

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

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The author has studied the degree of conditionality and assessment of power of cause-and-effect relation of emergence of parodontitis, dentoalveolar anomalies and teeth caries among people under the influence of salts of heavy metals in the environment. Relative and attributable risk of distribution of these illnesses is calculated.

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 not always cause considerable health problems. There are also other factors, additional, in the setting of which the impact of the main factors increases. One of such factors is hazard 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 population increases, as well as their intensity [3-5]. Thought, we did not find any information about the estimation of environmental hazard factors impact on the development of these diseases in the context of evidentiary medicine.

Goal of research was to determine risks, level of casualty and evaluation 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 dental status of 885 citizens of Sumy oblast was conducted. The data, pursuant to the recommendation of World Health Protection Organization, of key age group of 35-44 years was analyzed. The first group (experimental) of examined patients lived on 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) and 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 more clear interpretation of study results we consider it is necessary to study mathematical models handling by evidentiary medicine.

Relative Risk (RR) – that is the ratio of even risk in study group to even risk in 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 study 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 having pathological conditions from territory A; (a + b) – sum of diseased and healthy persons from the same territory; c – number of persons having indicated diseases from territory B, (c + d) – sum of diseased and healthy persons from the same territory.

Absolute effect is determined as a difference of indicator values in 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 part of diseases in the study group of examined people, the course of which was the impact of hazard factor only. It is also called the immediate risk or etiological part [7, 8]. Calculation of etiological fraction (EF) of sickness cases, related to the impact of heavy metals salt excess, was performed according to formula:

$EF = [(RR-1) / RR] \times 100\%$, where RR is Relative Risk of disease prevalence conditioned by the effect of hazard factors, character of which it is necessary to prove.

We observed the recommended criteria for estimation 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 part of people with parodontitis, dentoalveolar anomalies and teeth caries having very high intensity level (КІІВ) (%), and 95% CI is a confident interval at 95% level of confident probability of this part among general population. Confident interval for the part and relevant risk were calculated according to Klopfer-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 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 1.

As the Table shows the prevalence of parodontal tissues diseases among population from polluted with HMS territories has statistical significant difference from conditionally "clear" territories ($p = 0.03$). Probability of parodontitis nascency among population from territory A is in 1.1 times higher than on the territory B. Increase of diseases under external factor (HMS excess) amounts to 9.2%. Part of parodontal pathology going under this

Table 1

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

Disease	Prevalence, % (95% ДI)		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

factor amounts to 10.1%. It means that parodontal diseases prevalence under the impact of environmental heavy metals salts increases on 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 2 time more frequently among examined people from polluted territories ($p = 3.2E-10$). Probability of teeth caries prevalence among population from these regions is in 2.34 times higher. Nascency frequency of very high intensity level increases for 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 from "clear" territory, but this difference is statistically insignificant ($p > 0.05$). Increase of frequency of dentoalveolar anomalies registration among examined people from "polluted" regions amounts to 6.0% with very vast scale of confident interval and probability of anomalies nascency on the territory with microelements increases in 1.18 times. Due to heavy metals impact additional prevalence of dentoalveolar anomalies amounts to 15.4%

Criteria of cause-and-effect relationships and level estimation between impact of professional hazard factors and disease incidence among population [8, 9] can be extrapolated on the issue of consideration of the hazard environmental factors impact. In this connection it is obvious that the level of ecological casualty of parodontal tissues diseases nascency, on the example of our study, under such relevant risk is small ($1.0 < RR < 1.5$), share participation

of excess content of heavy metal salts in etiology of parodontal pathology amounts to less than 33.0%, $p < 0.05$. It testifies that environmental HMS excess is the condition on the basis of which other factors of parodontal pathology nascency risk 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 casualty. Although the relative risk of dentoalveolar anomalies nascency is more 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 said 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, excess of heavy metal salts is a background factor of nascency risk of dentoalveolar anomalies.

Turning to the goal of our study, let's evaluate 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, its attributable risk prove that on the polluted territories additional part of diseases (which is probably conditioned 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 considerate as weak. In

this case the excess of environmental HMS is the condition, on the basis of which, the other factors of nascency risks of parodontal pathology impact. It is also subject to prevalence of dentoalveolar anomalies. Etiological part of teeth caries with very high level more than 50.0% and when relative risk is from 5 to 2, has such intensity of cause-and-effect relationships, that characterizes these disease as etiological conditioned.

Chief specialists of medical ecology divide all ecological conditioned diseases in 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 they propose to mark as 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 effect develops. Such conditions they suggest to call induced or nonspecific ecological conditioned abnormalities (ecogenic) [10]. On this basis, main dental diseases being studied in our research can be considered as dental ecogenic.

The foregoing permits to make a **summary**: the excess of environmental heavy metals salts contributes to increase of relative and attributive risk of basic dental diseases prevalence. Casualty level of parodontal pathology and dentoalveolar anomalies nascency in the result of hazard 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 ecological conditioned.