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UŞAQ SAĞLAMLIĞININ MÜHAFİZƏSİNİN İDARƏEDİCİ ASPEKTLƏRİ: BRONX-AĞCİYƏR SİSTEMİNİN DİSPLAZİYADAN ASILI PATOLOGİYASI VƏ MÜHİTİN EKOLOJİ HETEROGENLİYİ

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Xülasə. *Uşaqlarda displaziyadan asılı bronx-agciyər sistemi patologiyasının regionar-ekoloji amillər nəzərə alınmaqla populyasion yayılmasını araşdırmaq məqsədilə tədqiqat aparılmışdır.*

*Tədqiqatda çoxamilli sistemli populyasion modelləşdirmə metodlarından istifadə edilməklə, regionar və ekoloji amillərin sağlamlığa təsiri öyrənilmişdir. Bundan ötrü 30 xarici mühit amili öyrənilmiş, onların hər birinin proqnostik, patometrik və sanoloji dəyəri araşdırılmışdır. Bu isə displaziyadan asılı bronx-ağciyər patologiyasının yaranması riskinin populyasion- fərdiləşdirilmiş baxımdan qiymətləndirilməsinə imkan verir. Uşaq yaşlarında bronx-ağciyər sisteminin displaziyasının və displaziyadan asılı patologiyasının müəyyənləşdirilməsinə imkan verən ətraf mühit amillərinin rolunun qiymətləndirilməsi üçün yeni metod əsaslandırılmış, təklif edilmiş və sınaqdan çıxarılmışdır. Tədqiq edilən patologiyanın regionar səviyyəsi (inzibati rayonlar və vilayətlər üzrə) öyrənilmiş və ətraf mühit təsirlərinin oxşar olduğu ərazilər müqayisə edilmiş*dir.

Müəlliflərin fikrincə, ətraf mühit amillərinin müxtəlif səviyyəli patometrik və sanometrik qiymətləndirmə üsullarının tətbiqi məqsədyönlü tibbi, sosial və regional ekoloji proqramların strukturunun əsaslandırılmasına imkan verə bilər ki, bu da əhalinin azyaşlı hissəsinin sağlamlığının möhkəmləndirilməsinə kömək edər.

Açar sözlər: *innovasion yanaşma, ictimai sağlamlıq, uşaqların sağlamlığı, ekoloji amillər*

Ключевые слова: *инновационные подходы, общественное здоровье, здоровье детей, экологические факторы*

Keywords: *innovative approaches, public health, children's health, ecological factors*

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MANAGEMENT ASPECTS OF CHILDREN'S HEALTH: DYSPLASTIC-DEPENDENT PATHOLOGY OF THE BRONCHOPULMONARY SYSTEM AND ECOLOGICAL HETEROGENEITY OF THE ENVIRONMENT

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Population stratification of the pediatric population was performed in the study, taking into account a set of regional-ecological factors relevant for the assessment of the health of children with dysplastic-dependent pathology of the bronchopulmonary system. The study was conducted using methods of systematic population modeling of a multi-factorial public health system under the influence of regional and ecologic factors. For each of the 30 environmental factors we have studied, its prognostic value, pathometric and sanologic value have been determined, which ensured the performance of population-personalized risk assessment of the dysplastic-dependent pathology of the bronchopulmonary system.A new methodology for environmental quality assessment has been substantiated, proposed and tested, the application of which allows to determine the differentiation of regional preventive programs of bronchopulmonary dysplasia and the

dysplastic-dependent pathology of the bronchopulmonary system in childhood. Personalized regional population stratification of children with bronchopulmonary dysplasia and the dysplastic-dependent pathology of the bronchopulmonary system were performed, and regional clusters (administrative districts of the regions) were identified with an alternative level of environmental quality. The use of pathometric and sanometric assessments (different levels) of environmental factors can be significant to substantiate the structure of targeted health, social, and regional environmental programs for promoting the health of the pediatric population.

Introduction. Bronchopulmonary dysplasia (BPD) is a polyetiological disease with symbiosis of trigger and hereditary contributing factors as well as environmental factors [1-3].It is not uncommon that the damage of the respiratory tract, beginning with the neonatal period, affects the ontogeny of the lungs and, under certain conditions, determines the formation of dysplastic-dependent pathology of the bronchopulmonary system (BLS) at subsequent stages of ontogeny [4-5]. That is why studying the influence of environmental factors in the aspect of ongoing lung ontogeny is important for the prevention of the adverse effects of the disease, their prevention and diagnosis [6-9]. BPD data vary widely across countries and data from different health centers. It is proved that the morbidity indicator is influenced by some environmental factors, the level of technical equipment and the intensity of work of hospitals, medical and organizational component of helping newborns and children 1-3 years of age. Due to differences in patient populations and neonatal care practices, BPD varies between neonatal care centers and can reach up to 68% in a group of children, between 22 and 28 weeks of gestation [10]. According to the European Respiratory Society, BPD develops in 30.0% of newborns requiring artificial lung ventilation. Thus, in Germany, 8059 children with a gestational age at birth <32 weeks were examined; 29.0% were diagnosed with BPD. In Japan, among 2145 children with birth defects, 28–33% were diagnosed with BPD; in Finland, 39% of premature births children had BPD [11].Laughon M.M. determined the percentage of BPD development based on the body weight of the newborn. Thus, with body weight ≤750 g, 90–100% of children developed BPD, 750–999 g in 70%, 1000–1249 g - 30–60%, and body mass greater than 1250 g, in 20.05% [12]. In Russia, the incidence of BPD is much lower (2.3 to 26.2%, depending on the region), which scientists consider as a hypodiagnosis of the disease [13, 14, 15]. The statistics of Ukraine, due to the comorbidity of BPD, do not yet reflect the true incidence of the disease, while the social and social monitoring of such children is absent at all, and the effects of BPD and the frequency of BPD in the older age groups of children have not been studied [16-20].

The purpose of the study was to perform population stratification of the pediatric population, taking into account a set of regional-ecological factors relevant for the assessment of the health of children with dysplastic-dependent pathology of the BLS.

Methodology. A personalized analysis of the available factors was performed in 116 children with BPD and 136 dysplastic-dependent pathology of BPS of two administrative regions of Ukraine (SPG_1 is the first stratified population group), 252 healthy children (SPG_2 is the second stratified population group) [21-25]. When studying the regional-population characteristics of groups of healthy and sick, a specially designed expert-prognostic card was filled, filled for each child and containing data on the presence of BPD or dysplastic-dependent pathology of BPS, as well as characteristics of specific regional-ecological clusters (RECs).In particular, according to factual mapping information of regional environmental management departments, four groups of environmental factors are identified: a group of factors characterizing climatic conditions of living and demographic characteristics (CDC): X_{14} – annual rainfall, X_{15} – population density, X_{16} – population (urban / rural population), X_{17} – water use rate (for 1 resident), X_{28} – drinking water pollution, X_{29} – food contamination, X_{30} – general morbidity rate: geo-ecological factors group (GEF): X_1 – soil washout intensity, X_2 – soil contamination with heavy metals, X_3 – soil erosion, X_4 – dusty soil load, X_5 – soil type, X_{21} - intensity of waste generation, X_{26} – soil contamination level (cesium, ^{137}Cs), X_{27} – erosion hazard, X_6 – lead, chromium,copper, nickel, zinc in the surface

atmosphere; group of hydro-environmental factors (HyEF): X_7 – intensity of removal of solid runoff and pollution of water objects from diffuse sources, X_8 – intensity of discharge of polluted industrial wastewater, X_9 – intensity of discharge of polluted economic and household wastewater, X_{10} drainage of pollution water, X_{11} – presence of landfills for storage of solid household, industrial, agrochemical wastes, X_{12} – mineralization of the aquifer, X_{13} – areas of flooding caused by economic activity, X_{18} – level of pollutant discharge, as well as a group of aero-ecological factors (AEF): waste generation, X_{22} – level of waste accumulation, X_{23} – presence of household waste landfills, X_{24} – level of air pollution, X_{25} – level of radiation background.

The problem, which is the basis of the new methodology, is solved by the fact that measurements of the level of radiation background (X_1), the content in the surface layer of the atmosphere of heavy metals (X_2), the content of heavy metals in the soil (X_3), pollution of the surface layer of the atmosphere from stationary sources (X_4) and the level of accumulated industrial waste (X_5), then for each of these factors calculate the index of its relative entropy by the formula $h_n=-k\times\log_2 k$, and stratification of population groups is performed by RECs using the integral indicator of the relative entropy of the environment, which is calculated personally for each group of individuals or for each person or $EQ_n=1-(\sum({}^{p}h_1+{}^{p}h_2+{}^{p}h_3+\ldots+{}^{p}h_n) / \sum({}^{R}h_1+{}^{R}h_2+{}^{R}h_3+\ldots+{}^{R}h_n)$, where: k is the index of the ratio of the measured indicator ${}^{p}X_n$ to ${}^{R}X_n$ is its regional average, ${}^{R}h_n$ is the total entropy index the environment of the region caused by the n factor ohms and when the value of EQ_n is within the range of 1.0 ÷ 0.7 determine the identity of a person or homogeneous ontogenetic group of persons to $RECs_1$ - with a high level of environmental quality, 0.69÷0.31- $RECs_2$ - with an average level of environmental quality, 0.30 and less to $RECs_3$ - with low environmental quality.

The practical implementation and implementation of the ecological-etiological principle of stratification of the population groups of the regions is possible not only in relation to BPD, but also other pre-existing or nosologically defined disorders, for example – dysplastic pathology of BPS.

Using this copyright innovation, population stratification was performed, resulting in the division of administrative districts with alternative levels of environmental quality. In Dnepropetrovsk region, the following districts are identified as alternative in terms of environmental quality: Nikopol district (with low environmental quality level - $RECs_3$) and Tsarichan district (high level of environmental quality - $RECs_1$).

Table. Age-sex distribution of sampling groups of children depending on personalized environmental quality and presence / absence of verified dysplastic pathology of BPS

Age	*Sex*	*Distribution of children by environmental clusters depending on the availability of DDP*				*Summary*
		$RECs_1$		*$RECs_3$*		
		SPG_1	*SPG_2*	*SPG_1*	*SPG_2*	
1-3 y.o.	female	25	25	29	29	108
	male	28	30	34	34	126
	both	53	55	63	63	234
3-7 y.o.	female	33	33	31	31	128
	male	35	35	37	37	144
	both	68	68	68	68	272
Summary	female	58	58	60	60	234
	male	63	63	71	71	270
	both	121	121	131	131	**504**
		242		262		

Note: *DDP is a dysplastic-dependent pathology of the bronchopulmonary system; $RECs_1$ is an environmental cluster of a region with high environmental quality, $RECs_1$ is an ecological cluster of a region with low environmental quality.*

Frequency, prognostic coefficients and informativeness were determined (using mathematical analysis of variance) for each of the 30 listed factors, with their comparative characteristics in stratified population groups of children (SPG) of Dnipropetrovsk and Kharkiv regions. On the territory of servicing of the respective medical-preventive institutions of these four districts, groups of children with BPD and, accordingly, their (children) number, were formed by the method of "copy-pair" control groups were formed.

Results. Analysis of habitat comparison groups with different levels of background radiation (X_{25}) found that in SPG_1 children living in areas with relatively high levels of background radiation were significantly higher than in SPG_2 children (55.2 ± 3.1% and 17.1 ± 2.5%, p<0.001); moreover, under conditions of the same proportion of persons in SPG_1 and SPG_2 (table 1), who live in areas with average regional background radiation levels (SPG_1 - 29.0 ± 2.9% and SPG_2 - 27.0 ± 2.8%, p>0.05), among healthy children there was a signify-cantly higher proportion of those living in areas with a lower background radiation level (SPG_1 - 15.9 ± 2.3% and SPG_2 - 56.0 ± 3.1%, p<0.001). The impact force (an indicator of the effect of a factor on the difference between the compared SPG) of this regional environmental factor was η^2 = 21.0%, and its overall informativeness was 2,070 bits; accordingly, the pathometric value of the factor $^{25}PK_p$= +5,1 pat, and sanology is $^{25}PK_C$= -5,4 pat, that is, this environmental factor is characterized by the most expressive potential for participation, both in the formation of pathological processes, and in the sanoge-netic management of health, as well as medico-social prevention among children of SPG under study (among the environmental factors studied, it is ranked first). Analysis of habitat com-parison groups based on lead, chromium, copper, nickel, zinc in the surface atmosphere (X_6) revealed that in SPG_1 the proportion of children living in areas with relatively high levels of X_6 was significantly higher than among children SPG_2 (56.7±3.1% and 17.5±2.4%, respectively, p<0.001); moreover, under conditions of practically the same proportion of individuals in SPG_1 and SPG_2 residing in areas with average X_6 levels (SPG_1 - 24.6 ±2.79%, and SPG_2 - 31.3 ± 2.9%, p>0.05), among healthy children there was a sig-nificantly higher proportion of those living in areas with a content of these metals in the surface layer of the atmosphere below the regional one (SPG_1 - 18.7 ± 2.5% and SPG_2 - 51.2 ± 3.1%, p<0.001). The impact of this regional environmental factor was η^2 = 18.0%, and its overall informativeness was 1,754 bits; accordingly, the pathometric valuefactor ^6PK_p= +5,1pat, and sanological is ^6PK_C = -4,4 pat, that is, this environmental factor has a distinct potential for participation, both in the formation of pathological processes and in the sanogenetic health management of the investigated SPG (among the investigated factors it has second place in the environment).

Analysis of habitat comparison groups based on soil contamination by heavy metals (X_2) revealed that in SPG_1 the proportion of children living in areas with relatively high levels of heavy metals was significantly higher than in SPG_2 children (61.5 ± 3.1% and 27.4 ± 2.8%, respectively, p<0.001); however, a significantly higher proportion of healthy children lived in areas with moderate regional pollution by soil metals (SPG_1 - 27.0 ± 2.8% and SPG_2 - 42.5 ± 3.1%, p <0.05), and among healthy children there was a significantly higher proportion of those living in areas with relatively low levels of heavy metals in soil (SPG_1 - 11.5 ± 2.0%, SPG_2 - 30.2 ± 2.9%, p <0.001). The impact of this regional environmental factor was η^2 = 12.0%, and its overall informativeness was 1,142 bits; accordingly, the pathometric value of the factor ^2PK_p= + 3.5 pat, and sanology is ^2PK_C = -4.2 pat, that is, this environmental factor is characterized by a clear potential for participation, both in the formation of patho-logical processes and in the sanogenic health management of SPGs studied. (third rank).

A medico-regional factor, such as general morbidity (X_{30}), on the one hand, reflects one's own incidence, the level of diagnostic activity of the institutions and the availability of medical care, on the other, may be evidence of the accumulated negative impact of environmental factors. An analysis of comparison groups by the overall incidence rate (X_{30}) revealed that the overall incidence of SPG_1 care facilities was significantly higher than in SPG_2 children (52.8 ± 3.1% and 19.4 ±2.5%, p<0.001); however, a significantly larger proportion of healthy

children resided on the territory of service of medical institutions with an average incidence of the population (see table 1; SPG_1 - 24.2±2.7%, and SPG_2 - 42.1 ± 3.1%, $p<0.05$), and among the healthy children there was a significantly higher proportion of those residing in the territory of services of low-morbidity-level treatment facilities (SPG_1 - 23.0 ± 2.7% and SPG_2 - 38.5 ± 3.1 %, $p<0.001$). The impact of this regional environmental factor was η^2 = 12.0%, and its overall informativeness was 1,110 bits; accordingly, the pathometric value of the factor $^{30}PK_p$= + 4,3 pat, and sanology is $^{30}PK_C$ = -2,2 pat, that is, this medical and social factor has a distinct potential; in other words, the diagnostic and prophylactic activity of the medical and preventive institutions is an influential factor in the formation of indicators of general morbidity and diagnosis of dysplastic-dependent pathology, particularly in childhood.

Analysis of comparison groups by levels of anthropogenic load from stationary sources (X_{19}) revealed that in SPG_1 the proportion of children living in areas with relatively high levels was significantly higher than in SPG_2 children (44.0 ± 3.1% and 20.3 ± 2.5%, respectively, $p <0.001$); however, practically the same proportion of healthy and sick children lived in areas with an average regional level of anthropogenic load from stationary sources (SPG_1 - 36.5 ± 3.0%, and SPG_2 - 30.7 ± 2.9%, p> 0, 05), and among healthy children there was a significantly higher proportion of those living in areas with relatively low anthropogenic load from stationary sources (SPG_1 - 19.4 ± 2.5% and SPG_2 - 49.0 ± 3.2% , $p<0.001$).The impact of this regional environmental factor was η^2 = 11.0%, and its overall informativeness was 1,014 bits; accordingly, the pathometric value of the factor $^{19}PK_P$ = + 3,3 pat, and sanology is $^{19}PK_C$ = -3,0 pat, that is, this environmental factor is characterized by a clear potential for participation, both in the formation of pathological processes and in the sanogenetic management of health of the investigated SPG (ranked fifth).

Analysis of comparison groups by levels of waste generation (X_{21}) revealed that in SPG_1 the proportion of children living in areas with relatively high levels of waste generation was significantly higher than in SPG_2 children (42.9±3.1%, respectively, and 17.9±2.4%, $p<0.001$); however, almost the same proportion of healthy and sick children lived in areas with an average regional level of this factor (SPG_1 - 36.9 ± 3.0% and SPG_2 - 36.9 ± 3.0%, $p>0.05$), and among healthy children, the proportion of those living in areas with a relatively low level of waste generation was significantly higher (SPG_1 - 20.2 ± 2.5% and SPG_2 - 46.4 ± 3.1%, $p<0.001$). The impact of this regional environmental factor was η^2 = 10.0%, and its overall informativeness was 0.948 bits; accordingly, the pathometric value of the factor $^{21}PK_P$ = +3,8 pat, and theological is $^{21}PK_C$ = -3,6 pat; The level of waste accumulation (X_{22}) is also characterized by a similar pattern, since the distribution of children with SPG under study is completely the same as the distribution by factor (X_{21}). That is, the intensity of waste generation and accumulation in the regions are factors that are characterized by a clear potential for participation, both in the formation of pathological processes and in the sanogenic management of public health. Analysis of comparison groups by water use levels (for 1 resident) (X_{17}) revealed that in SPG_1 the proportion of children living in areas with relatively high water use levels was signify-cantly higher than in SPG_2 children (37.3±3.0% and 11.5±2.0%, respectively, $p<0.001$); however, almost the same proportion of healthy and sick children lived in areas with an average regional level of this factor (SPG_1 - 38.5±3.1%, and SPG_2 - 44.8 ± 3.1%, $p>0.05$), and among healthy children, the proportion of those living in areas with relatively low drinking water was significantly higher (SPG_1 - 24.2 ± 2.7% and SPG_2 - 43.7 ± 3.1%, $p<0.001$). The impact of this regional environmental factor was η^2=9.0%, and its overall informativeness was 0.929 bits; accordingly, the pathometric value of the factor $^{17}PK_P$=+5.1 pat, and the sanology is $^{17}PK_C$ =-2,5 pat.

Conclusions

1. For each of the 30 environmental factors we have studied, its prognostic value, pathometric and sanologic value have been determined, which ensured the performance of population-personalized risk assessment of the dysplastic-dependent pathology of the BPS.

2. A new methodology for environmental quality assessment has been substantiated, proposed and tested, the application of which

allows to determine the differentiation of regional preventive programs of BPD and the dysplastic-dependent pathology of the BPS in childhood.

3. Personalized regional population stratification of children with BPD and the dysplastic-dependent pathology of the BPSwere performed, and regional clusters (administrative districts of the regions) wereidentified with an alternative level of environmental quality.

4. The use of pathometric and sanometric assessments (different levels) of environmental factors can be significant to substantiate the structure of targeted health, social, and regional environmental programs for promoting the health of the pediatric population.

The *prospects* for further research on these issues are determined by the need to develop algorithms for population and individual prognosis of the dysplastic-dependent pathology of the BPS in the antenatal period and at the stages of postnatal ontogeny.

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УПРАВЛЕНЧЕСКИЕ АСПЕКТЫ ВЕДЕНИЯ ЗДОРОВЬЯ ДЕТЕЙ: ДИСПЛАСТИЧЕСКАЯ ПАТОЛОГИЯ БРОНХОЛЁГОЧНОЙ СИСТЕМЫ С УЧЕТОМ ЭКОЛОГИЧЕСКОЙ ГЕТЕРОГЕННОСТИ СРЕДЫ

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Резюме. Проведена популяционная стратификация педиатрической популяции с учетом комплекса регионально-экологических факторов, актуальных для оценки состояния здоровья детей с диспластическизависимой патологией бронхолегочной системы. Исследование проводилось с использованием методов системного популяционного моделирования многофакторной системы здравоохранения под влиянием региональных и экологических факторов. Для каждого из 30 изученных факторов окружающей среды определена его прогностическая, патометрическая и санологическая ценность, что обеспечило проведение популяционно-персонализированной оценки риска диспластическизависимой патологии бронхолегочной системы. Обоснована, предложена и апробирована новая методика оценки качества окружающей среды, применение которой позволяет определить дифференциацию региональных программ профилактики бронхолегочной дисплазии и диспластическизависимой патологии бронхолегочной системы в детском возрасте. Проведена персонализированная региональная популяционная стратификация детей с бронхолегочной дисплазией и диспластически зависимой патологией бронхолегочной системы, определены региональные кластеры (административные районы областей) с альтернативным уровнем качества окружающей среды. Использование патометрических и санометрических оценок (различных уровней) факторов окружающей среды может иметь важное значение для обоснования структуры целевых медицинских, социальных и региональных экологических программ для укрепления здоровья педиатрического населения.

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