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METHODOLOGICAL APPROACHES TO EPIDEMIOLOGICAL SURVEILLANCE OF CHRONIC NON-INFECTIOUS DISEASES

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Ключові слова: *хронічні неінфекційні хвороби, хронізація патології, епідеміологічний нагляд, громадське здоров'я*
Ключевые слова: *хронические неинфекционные болезни, хронизация патологии, эпидемиологический надзор, общественное здоровье*

Abstract. Methodological approaches to epidemiological surveillance of chronic non-infectious diseases. Berdnyk O.V., Antomonov M.Yu., Polka N.S., Rudnytska O.P. *In the context of the constant growth of the burden of chronic non-infectious diseases, surveillance needs in supplementing traditional statistical health indicators with criteria characterizing the processes of chronicity of pathology. Aim: to scientifically substantiate and develop statistical characteristics of chronic non-infectious diseases suitable for surveillance in the public health system. Methods used: bibliographic; statistical (for analyzing materials about the health of the population); mathematical (for constructing formulas and indices); calculational (to calculate indicators of pathology chronicity); epidemiological (to assess the chronicity of diseases of different classes). The initial statistical information was the materials of the Ministry of Health of Ukraine on mortality, general and primary morbidity of the population for six classes of diseases, which include the most common chronic diseases. The proposed set of indicators, which includes both the indices available in the scientific literature and those developed by us, contains the following characteristics: statistical indicators of official reporting, indicators of pathology chronicity, mortality and survival of the population, and the hazard index of chronic diseases, which can be considered an integrated indicator characterizing chronic diseases. Diversified characteristics of chronic non-infectious diseases of different classes of diseases were established, which is reflected, in particular, on the relationship between chronic diseases with preserved and lost viability. For diseases of the musculoskeletal system, one fatal case accounts for more than 9000 cases of chronic diseases with preserved viability; for diseases of the circulatory system, this indicator reaches only 58, and for neoplasms – only 22. This corresponds with the assessment of the hazard index: chronic diseases (respectively, 0.7; 153.7; 328.5 cu). The use of the proposed set of indicators makes it possible to carry out a comparative analysis of the danger of chronicity of diseases of certain classes, to track the change in these processes over time, being an important part of managing the frequency and outcomes of chronic diseases.*

Реферат. Методологические подходы к эпидемиологическому надзору за хроническими неинфекционными заболеваниями. Бердник О.В., Антомонов М.Ю., Полька Н.С., Рудницька О.П. *В условиях постоянного роста бремени хронических неинфекционных заболеваний эпиднадзор нуждается в дополнении традиционных статистических показателей здоровья критериями, характеризующими процессы хронизации патологии. Цель работы – научное обоснование и разработка статистических характеристик хронических неинфекционных заболеваний, пригодных для эпиднадзора в системе общественного здоровья. Использованы методы: библиографический; статистический (для анализа материалов о здоровье населения); математический (для конструирования формул и индексов); расчетный (для вычисления показателей хронизации патологии); эпидемиологический (для оценки хронизации болезней разных классов). Исходной статистической информацией служили материалы МЗ Украины о смертности, общей и первичной заболеваемости населения по шести классам болезней, к которым относятся наиболее распространенные хронические болезни. Предложенный комплекс показателей, включающий и имеющиеся в научной литературе индексы, и разработанные нами, содержит следующие характеристики: статистические показатели официальной отчетности, показатели хронизации патологии, летальности и выживаемости популяции и индекс опасности хронических заболеваний, который можно считать интегрированным показателем, характеризующим хронические*

болезни. Были установлены разноплановые характеристики хронических неинфекционных заболеваний разных классов болезней, что отражается, в частности, на соотношения между хроническими заболеваниями с сохраненной и утраченной жизнеспособностью. Для болезней костно-мышечной системы на один фатальный случай приходится более 9000 случаев хронических болезней с сохраненной жизнеспособностью; для болезней системы кровообращения этот показатель достигает лишь 58, а для новообразований – всего 22. Это корреспондируется с оценкой индекса опасности хронических заболеваний (соответственно 0,7; 153,7; 328,5 у.е.). Использование предложенного комплекса показателей позволяет проводить сравнительный анализ опасности хронизации болезней отдельных классов, отслеживать изменение этих процессов во времени, является важной частью управления частотой и исходами хронических заболеваний.

According to the "National Strategy for Reforming the Health Care System in Ukraine", the main function of the state in the field of preventive medicine and public health should be "the development of policies and strategies in the field of disease prevention, health protection and promotion" [14]. This applies, in particular, to chronic non-communicable diseases (CNCDs). Scientists in many countries of the world [1, 5, 8, 9, 12, 13] record an increase in the number of chronic diseases, which they describe as an increase in the burden of CNCDs. This phenomenon is generally considered negative, as it leads to an increase in the resource and financial burden on the health care system; is accompanied by a decrease in the quality of human life, etc. However, as analytical studies show, it also has positive features, in particular, a consistent and steady decrease in mortality, especially among young and middle-aged people; increase in life expectancy, etc. In 1971 demographer and epidemiologist A.R. Omran, studying long-term changes in the structure of the health of the human population, singled out a series of stages of the so-called "epidemic transition": with the change of stages, a transformation of population mortality patterns is observed. At the fourth stage, which is defined at the present time (mostly in developed countries), there is an "accelerated increase in the prevalence of chronic diseases" [6, 11] and, as a result, the phenomena of "inhibition of mortality" and "delayed death" [3].

An important question that needs to be clarified is: "Which diseases should be considered chronic according to the duration of their course?". There are significantly different opinions on this issue in the academic literature and in the practice of doctors of various profiles. According to the definition of the National Center for Health Statistics of the USA, chronic diseases should be considered those ones whose course and treatment period exceeds three months. Of course, this cannot be reflected in the accepted statistics that characterizes the annual intervals of data collection. At the same time, the US National Center for Chronic Disease Prevention and Healthy Lifestyle considers health disorders that last more than one year to be chronic [7]. This approach opens up the possibilities of epidemiological assessment of chronic diseases based on annual statistical materials.

For a long time, the issues of chronic diseases (HDs), and more precisely, their specific nosological forms, remained mainly in the sphere of attention of clinical medicine specialists. At the same time, of the four strategies for overcoming the burden of chronic diseases proposed by the US Centers for Disease Control and Prevention, two lie in the sphere of preventive medicine. The first of them is defined as "epidemiology and supervision" of chronic diseases in order to track the trends of their change and the formation of target programs. This echoes the "European Action Plan for Strengthening the Capacity and Services of Public Health", where surveillance and assessment of population health are classified as the first of the priority functions of public health. To perform this function, it is necessary, in particular, to analyze the relevant statistical information. However, neither state nor departmental official statistics contain direct indicators that would characterize chronic non-infectious diseases (except for certain nosological forms).

The purpose of this study was scientific substantiation and development of statistical characteristics of chronic non-infectious diseases suitable for epidemiologic surveillance in the public health system.

MATERIALS AND METHODS OF RESEARCH

The following methods were used in the work: bibliographic – for the analysis of available scientific literature and thematic materials regarding the indicators of the chronicity of pathology; statistical – for the selection and analysis of materials on the incidence, prevalence and mortality of the population as a starting point for the assessment of chronicity; mathematical – for constructing formulas and indices; calculation – for calculating values of indicators of chronicity of pathology; epidemiological – to determine the causes, conditions and mechanisms of the incidence of chronic non-infectious diseases [2, 4].

WHO has traditionally focused attention on the four most socially significant CNCDs: cardiovascular diseases, malignant neoplasms, chronic respiratory diseases and diabetes. However, public health initiatives are now expanding to include not only specific chronic diseases, but also certain conditions that are not manifestations of physical disease but exist for a long time (e.g., limb dysfunction; a wide range of behavioral problems, etc.). Taking this into account, we conducted an epidemiological analysis of the chronicity of the pathology of six classes of diseases: diseases of the circulatory system, neoplasms, diseases of the respiratory organs, endocrine diseases, mental and behavioral disorders, and diseases of the musculoskeletal system.

When substantiating the methodology of epidemiological surveillance of chronic diseases, it was important to determine the method of measuring the prevalence of chronic diseases. The initial information can be different and vary from those obtained in special examinations and health screening in communities to the analysis of registers of individual diseases and statistical reporting data. Naturally the choice of definitions and methods causes affect which persons are included in the study, and therefore, the obtained indicators of the prevalence of the pathology. In our work, the initial data for calculating the proposed indicators of chronicity were the materials of the Annual Report of the Ministry of Health of Ukraine on the state of health of the population for 2017.

RESULTS AND DISCUSSION

An important starting point in achieving the goal of the work was the proposition that the results of the course of any disease lie in the space of options from recovery to a terminal outcome. CNCDs "as a rule cannot be cured with drugs, prevented with vaccines, and they simply do not disappear" [10]. However, the course and outcome of CNCDs can be transformed from fatal to chronic. That is why it was important to justify a complex of indicators that would characterize both the levels of primary morbidity and prevalence of chronic pathology, as well as the process of chronicity itself, its dangers. The proposed set of indicators contains both indices available in the scientific literature and those proposed (developed) by us. All of them can be conventionally divided into the following groups (Table 1):

1. "Statistical indicators of official reporting", which are used as initial data for further calculations. This group includes the following indicators: overall incidence (OI), primary disease incidence (PDI) and mortality (M).

2. "Indicators of the chronicity of pathology." The key indicator of this group is the "prevalence of chronic diseases" (CD). The basis for determining the value of this indicator is the provision that diseases with which people "arrive" in the current year and, maintaining a certain vitality, pass into the next year should be considered chronic [3]. That is, the prevalence of chronic diseases is determined by the total number of diseases registered this year, excluding cases of their fatal outcome and newly discovered cases. For detailing and obtaining additional information, it is advisable to calculate the share of chronic diseases (SCD) among all diseases of a certain class

3. "Population survival rates" characterize the probability of survival of persons with chronic diseases (CD). An indicator that characterizes the ratio between registered diseases with preserved and lost viability (PLV), i.e. how many cases of "chronic" diseases correspond to one case with a fatal outcome, is evident in this group. The lower the value of this indicator, the worse is the survival of patients with the corresponding pathology.

4. "Lethality rates." This group includes the traditional indicator of the proportion of all diseases of a certain class that ended in death (LR) and the indicator showing what proportion of cases of chronic diseases ended in death (LRCD).

5. The "Chronic Disease Risk Index" (CDRI) can be considered an integrated indicator characterizing chronic diseases, the calculation of which takes into account data on prevalence, morbidity and mortality.

According to the definition of the WHO Working Group on Epidemiological Surveillance Systems (1978), monitoring should be understood as the simple collection and recording of data on health status, while the broader concept of "surveillance" means the study of data, interpretation and intention to implement the results. According to the Order of the Ministry of Health No. 1726 (2020), epidemiological surveillance is defined as "systematic and continuous collection, accounting, compilation and analysis, interpretation, dissemination of data for medical and sanitary purposes, epidemic well-being of the population and adoption of necessary measures in the field of public health". From these positions, we analyzed data on the formation of chronic diseases. It was established that the indicators of the epidemiological analysis of the chronicity of the pathology of different classes of diseases differ significantly (Table 2).

According to the share of chronic types of pathology, among all diseases of a certain class, classes with almost the same SCD can be distinguished: mental disorders; circulatory system diseases; diseases of the endocrine system. However, other characteristics of chronization in them are significantly different.

Table 1

The proposed set of indicators of the chronicity of pathology to be used for epidemiological surveillance in the public health system

No.	Name and contents of an indicator (index)	Notation	Source, formula of calculatioin
	1. Indicators of statistical reporting		
1.1	Overall incidence (prevalence)	OI	Data from statistical reporting
1.2	Primary disease incidence	PDI	
1.3	Mortality	M	
	2. Indicators of chronicity		
2.1	Prevalence of chronic diseases	CD	OI – PDI - M
2.2	Share of chronic diseases among all diseases of a certain class	SCD	CD * 100 / OI
	3. Indicators of survival		
3.1	Specific gravity of CD with preserved viability	CDPV	(OI - M) * 100 / OI
3.2	Ratio between registered diseases with preserved and lost viability	CDLV	(OI – M) : M
	4. Lethality rates		
4.1	Share of all diseases of a certain class ended in death	LR	M * 100 / OI
4.2	Share of CD ended in death	CDLR	M * 100 / CD
	5. Risk index		
5.1	Risk index of chronic disease of a certain class	CDRI	M * CD * 10000 / OI

The specific gravity of CD of the circulatory system is more than 90.3% of all diseases of this class. Against this background, the lethality rates look quite "calm": during the year, 1.7% of all diseases of this class ended fatally, and among chronic diseases – 1.88%. Data on the large number of deaths from diseases of the cardiovascular system, which are often operated on, are due to the high prevalence of heart disease (47,825.8 cases per 100,000 population). Thus, the class "Diseases of the circulatory system" is characterized by a high chronicity of diseases, but due to the high rates of accumulation of diseases, a fairly high proportion of the population adapted to diseases of this class is observed.

Approximately the same percentage of chronic pathology (92.3%) was found in the class "Psychic disorders", but, in this case, against the background of practically the lowest (among the analyzed classes of diseases) prevalence rates (3,641.6 per 100,000).

As for endocrine diseases, with a fairly high prevalence of chronic pathology (7,745.3 per 100,000 population) and a share of chronic diseases among all diseases of 89.3%, survival rates are high and on the contrary, lethality rates are low.

Against the background of high rates of mortality and lethality according to the class "Neoplasms", moderate indices of chronicity and accumulation of chronic diseases and low rates characterizing the survival of patients and the adaptability of the population as a whole are observed. The prevalence of chronic pathology of this class is recorded at the level of 3,136.7 cases per 100,000. The relatively low level of prevalence (among all analyzed classes) is due to high mortality rates against the background of the worst survival rates, which "impedes" the accumulation of diseases.

Table 2

Indicators of chronicity of diseases of different classes

Indicators		Classes of diseases					
		II	IV	V	IX	X	XIII
1 Indicators of statistical reporting							
Overall incidence per 100 000 of population	OI	4183.4	8676	3944.8	52924	34490.6	9344.5
Primary disease incidence per 100 000 of population	PDI	863.4	925.4	300.9	4198	28378.3	3182.3
Mortality per 100 000 of population	M	183.3	5.3	2.3	900.2	32.1	1.0
2. Indicators of chronicity							
Prevalence of chronic diseases per 100 000 of population	CD	3136.7	7745.3	3641.6	47825.8	5791.3	6161.2
Share of CD of a certain class, %	SCD	74.98	89.27	92.31	90.37	17.63	65.90
3. Indicators of survival							
Specific gravity of CD with preserved viability, %	CDPV	95.6	99.9	99.9	98.3	99.9	99.9
Ratio between CD with preserved and lost viability	CDLV	22 : 1	1734 :1	1971 :1	58 :1	1077 :1	9343 : 1
4. Lethality rates							
Share of all diseases of a certain class ended in death, %	LR	4.38	0.06	0.06	1.70	0.09	0.01
Share of CD ended in deaath, %	CDLR	5.84	0.07	0.06	1.88	0.53	0.03
5. Risk index							
CD risk index, c.u.	CDRI	328.53	5.45	5.38	153.71	1.64	0.71

Notes: II – neoplasms; IV – endocrine diseases, disorders of alimentation and metabolic disorders; V – mental and behavioral disorders; IX – circulatory diseases; X – respiratory diseases; XIII – musculoskeletal system diseases and connective tissue diseases.

Characterizing the chronicity of diseases of the respiratory organs, it should be noted that with a fairly significant level of prevalence of chronic pathology (5,791.3 cases per 100,000), the percentage of chronic pathology among all diseases reaches only 17.6%, which leads to a fairly calm picture regarding diseases of this class.

Various characteristics of chronic non-communicable diseases of different disease classes are reflected, in particular, in the ratio between chronic diseases with preserved and lost viability. For diseases of the musculoskeletal system, one fatal case accounts for more than 9,000 cases of chronic diseases with preserved viability; for diseases of the circulatory system, this indicator reaches only 58, and for neoplasms – only 22. This corresponds to the assessment of the risk index of chronic diseases (respectively, 0.7; 153.7; 328.5 c.u.).

CONCLUSIONS

In modern conditions of constant growth of the burden of chronic non-communicable diseases among the population, an integral part of the performance of the first of the main functions of public health, namely "epidemiological surveillance of diseases", requires the addition of traditional health indicators with criteria that provide a thorough characterization of the processes of chronicity of pathology (from measuring the prevalence of CD to survival and mortality). The use of

the proposed set of indicators makes it possible to carry out a comparative analysis of the risk of chronicity of certain classes of diseases, to monitor the change of these processes over time, which is an important part of managing the frequency and consequences of chronic diseases.

Contributors:

Berdnyk O.V. – conceptualization, writing – reviewing and editing;

Antomonov M.Yu. – formal analysis;

Polka N.S. – conceptualization, project administration;

Rudnytska O.P. – research.

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