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DYNAMICS OF INFECTIOUS AND PARASITOGENIC MORBIDITY AT THE CHILDREN POPULATION IN THE RURAL DISTRICTS AND CORELATION WITH WATER FACTOR

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ABSTRACT

Introduction: Intestinal parasites are important enteric pathogens. Poverty, low quality of food and water supply and poor sanitation systems are the important factors associated with intestinal parasitic infections. These kinds of infections can be a good index for hygienic and sanitation status of the society.

The aim: To study dynamics of infectious and parasitic diseases (for 2008-2013 years) among the children population in Dnipro region and to define influence of water factor on the disease and prevalence given class of illnesses.

Materials and methods: Retrospective study of infectious and parasitogenic diseases (I class by ICD-10) among children population from rural districts of Dnipropetrovsk region for 2008-2013 years was carried out.

Results: It was spent correlation analysis between some indicators of potable water quality of diseases of the given class in all districts. In the majority of rural districts, was shown increasing I class of diseases from (1.4 to 1.63) times in dynamics. In some districts was reveled an average correlation link between content in water of the dry residue, chlorides, sulphates, calcium, magnesium, except rigidity and iron and prevalence I class of diseases ($r=0.50$, $p<0.001$). Prevalence of the given class of diseases was correlated with pH, nitrates, oxidability in the three rural districts of Dnipropetrovsk region ($r=0.74$-0.89, $p<0.001$).

Conclusions: It has been shown that the composition of drinking water consumed by the rural population remains one of the basic factors in the formation of public health in the conditions of small exposure of the influence individual indicators of salt and chemical composition. The children's cohorts were the most sensitive to these indicators.

KEY WORDS: water factor, correlation link, morbidity, children population, infectious and parasitic diseases

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INTRODUCTION

In the late 19th Century, cities in Western Europe and the United States suffered from high levels of infectious disease [1]. Over a 40 year period, there was a dramatic decline in infectious disease deaths in cities [2]. At that time newspapers were the major source of information educating urban households about the risks they faced. By constructing a unique panel data base, it was finding that news reports were positively associated with government announced typhoid mortality counts and the size of this effect actually grew after the local governments made large investments in public water works to reduce typhoid rates [3]. News coverage was more responsive to unexpected increases in death rates than to unexpected decreases in death rates [4]. A cross-sectional study of the prevalence of intestinal parasitic infections at eight schools in Bo Klau district and four schools in Chalerm Prakiet district in Nothern Tailand was carried out [5].

Intestinal parasites are important enteric pathogens [6]. Poverty, low quality of food and water supply and poor sanitation systems are the important factors associated with intestinal parasitic infections [7]. These kinds of infections can be a good index for hygienic and sanitation status of the society [8-10].

The burden of gastrointestinal illness (GII) associated with drinking water supplies in the United States (US) is not precisely known [10-15]. Although available surveillance data suggest declining numbers of outbreaks, aging infrastructure and distribution system deficiencies represent persistent challenges that may be associated with increased risks. Estimates of the endemic attributable disease burden of acute gastroenteritis associated with public water supplies in the US range from 4.3–16.4 million cases annually.

THE AIM

To study dynamics of infectious and parasitogenic morbidity (for period 2008-2013 years) among children population in the rural districts of Dnipro region and define influence of water factor on the morbidity and prevalence this class of diseases.

MATERIALS AND METHODS

Retrospective research of the infectious and parasitogenic diseases (I class by ICD-X) was conducted on children population in the rural districts of Dnipro region for 2008-2013

years, on a basis of official statistical documents Ministry of Public Health of Ukraine. A cross-correlation analysis was carried out between separate indicators of drinking-water quality and the morbidity indexes I class of diseases in all rural districts of region. Estimation of intercommunication between the given signs was conducted by coefficient of correlation Spearmen (r). Level of statistical meaningfulness was accepted ($p<0.05$; $p<0.001$). Research methods: physical and chemical (for determination indexes of drinking-water quality from the sources of water-supply); medical-statistical (for mathematical calculations of the given quantitative indexes, methods of variation statistics). Bioethics Commission on the protocol of Committee on Biomedical Ethics in the Dnipropetrovsk Medical Academy Ministry of Health of Ukraine (№ 5 from April 10, 2019) were not revealed any violations of the moral and ethical norms during research work.

RESULTS AND DISCUSSION

Analysis indexes of morbidity I class (infectious and parasitogenic diseases) among children population for 2008–2013 years found out the greatest level of morbidity in the majority rural districts of Dnipro region in 2008 year: Vasylkivskyi (442.6 cases), Verkhniodniprovskyi (1260.5), Dnipropetrovskyi (308.5), Krynychanskyi (854.2), Magdalynivskyi (460.2), Novomoskovskyi (952.3), Petropavlivskyi (638.0), Pokrovskyi (769.9), Synelnykivskyi (468.2), Solonyanskyi (673.3) and Sofievskyi (638.1) cases on 10 000 of children population. Thus, in the majority of rural districts level of morbidity I class of diseases was decline in dynamics for 6 years, except Petrykivskyi (561.4), Tsarychanskyi (338.5) and Yurievskyi districts (490.7) cases per 10 000 of children. In the given districts, the greatest level this class of diseases was observed in 2013 years. In particular, middle level I class of diseases in all rural districts was decline in dynamics in 1.6 times: from 564.2 cases (in 2008) to 358.7 cases on 10 000 children (in 2013).

The greatest level of infectious and parasitogenic diseases, in comparison with all rural districts, was found out in Verkhniodniprovskyi district: 1260.5 cases on 10 000 children at the 14 years old (in 2008), with a tendency to decline in 2013 – 239.9 cases, i.e. in 5.25 times.

In some rural districts was revealed dynamics of increasing I class of diseases for 2008-2013 years. For example, in Kryvorizkyi district level of morbidity was increased in 1.4 times: from (253.2 to 357.6) cases on 10 000 of children. In the Petrykivskyi district morbidity this class of diseases increased in 3.07 times: from (182.8 to 561.4) cases; in Piatykhatskyi district – in 1.07 times: from (518.1 to 554.4) cases; in Solonyanskyi district – in 1.01 times: from (673.3 to 682.7) cases; in Sofievskyi district – in 1.1 times: from (638.1 to 704.3) cases; in Tomakivskyi district – in 2.0 times: from (178.5 to 342.8) cases; in Tsarychanskyi district – in 1.4 times: from (239.4 to 338.5); in Yurievskyi district – in 1.63 times: from (300.5 to 490.7) cases on 10 000 children.

Generally, in Dnipro region was found out a dynamic to decline level of diseases for this class in 1.4 times: from (722.5 to 501.4) cases on 10 000 children. It should be noted, that in some districts level of infectious and parasitogenic morbidity exceeded the middle level by the districts and Dnipro region at whole. Firstly, in Verkhniodniprovskyi district morbidity I class of diseases was higher, than a middle level for rural districts in 2.23 times (in 2008); in 2009 – 1.68 times; in 2010 – 1.66 times; in 2011 – 1.48 times.

Similar tendency was observed in Krynychanskyi district in 2008 – 2010 years; in the Mezhivskyi and Nikopolskyi districts in 2009 and 2011 years; in the Novomoskovskyi and Pokrovskyi districts in 2008 year; in the Pavlohradskyi district in 2009-2011 years; in the Petrykivskyi district in 2013 years; in Piatykhatskyi district in 2009, 2011-2013 years; in Solonyanskyi district in 2012-2013 years; in the Sofievskyi district in 2013 year (figure 1).

Consequently, the most favorable dynamics of morbidity (below middle level in Dnipro region) was observed in the following rural districts for 2008-2013 years: Vasylkivskyi, Dnipropetrovskyi, Kryvorizskyi, Magdalynivskyi, Petropavlivskyi, Synelnykivskyi, Tomakivskyi, Tsarychanskyi, Shyrokivskyi, Yurievskyi.

It was discovered a middle cross-correlation link between infectious and parasitogenic morbidity at the children, which consumed drinking-water from the centralized sources of water-supply in the Nikopolskyi and Pavlohradskyi districts with such chemical indexes: Zn, Cu, Mn, F, Al, nitrogen ammonia, nitrates and oxidableness ($r=0.30$-0.31, $p<0.05$). In Kryvorizskyi and Novomoskovskyi districts was found out a middle correlation between content of dry remain, chlorides, sulfates in the centralized water sources and prevalence of infectious and parasitogenic diseases among children population ($r=0.50$, $p<0.001$).

Tendency with a middle cross-correlation link had been shown between all chemical indexes, which influence on the salt composition of drinking-water, except rigidity and iron, and prevalence this class of diseases among peasants children ($r=0.50$, $p<0.001$) in the Kryvorizskyi, Novomoskovskyi, Nikopolskyi, Pavlohradskyi, Dnipropetrovskyi, Vasylkivskyi, Krynychanskyi, Synelnykivskyi, Verkhniodniprovskyi, Mezhivskyi, Petrykivskyi, Piatykhatskyi, Sofievskyi and Shyrokivskyi districts.

It should be noticed, that water from the centralized sources of water-supply, which were taken in the given rural districts: Verkhniodniprovskyi, Mezhivskyi, Petrykivskyi, Piatykhatskyi, Sofievskyi and Shyrokivskyi having a middle correlation with all indexes of salt composition and prevalence of infectious and parasitogenic diseases ($r=0.50$, $p<0.001$).

Results of research demonstrated that on the prevalence I class of diseases among children population influenced the followings indexes, such as salt composition of water, taken from the decentralizing sources: in Kryvorizskyi, Novomoskovskyi, Nikopolskyi, Pavlohradskyi districts – dry remain, chlorides, sulfates ($r=0.87$, $p<0.001$). In the territory of Vasylkivskyi, Krynychanskyi and Synelnykivskyi districts the same tendency was revealed for the

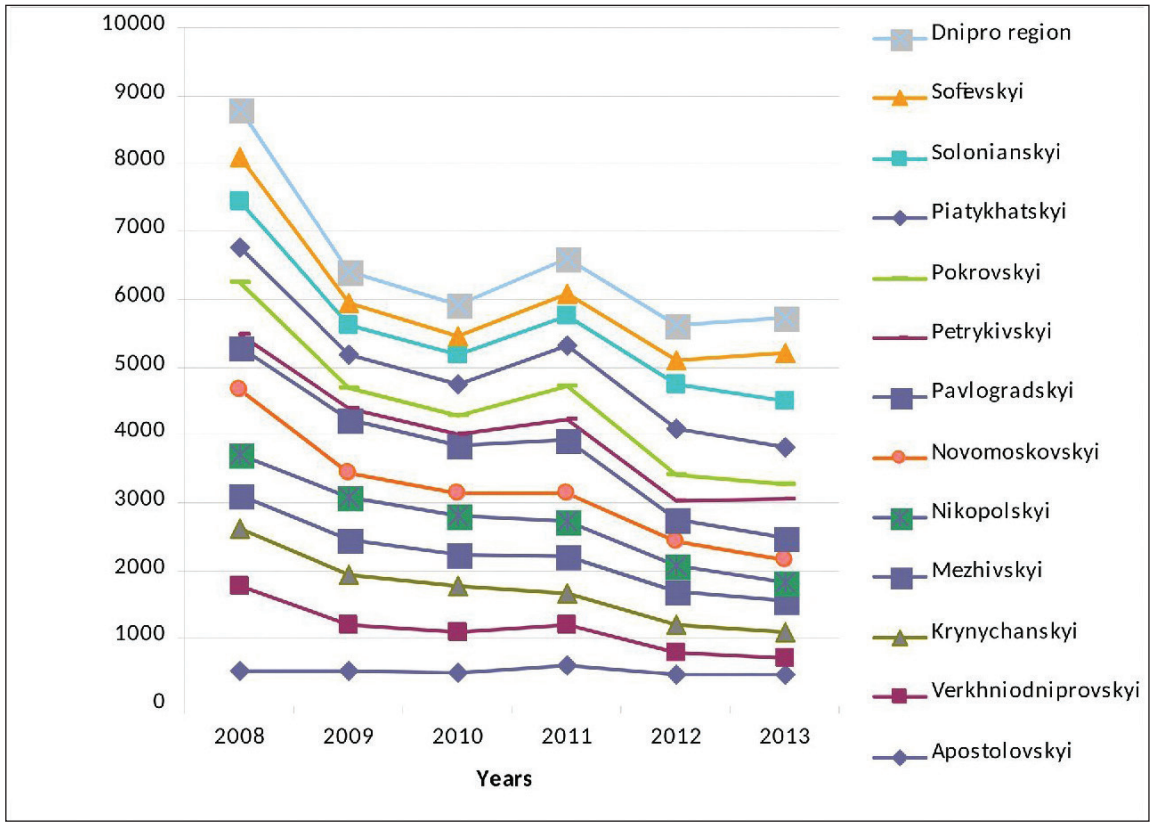

Figure 1. Dynamics of morbidity I class of diseases at the children population in some rural districts of Dnipro region for 2008-2013 years.

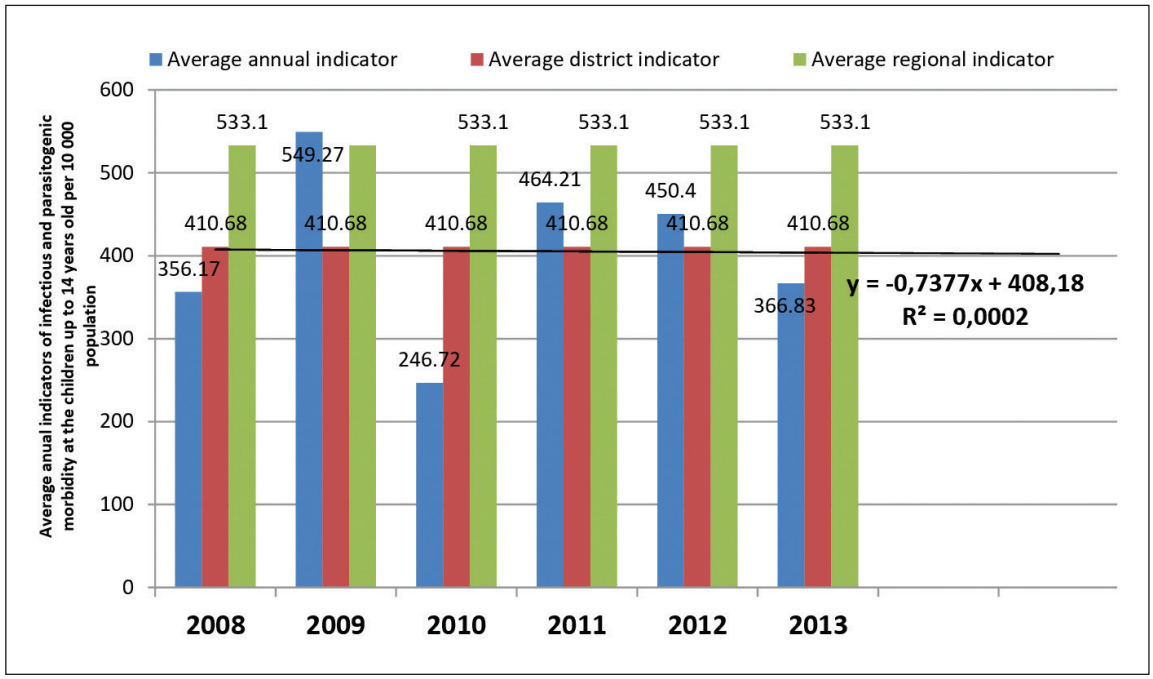

Figure 2. Average annual indicators of infectious and parasitogenic morbidity at the children up to 14 years old in the Kryvorizhskyi rural district of Ukraine in the dynamics for 2008-2013 years and its prognoses.

general rigidity, dry remain, chlorides, sulfates, calcium, magnesium (r=0.73-0.89, p<0.001). In the majority of districts – Verkhniodniprovskyi, Mezhivskyi, Petrykivskyi, Piatykhatskyi, Sofievskyi, Shyrokivskyi, Apostolivskyi, Magdalynivskyi, Petropavlivskyi, Pokrovskyi, Solonyanskyi, Tomakivskyi, Tsarychanskyi, Yurievskyi was determined correlation between a general rigidity and prevalence of I class of diseases (r=0.82, p<0.001). Prevalence I class of

diseases was correlated with pH, nitrates, oxidableness in such rural territories: Vasylkivskyi, Krynychanskyi and Synelnykivskyi districts (r=0.74-0.89, p<0.001) and in the Verkhniodniprovskyi, Mezhivskyi, Petrykivskyi, Piatykhatskyi, Sofievskyi, Shyrokivskyi districts (r=0.70-0.83, p<0.001).

A high average anual level of incidence infectious and parasitogenic morbidity among the children in Kryvorizhskyi rural districts of Dnipropetrovsk region has been established. The frequency of infectious and parasitogenic morbidity was on 10-30% higher than the average regional indicator (p <0.001). In (fig. 2) average anual levels of infectious and parasitogenic morbidity among the children's population in Kryvorizhsky rural district is presented and calculation of its forecast level, which indicates about probable decrease in the dynamics incidence for this class of diseases in the rural settlements and villages of Kryvorizhsky district.

CONCLUSIONS

1. It has been shown that the composition of drinking water consumed by the rural population remains one of the basic factors in the formation of public health in the conditions of small exposure of the influence individual indicators of salt and chemical composition. The children's cohorts were the most sensitive to these indicators.
2. It was determined that the greatest determinant influence on the incidence of infectious and parasitogenic morbidity among the children is caused by the saline composition of drinking water (18%) due to a high calcium-magnesium water hardness in rural wells (in decentralized water supply systems).
3. The predicted level of incidence for the infectious and parasitogenic morbidity among the children of Kryvorizhskyi rural district, which indicates a possible decrease in the incidence rate this class of diseases in the countryside, which can be calculated with using the following formula: $y = -0.7377x + 408.18$, $R^2 = 0.0002$.

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The Authors declare no conflict of interest

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