



THE SUBJECTIVE HEALTH INDEX AS A CRITERION FOR ASSESSING THE LEVEL OF THE PRENOLOGICAL STATE OF THE BODY

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AUTHORS' CONTRIBUTIONS

This work was carried out in collaboration among all authors. Author MKK developed research and supervises the scientific work of the applicant, wrote the final version of the manuscript. Author MTB performed statistical analysis, wrote a draft version of the manuscript. Author NMG is a competitor for this work and led the search for literature. All authors read and approved the final manuscript.

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ABSTRACT

Early diagnosis of prenosological conditions and focus on strengthening primary prevention, health improvement and health protection of practically healthy people is an urgent task of preventive medicine. One of the most significant indicators of each person's attitude to health is his self-assessment of his physical and mental state. Subjective assessment of health can be considered as one of its indicators. In this work, based on the results of subjective self-assessment of the health level of groups of young people, using the approach of deterministic factor analysis and an additive model of the relationship of factors with the result to be detected, an informative integral marker is proposed - the subjective health index (SHI), methods for its determination, as well as criteria and scales for assessing the prenosological level of somatic health. The reliability of the obtained results is confirmed by their comparison with the results of objective studies. The aim of this work is to develop a non-invasive express method for assessing the prenosological level of individual health and, on their basis, to create a technology for remote prenosological diagnostics and monitoring of the health of a healthy population.

Keywords: Health levels; prenosological conditions; prenosological diagnostics; subjective health assessment; subjective health index; risk factors.

1. INTRODUCTION

The problem of forming a healthy lifestyle and strengthening the health of the population, creating conditions and creating motivation for a healthy lifestyle are one of the priority tasks of public health [1,2]. Solving these problems requires assessing the state of individual health of the population and monitoring changes in their levels. In this regard, in recent years, ideas about the gradual change in the state of human health, about its quantity and quality

have been increasingly used. This approach to assessing health is consistent with the currently accepted classification of states of the body [3], substantiated by Avicenna [4], which include:

- conditions with a sufficient functional (adaptive) reserve of the body (physiological norm);
- prenosological conditions, in which unfavorable changes in the body's work are compensated for by a higher than normal tension of the body's regulatory systems;

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- premorbid conditions, which are characterized by a decrease in the functional reserves of the body (overstrain and depletion of regulatory mechanisms);
- states of failure of adaptation, decompensation, development of diseases (breakdown of regulatory mechanisms).

Timely detected state of “tension” of the regulation systems allows us to recognize the causes of dysfunctions, create conditions for the body to compensate for the results, traumatic influences and increase its reserve capabilities. It should be noted that deviations from the norm, characteristic of prenosological conditions, do not significantly affect the objective well-being and performance of a person, but they are a potential risk factor for the development of diseases [5]. Thus, the identification of changes in the body, in a state of prenosological dysfunction, makes it possible to obtain a reasonable answer to the question of how far from the possible development of the disease a person is and to choose a system or organ that requires priority action. In this regard, early diagnosis of prenosological conditions and prevention of socially significant diseases and focus on strengthening primary prevention, improvement and health protection of citizens, including healthy and practically healthy people, which make up at least 70-75% of the total population of the republic, determines its relevance in preventive medicine.

2. RESEARCH METHODS AND OBJECTS

There are three types of diagnostic models of individual health: nosological, prenosological and health diagnostics by direct indicators. Nosological diagnostics aims to establish the nature of the disease in accordance with the International Classification of Diseases. Prenosological diagnostics is the definition of the stages of the adaptation process on the way from health to disease. To date, the most widespread are two models for diagnosing the level of health by direct indicators. The first is the determination of biological age. The second is an assessment of the energy potential (bioenergy reserves) at the organismic level. It is known that in the process of studying individual health, methods of subjective or objective assessments of health are used, or methods that combine both options. Subjective methods of assessing health are based on information about the state of health, which is collected as a result of interviewing the individual himself. Subjective methods of assessing health are based on information about the state of health, which is collected as a result of interviewing the individual himself. The state of health depends on many factors, among which, undoubtedly, the factor of a person's attitude to his

health is significant, while the nature of the individual's behavior in relation to his health is determined by the self-assessment of his own health (SAH), which is formed according to the results of questionnaires using questionnaires containing questions that reflect the main components of the concept of health. Thus, the great heuristic potential of the subjective self-assessment of health method in prenosological diagnostics became obvious. However, unfortunately, at present in preventive medicine it is not in high demand. The reason for this is the absence of a single informative integral marker of subjective health, the method of determining it, as well as the lack of elaboration of its criteria and scale, for assessing the level of somatic health by them. For the successful implementation of this task, it is necessary to develop appropriate technologies, examination methods and interpretation of their results, which would be sufficiently reliable and informative in relation to the diagnosis of prenosological conditions and the identification of risk factors. In addition, given that prenosological diagnostics should cover wide layers of a practically healthy contingent of the population, it is required to ensure a non-invasive and massive nature of the examination and does not require large expenditures of funds, time, and most importantly, it allows remote implementation. Note that the implementation in preventive medicine of a non-invasive technology of self-assessment of health will allow, on the one hand, to ensure the automation and remote control of receiving, receiving, transmitting, storing, analyzing and evaluating formalized medical information about the health of specific individuals, and on the other hand, to actively mobilize the population itself in the process assessment of their health and its improvement. In addition, in the case of using modern information and communication technologies, the creation of computer expert systems and relevant databases, it will allow automated monitoring of the level of public health and the identification of risk factors, which will allow the timely implementation of preventive measures. The connection between the subjective assessment of health and many objective indicators of the state of the body allowed V.P. Voitenko propose [6], for a subjective assessment of health (SAH), a questionnaire consisting of 29 questions, formed according to dichotomous principles, i.e. providing two answers ("yes" or "no"). The dichotomous question is interesting in that it allows, at least roughly, but quite clearly, to reveal the extreme positions of respondents in relation to the phenomenon under study, i.e. to find out how categorically the proposed positions, characteristics, assessments are accepted or rejected by the respondents. The questionnaire is formed as a multi-parameter subjective indicator of the level of somatic health and contains questions

reflecting the main components of the concept of health: lifestyle, physical, mental, social well-being, self-assessment of health, health value, health satisfaction, health care, forms of health care, changes in psychosomatic status. Thus, the concept of subjective health can include all these dimensions, and a quantitative approach to health assessment makes the question of the criteria and indicators of its assessment relevant. The method of working with the questionnaire is formalized and convenient for computer processing. The number of unfavorable answers is determined and each of them will be assigned 1 mark. At the same time, the value of self-esteem equal to "0" marks corresponds to the ideal feeling of one's own health (there are no unfavorable answers); With the deterioration of the prenosological state of the organism, SAH sharply deteriorate and manifests itself in the form of an increase in the number of unfavorable responses, and the value of this indicator can increase to 29 points (very bad health). However, the analysis of the biophysical foundations of the questionnaire questions and the etiopathogenesis of the processes, which provides for options for answers to them and determines their choice, indicate that there are different degrees of weight of questions in somatic health, and the given approach - the assessment of all questions by the same score, does not take into account the reflection in unfavorable answers of different the degree of etiopathogenesis of subjective disorders, which, accordingly, lead to systematic errors in assessing the level of health.

All these features allowed us to accept the content of this questionnaire as the basis for determining the index of subjective assessment of individual health and to develop author's methods for assessing the prenosological state of the subjects, based on a differentiated assessment of their answers and the classification of survey results. The problem of assessing the state of individual health of a person and monitoring changes in its levels are becoming increasingly important, especially for people exposed to high psycho-emotional and physical stress [7]. In this respect, the most homogeneous, both in age and in social characteristics, part of the youth are students, whose main activity, which determines all the existing features of their way of life, is study, preparation for a future working life. Students of higher educational institutions - persons of adolescence and the first years of adulthood (18-30 years old), are characterized by special vulnerability and susceptibility of the body to the adverse effects of the social and environment. This is the most significant age stage in the definition of specific morphological markers of norm and pathology and the primary prevention of various diseases, which made us choose

them as the objects of our research. Were examined by the method of questioning 43 (19 boys and 24 girls) aged from 18 to 26 years old - students of 1-3 courses of the Fergana branch of the Tashkent Medical Academy.

3. RESULTS AND DISCUSSION

Achievement of our goals, i.e. assessing the applicability of the SAH method in diagnosing the level of the prenosological state of the body, first of all, as already noted, require that on the basis of the results of answers to individual questions of the questionnaire, a generalized integral marker of subjective health, ranked in the scales of prenosological diagnosis (physiological norm; prenosological; premorbid and pathological conditions;). In the literature there are approaches to determining the level of subjective health, based on the number of adverse responses, regardless of their content. However, it is necessary to take into account the existing place of ambiguity, the relationship of the etiopathogenesis of the processes provided for in the content of various questions of the questionnaire, with the level of somatic health of the subjects. In this regard, it is obvious that the integral marker (indicator) of the subjective component of somatic health should take into account different weight coefficients for accounting for the answers to the questionnaire, depending on the etiopathogenesis of the factors provided for in their contents.

In addition, a comparison of the answers to the questionnaire questions providing for the choice of only one of the two (yes or no), i.e. being binary markers of the state, with 4 levels of prenosological state is incorrect. From a mathematical point of view, the construction of decision rules based on binary data requires the use of special statistical methods, which complicates the health assessment procedure. Thus, the issue of finding the optimal marker for self-assessment of health status is an urgent task of preventive medicine. Promising in this aspect is the use of the subjective health index (SHI), in conditional points, ranked on a scale with the required number of gradations. Indicators of this type have proven to be highly effective as indicators of the state for a practically healthy contingent of persons [8]. To bring the qualitative characteristics of the health of the surveyed to a quantitative value, we have developed a method for determining the formalized subjective health index (SHI). In our case, SHI is an integral marker of the level of subjective somatic health of an organism, expressed as a percentage (%) and changing, depending on its level of health, from 0 to 100. In this regard, we made an attempt, on the basis of formalized survey results, to create models of an

integral marker of health levels, similar to Altman's multivariate model. We have proposed an approach that foresees, first of all, grouping the questionnaire questions into blocks that form, according to the functional-system principle, the main aspects of somatic health. A quantitative assessment of the level of health is advisable through the development of integral indicators for each of the components of the somatic status of the body. Considering these circumstances, all the questions of the above-mentioned questionnaire, according to their etiopathogenesis of the subject, providing for their content, we grouped into four components of integral (somatic) health, namely: physical and physiological components - 15 questions; psychoemotional and psychophysiological components-7; by lifestyle-5; as well as the intellectual component -2 questions. It is known that the formalization of the studied indicators allows the use of languages of mathematics and logic for displaying any knowledge in a sign-symbolic form, transferring verbal reasoning about objects to the plane of operation with form-signs and contribute to the generalization of various forms of processes, which are necessary to obtain new relations. reflecting their properties. Taking these aspects into account, we have determined the number of logical variables that allow us to formalize (write in the form of a formula) logical reasoning:

A = {each unfavorable answer of the subject is an indicator of his subjective self-assessment of his health and expresses a health risk factor with a certain etiopathogenesis and degree of influence};

B = {the absence of unfavorable answers reflects a high level of the subjective health index, their maximum number, respectively, is a bad level}. All subsequent statements in the reasoning can be written using statements of these logical variables. Note that to assess health levels based on Subjective assessment of health (SAH) data, we used the deterministic factor analysis approach, where the relationship between the resulting indicator and the studied factors is of a functional nature. This function is expressed in different intensities of the influence of the studied factors of different status on the assessment result. We took into account this peculiarity of the relationship between SHI and various factors related to various components of the body's somatic health when selecting the values of special coefficients associated with the intensity of the influence of the studied factors of different status on the assessment result. Based on the analysis of these features, to calculate the SHI, we have chosen an additive model of the

relationship between factors and the result to be detected. This model is used in cases where the desired result is an algebraic sum of several factor indicators, in our case, this is the number of unfavorable answers in each selected component of the questionnaire. As a result, we have obtained a four-factor additive deterministic integral model with formulas of the following form:

$$SHI=100 - (4x a + 3,5 \times b + 2,5xc + 1,5xd),$$

where a, b, c, d - the number of unfavorable responses of the interviewed persons, according to certain components of the questionnaire, namely: a - physical and physiological; b-psycho-emotional and psychophysiological; c-lifestyle; and also d - intelligent; 4; 3.5; 2.5; and 1.5 are the coefficients recommended by us, taking into account the weight status of the questions considered in the questionnaire of components in the general state of health of the organism; 100-constant equation.

In this case, fluctuations in the value of the subjective health index are from 0 to 100. Based on this model, and taking into account the need to measure indicators, the estimates of which are obviously subjective, we used a special type of ordinal scales - verbal-numerical scales. Such scales include a verbal description of the selected gradations and the corresponding numerical values. Similar to the most famous and widely used in practice Harrington scale [9], a scale for interpretation of SHI data was developed, which consists of 5 grades of assessment, namely: the value of satellite = 91-100 - corresponds to high; 72-90 - good; 40-71 - satisfactory; 21-39 is bad and 0-20 is very poor self-appraisal of health. In the future, based on the results of the questionnaire, according to our proposed formula, the SHI index of each subject was calculated and, in accordance with the recommended scale, their health levels were assessed, which are presented in Table 1.

Through an individual analysis of our survey, the following results were obtained: First of all, we note that to the 29-main question of the questionnaire, how do you assess your health ?, all respondents answered positively, while 2 of them rated their health as "excellent", 33- for "good", 8 for "satisfactory". At the same time, in 55.8% of the examined their SAH corresponded with the assessment of the health level established by the results of the SHI, and in 30.2%, there was an overestimation, 14.0% - an underestimation of the level of their health.

Table 1. Subjective assessment of the level of health

Indicators health surveyed	Subjective assessment of the level of health										
	The subjects themselves (according to the answer to the 29 th question)					According to SHI calculations					
	Good and great		Satisfactory			Good and great		Satisfactory		Bad	
	n	In, %	n		In, %	n	In, %	n	In, %	n	In, %
Total, (n = 43)	35	79,08	8		20,92	27	62,79	14	32,56	2	4,65
of them:											
Boys (n = 19)	14	73,68	5		26,32	13	68,42	5	26,32	1	5,26
girls(n=24)	21	87,5	3		12,5	14	58,33	9	37,5	1	4,17

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assessing SHI according to the gradations of the scale of prenosological diagnostics, we made an express assessment of the level of the adaptive potential (AP) of the functional state of the organism of the examined according to the method [10], followed by analysis of compliance and, if necessary, correction, our proposed assessment criteria with these objective criteria for assessing the level of prenosological conditions. AP calculations were made according to the following formula:

$$AP=0,011*PR+0,014* BPs +0,008* BPd +0,014*A+0,009*BW-(0,009*H+0,27)$$

where:

- A - age in years; BW - body weight (in kg); H - height (in sm)
- BPs and BPd - systolic and diastolic blood pressure (mm Hg)
- PR - pulse rate (beat per minute).

The results of the classification of the functional states of the organism of the examined, carried out on the basis of the calculated AP values of their organism according to this formula and the criteria presented in Table 2, are given below:

As a result of these objective studies, we established that the environment of the surveyed contingent, persons in premorbid and pathological states are not available, in 25.6% of the surveyed - the functional state of the body corresponds to physiological norms, and in 74.4% - are in the prenosological state.

In the future, using the contingency tables method, which allows us to analyze the relationships between variables, reflecting the joint distribution of two or more variables, we studied the degree of compliance of our proposed criteria and scales for assessing the level of prenosological state, with the generally accepted ones.

Table 2. Calculated AP values and criteria appraisals

Criteria appraisals AP marks	The state of adaptation mechanisms	Functional body condition	amount surveyed
Less than 1.8	Good adaptation	Physiological norm	11 (2 boys, 9-girls)
1,8-2,1	Satisfactory adaptation	Prenosological condition	21 (8 boys, 13-girls)
2,11-3,2	Intense adaptation mechanisms		11 (9 boys, 2-girls)
3,21-4,3	Unsatisfactory adaptation	Premorbid condition	not
More than 4.3	Disruption of adaptation mechanisms	Pathological condition	not

Table 3. List of functional body conditions

Functional body conditions	The state of adaptation mechanisms	Health level according to SHI	SHI value in conventional units
Physiological norm	Good adaptation	excellent	91-100
	Satisfactory adaptation	Good	72-90
Prenosological condition	Intense adaptation mechanisms	satisfactorily	40-71
		Bad	21-39
Premorbid condition	Unsatisfactory adaptation	Bad	21-39
Pathological condition	Disruption of adaptation mechanisms	Very bad	0-20

Thus, the conducted studies and analysis of their results allow us to formulate the following

As a result of this analysis, the presence, with an accuracy of at least 85%, was established that the gradation of diagnostics of the levels of prenosological states according to the value of the SHI (Table 3) and the generally accepted criteria for the values of the adaptive potential were consistent.

4. CONCLUSIONS

The proposed, based on the results of multifactorial subjective self-assessment of health, the index of subjective health (SHI), can be used as an integral indicator of the level of the prenosological state of an individual's body. The developed methods for determining its values, scales and gradation criteria create the preconditions for the development of a remote, non-invasive, and automated screening method for mass monitoring of the health of healthy people.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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