DETERMINATION OF RISKS OF BASIC DENTAL DISEASES NASCENCY AND ASSESSMENT OF IMPACT LEVEL OF ENVIRONMENTAL HEAVY METALS SALTS ON THE DISEASES PREVALENCE

Y. Lakhtin, Candidate of Medicine, Associate Professor
Kharkiv Medical Academy of Post-graduate Education, Ukraine

The author has studied the degree of conditioning and strength assessment of cause-effect relationships of the major stomatological diseases among the population caused by effects of environmental heavy metal salts. It was established that an excessive heavy metals in the environment is a factor, against which other risk factors for periodontal diseases and dentoalveolar anomalies can be found. The strength of a causal link between heavy metals excess and the development of this disease is poor. Dental caries with "very high" intensity level has high occurrence of conditionality from the effects of heavy metals and it can be considered environmentally induced.

Keywords: heavy metal salts, parodontitis, teeth caries, dentoalveolar anomalies, diseases prevalence, relative risk, attributable risk, etiological part, ecology.

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Foreword. Vision of the main causes of dental diseases nascency has been formed by science long ago and the confirmation was found in practice [1, 2]. These are so called main causes of diseases. But they do not always cause considerable health problems. There are also other additional factors, in the setting of which the impact of the main factors increases. One of such factors is hazardous factors of environment, as well as heavy metals salts (HMS). Analyzing their studies, authors indicate that on the polluted territories the prevalence of dental diseases among the population increases, as well as their intensity [3-5]. Though, we did not find any information about the assessment of impact of environmental hazardous factors on the development of these diseases in the context of evidentiary medicine.

Goal of the research was to determine risks, level of casualty and assessment of cause-and-effect relationship intensity of parodontitis diseases nascency, teeth caries having very high intensity level and dentoalveolar anomalies among population under the impact of environmental heavy metals salts.

Materials and Methods. The goal-oriented follow-up epidemiological study of the dental status of 885 citizens of Sumy oblast was conducted. The data, pursuant to the recommendation of the World Health Protection Organization, of key age group of 35-44 years old was analyzed. The first group (experimental) of examined patients lived in the territories with Cu, Pb, Mn, Zn, Cr, Fe salts excess in water and soil and consisted of 91 persons (territory A). The second group (reference group) consisted of 172 persons from territories not polluted with these microelements (territory B). The data of examination was registered in "Simplified card of dental status evaluation" (World Health Protection Organization, 1986). Further relative risk, total increase and attributable risk of parodontitis diseases prevalence, teeth caries (having very high intensity level) and dentoalveolar anomalies (DAA) were analyzed.

For clearer interpretation of the examination results we consider it is necessary to study mathematical models used by evidentiary medicine.

Relative Risk (RR) – is the ratio of even risk in the study group to even risk in the reference group. In other words it shows how the corresponding index increases (parodontitis diseases prevalence, teeth caries and dentoalveolar anomalies among population) under the impact of the studied factor (EHMS) [6, 7]. In our case the calculation of RR of diseases prevalence was performed on the ground of mathematical formula:

$$RR = [a/(a+b)]/[c/(c+d)],$$

where a – number of persons from territory A having pathological conditions; (a + b) – sum of diseased and healthy persons from the same territory; c – number of persons from territory B having indicated diseases; (c + d) – sum of diseased and healthy persons from the same territory.

Absolute effect is determined as a difference of indicator values in the study and reference groups. This difference estimates the absolute increase of indicator conditioned by the impact of the factor.

Attributable effect or attributable risk (AR) determines the share of diseases in the study group of the examined people, the course of which was the result of the hazardous factor only. It is also called the immediate risk or etiological share [7, 8]. Calculation of etiological fraction (EF) of sickness cases, related to the impact of heavy metals salt excess, was performed according to the formula:

$$EF = [(RR-1)/RR] \times 100\%,$$

where RR is Relative Risk of disease prevalence conditioned by the effect of hazardous factors, the nature which must be proved.

We observed the recommended criteria for assessment of the cause-and-effect relationship and the level of professional casualty of diseases prevalence according to Relative Risk [8, 9].

Diseases prevalence and their absolute increase were expressed as P (95% CI), where P is the share of people with parodontitis, dentoalveolar anomalies and teeth caries having very high intensity level (DMF) (%), and 95% CI is a confident interval at 95% level of confident probability of this share among general population. Confident interval for the share and relevant risk were calculated in accordance with Klopper-Pirson. Comparison of disease prevalence in two independent groups of examined people was conducted according to one-sided accurate Fisher criteria and non-

parametrical "chi-square". Statistical significant differences were considered when $p<0.05$. Material processing was performed with the help of statistical package AtteStat 10.8.4. for MS Excel.

Study Findings and Discussion. Analysis of our study results is shown in the Table.

As the Table shows, the prevalence of parodontal tissues diseases among population living in territories polluted with HMS has statistically significant difference from conditionally "clear" territories ($p = 0.03$). Probability of parodontitis nascency among population from territory A is 1.1 times higher than the one on the territory B. Increase of diseases due to external factor (HMS excess) amounts to 9.2%. The share of parodontal pathology going under this factor amounts to 10.1%. It means that parodontal diseases prevalence under the impact of environmental heavy metals salts increases by the same percent.

Teeth caries is the most indicating characteristics of HMS impact on the development of dental diseases. Moreover its intensity level is very high. Such intensity level occurs more than twice more frequently among the examined people from polluted territories ($p = 3.2E-10$). Probability of teeth caries prevalence among population from these regions is 2.34 times higher. Frequency of nascency of very high intensity level increases by 40.3%, and additional prevalence based on the impact of HMS amounts to 57.3%.

The prevalence of dentoalveolar anomalies among population from territory A is higher than the one from "clear" territory, but this difference is statistically insignificant ($p > 0.05$). Increase of frequency of dentoalveolar anomalies registration among the examined people from "polluted" regions amounts to 6.0% with very vast scale of confident interval; probability of anomalies nascency on the territory with microelements increases by 1.18 times. Due to heavy metals impact additional prevalence of dentoalveolar anomalies amounts to 15.4%

Criteria of assessment of level and cause-and-effect relationships between impact of professional hazardous factors and disease incidence among population [8, 9] can be extrapolated to the issue of consideration of the hazardous environmental factors impact. In this connection it is obvious that in the example of our study the level of ecological casualty of parodontal tissues diseases nascency under such relevant risk is small ($1.0 < RR < 1.5$), the share of participation of excessive heavy metal salts in etiology of paradontal pathology amounts to less than 33.0%, $p < 0.05$. It testifies to the fact that environmental HMS excess is the condition on the basis of which other factors of risk of parodontal pathology nascency act. Under relative risk $2 < RR \leq 3.2$ it is possible to interpret the nascency of teeth caries with very high intensity level among population from polluted regions as high level of casuality. Although the relative risk of dentoalveolar anomalies nascency is higher than 1, minimal index of the scale of confidence interval characterizing the prevalence of disease among general population, is less than 1. According to the abovementioned criteria the casualty level of dentoalveolar anomalies nascency under the effect of heavy metal salts is small. In other words, as on the example with parodontal diseases, the excess of heavy metal salts is a background factor of risk of dentoalveolar anomalies nascency.

Turning to the goal of our study, let's assess the intensity of cause-and-effect relationships between pollution of the environment with HMS and prevalence of dental diseases. If we assume that the said chemical mixtures do not take part in nascency of these diseases, than its prevalence on the territory A and B have to be of little difference. But total increase of pathology prevalence and its attributive risk prove that on the polluted territories the additional share of diseases (which is probably preconditioned by the impact of HMS) is registered.

According to the said criteria, when additional share of parodontitis diseases prevalence is less than 50.0% and when relative risk is smaller than 2, the intensity of cause-and-effect relationships is considered as weak. In this case the excess of environmental HMS is the condition, on the basis of which, the other factors of risks of parodontal pathology nascency impact. It is also subject to prevalence of dentoalveolar anomalies. Etiological part of teeth caries with very high level (more than 50.0%) and with relative risk from 5 to 2, has such intensity of cause-and-effect relationships that characterizes these diseases as etiologically conditioned.

Chief specialists of medical ecology divide all ecologically conditioned diseases into two groups depending on the role of the factor. In the first case environmental factor appears as the cause of disease development and such effect is proposed to be marked as the determined (ecopath). In other case environmental factor is a condition, on the basis of which, under the impact of other etiological risk factors the negative

Table

Indexes of dental diseases prevalence risk under the impact of heavy metals salts

Disease	Prevalence, % (95% CI)		Relative risk (95% CI)	Absolute increase of prevalence, % (95% CI)	Attributable risk, %
	territory "A"	territory "B"			
Parodontitis	91.21 (83.41; 96.13)	81.98 (75.40; 87.41)	1.1 (1.01; 1.2)	9.2 (0.2%; 18.2)	10.1
Teeth caries having very high intensity level	70.33 (59.84; 79.45)	30.06 (23.33; 37.48)	2.34 (1.8; 3.05)	40.3 (28.0; 53.0)	57.3
Dentoalveolar anomalies	38.46 (28.45; 49.25)	32.56 (25.62; 39.90)	1.18 (0.84; 1.66)	6.0 (0.07; 19.0)	15.4

effect develops. Such conditions they suggest to call induced or nonspecific ecologically conditioned abnormalities (ecogenic) [10]. On this basis, main dental diseases being studied in our research can be considered as dental ecogenic.

The foregoing allows making a **summary**: the excess of environmental heavy metals salts contributes to the increasing relative and attributive risk of basic dental diseases prevalence. Casualty level of parodontal pathology and dentoalveolar anomalies nascency as a result of hazardous impact of heavy metals salts is small, but teeth caries with very high intensity level is high. The intensity of cause-and-effect relationships, between the effect of heavy metals and parodontal diseases and dentoalveolar anomalies nascency is weak, but teeth caries nascency can be considered as ecologically conditioned.

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Information about author:

Yuriy Lakhtin - Candidate of Medicine, Associate Professor, Kharkiv Medical Academy of Post-graduate Education; Ukraine, Kharkiv city; e-mail: sumystom@yandex.ru