute Enteric Infections (AEI). At the same time, the range of the territories examined by the degree of the bacterial pollution of soil, water and the disease intensity with AEI had revealed a definite equivalence in the range of locations of the territories by the variables explored. These results enabled the assumption of the presence of causal effects among them [1-3].

However, the causal effect between the pollution of the environment influenced by bacterial factors and population disease can be reasonably affirmed only by defining the epidemiological data, which reflect the chances, risks and relationships [4-6].

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In light of this truth, the following work is aimed at defining the data of the corresponding epidemiological parameters.

Material and Methods

The digital data of the long-term annual average indicators of population disease with the AEI and the index of the Coliform Bacteria Group (CFBG), collected in prior researches [1-3] in the urbanized (Ust-Kamenogorsk, Taraz, Aktau, Temirtau. Ekibaztus, Zhanaozen) and reference territories (Shuchinsk), served as the research material.

The OR, RR, IDR and AR values, as well as the degree (X%) of bacterial pollution in population disease were defined by biostatical analysis methods with appropriate formulae [4-6], as well as with the help of the estimation of the risk with confidential intervals.

Results and Discussion

The data from all the parameters examined, typical for the urbanized territories, collected by employing the biostatical methods, are given in the Table 1.

The data in the Table 1 reveal that in Ust-Kamenogorsk,

Taraz Aktau, Temirtau, Ekibaztus, the value of the OR data, as a ratio of possibility of being exposed, among sick persons, to an analogous indicator among the healthy population ranges between 1.26 and 1.78 and RR. This expresses the possibility of morbidity from the biological factor in a range between 1.33 and 2.22, i.e. more than 1.0, which implies the trustworthiness of the indicators, when the significance level is 0.05.

Table 1

Epidemiological parameters of population morbidity from AEI in the urbanized territories depending on the degree of soiling

Territory name	Value of indicators				
	OR	RR	IDR	AR	X %
Ust-Kamenogorsk	1.78	2.22	2.21	113.1	121.5
Taraz	1.64	2.0	1.96	90.1	96.1
Aktau	1.36	1.56	1.48	45.2	48.5
Temirtau	1.64	2.0	1.94	88.1	94.5
Ekibaztus	1.21	1.33	1.26	24.5	26.3
Zhanaozen	1.02	1.00	1.05	4.3	4.6

The OR and RR indicators range within 1.0 in Zhanaozen, which imply the lesser possibility of morbidity dependence from environmental pollution. Apparently, the results show almost equal CFBG index indicators in Zhanaozen (33.5) and in the reference territory of Shuchinsk (29.1), as well as an indicator of population morbidity with SEI (97.4 and 91.8, respectively).

The IDR value of the territories examined, barring Zhanaozen, varied from 1.26 to 2.21. In other words, the density of the morbidity induced by AEI in these territories exceeded the density of morbidity by 1.26 to 2.21 times, when compared with the reference territory (Shuchunsk).

The IDR value in Zhanaozen was 1.05, i.e. almost equal to 1.0, showing the absence of any distinction when compared with the reference territory.

AR reveals an excessive risk of morbidity when compared with the reference territory and implies causal relations. The AR>0 value indicates the number of cases which would not exist, except for the risk factor.

According to the data given in the Table, the number of AEI cases connected with pollution, in the regions examined, varies from 4.3 in Zhanaozen to 113.1 in Ust-Kamenogorsk, which proves the presence of causal relations.

This fact is also corroborated by the degree of pollution in the territory participating in the population morbidity with AEI. The next formula was developed in order to calculate the participation share in population morbidity:

$$X = \frac{100\% x IDe}{IDo} - 100\%$$

X - participation share of pollution in the population morbidity;
IDe – the density of morbidity in the territories examined;
IDo – the density of morbidity in the reference territory.

100% population morbidity in the reference territory assumed to be equal to 100%.

As deduced from the Table, the indicators of the participation share of pollution with the Coliform Bacterial Group in the territories examined were observed to vary between 4.6% (Zhanaozen) and 121.5% (Ust-Kamenogorsk). In other words, in every territory the percentage of the morbidity from AEI was caused by the CFBG pollution.

Therefore, the implications of all the epidemiological parameters of population morbidity from AEI in the urbanized territories are evident by considering the cause-effect relationship between the population morbidity and the pollution of the territories with the Coliform Bacteria Group. The higher the value of the indicators the stronger is the cause-effect relationship.

Competing interests

The authors declare that they have no competing interests.

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