THE SYSTEM OF RISK FACTORS FOR DISEASES IN VALEOLOGICAL DISCIPLINES

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ABSTRACT

Background. With a view of primary prevention of diseases common in the world, medical workers and educators can effectively work together within teaching valeological disciplines at higher education institutions. Medical information should be adapted for non-medical students using the methods of scaling, aggregation, balancing and system analysis. Their application requires studying the content of main topics of valeological disciplines, determining the boundaries of didactic adaptation and testing in different higher education establishments. Adaptation of medical information on risk factors for understanding by non-medical students has not been studied enough.

Aim. To study the characteristics and interrelationships of risk factors of socially significant diseases for the didactic adaptation of the content of valeological disciplines.

Materials and Methods. The bibliosemantic method, comparative method, and system analysis method were used for the study. The analysis takes into account the experience of primary prevention of diseases and teaching valeological disciplines in higher education institutions in Ukraine and Germany.

Results and Conclusions. The system of risk factors for diseases that are responsible for a significant number of deaths in most countries of the world is the subject of study of modern valeological disciplines. Medical research allows us to divide risk factors into controllable, conditionally controllable and uncontrollable. The impact of the first two groups of risk factors on health can be eliminated or significantly weakened by forming non-medical students' valeological competence and adherence to a healthy lifestyle throughout life. The programs for primary prevention of socially significant diseases should include recommendations for quitting smoking, alcohol abuse, drug use, overeating, overfatigue, hypodynamia, or, conversely, extreme sports, and unprotected sex. Didactic adaptation of complex medical information is needed for valeological education of non-medical students. Its algorithms are analyzed in this article.

Keywords: *primary prophylaxis, preventable disease, controllable risk factors, healthy lifestyle, valeological competence, didactic adaptation.*

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Introduction

In 2024, the main causes of death worldwide were chronic diseases, infections and external factors [1–3]. [16–18]% of all deaths were due to Ischaemic Heart Disease (IHD), [11–12]% to stroke, [6–7]% to Chronic Obstructive Pulmonary Di-

sease (COPD; it should be distinguished from deaths caused by COronaVIrus Disease 2019, COVID-19); [5–6]% to lower respiratory tract infections (pneumonia, COVID-19, influenza); 13% to lung, liver, stomach and breast cancer; [3–4]% to type 2 diabetes; 3% to dementia (including Alzheimer's disease); [2–3]% to car and other accidents; [1.5–2]% – Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome (HIV/AIDS); 1.5% – neonatal pathologies that cause perinatal mortality. External causes account for 8% of global mortality (injuries, accidents, violence). The listed diseases and life-threatening conditions have common risk factors, the connection of which, is well known to the medical community, but is not sufficiently covered in the programs of many modern valeological disciplines for non-medical students [4–6]. For example, the main risk factors for death from vascular crises are arterial hypertension, atherosclerosis, smoking, obesity and stress; COPD – smoking and air pollution; lung cancer – smoking, radon and smog; type 2 diabetes mellitus – obesity and a sedentary lifestyle. Of the listed risk factors, at least smoking is a completely controllable factor, and quitting smoking is not as difficult as quitting other addictive psychoactive substances.

The study of risk factors for diseases that cause death allows us to determine the list of issues that need to be studied with non-medical students within a limited time and depending on their level of training (knowledge of anatomy, human physiology, hygiene and the basics of a healthy lifestyle) [7–11]. Risk factors in educational materials can be described for non-medical students in a simplified way, but within the framework of evidence-based medicine [5; 7; 12]. Such balancing and scaling should allow us to increase the preventive impact of valeological disciplines taught in higher education institutions of Ukraine on the fulfillment of the requirements of national educational standards, and will also improve preparation for the formation of models of safe behavior and a healthy lifestyle among graduates of higher education institutions for their education throughout life [13–15].

We did not find any studies devoted to the didactic adaptation of information about risk factors for socially significant diseases for their understanding by non-medical students of higher education institutions in Ukraine. This gap in the literature highlights the need for tailored educational approaches, which determined the aim of our study.

The **aim** of the study was to study the characteristics and interrelationships of risk factors for socially significant diseases for the didactic adaptation of the content of valeological disciplines.

Materials and Methods

The bibliosemantic method, comparative method, and system analysis method were used in the study. In our analysis we took into account the experience of primary disease prevention and teaching of valeological disciplines "Health Pedagogy" and "Fundamentals of Medical Knowledge and Health Preservation" in higher education establishments of Ukraine and Germany. In particular, in Ukraine, teaching took place 1) in such higher education institutions as Ukrainian Engineering Pedagogics Academy (V.N. Karazin Kharkiv National University), National Technical University "Kharkiv Polytechnic Institute", Simon Kuznets Kharkiv National University of Economics; 2) in classroom and distance learning modes during 2004–2024; 3) for full-time, part-time (evening), and distance learning students; 4) with teaching of disciplines in full volume and individual lectures at the request of the higher education institution. Understanding of risk factors and their interrelationships by non-medical students of higher education institutions was taken into account according to the feedback principle when they performed creative and control tasks [16; 17].

The study was approved by the Ethics Committee of the International Institute of Public Health (protocol No.23 of December 24, 2024).

Results and Discussion

The valeological programs "Health Pedagogy" and "Fundamentals of Medical Knowledge and Health-Saving" were created in compliance with a number of principles [14; 18–23]:

1) evidence-based medicine (in particular, facts about diseases and risk factors are given only from peer-reviewed scientific publications; all controversial, debatable in the scientific community, the points are indicated when citing each fact) [24; 25];

2) first of all, students are offered to study the diseases that are responsible for the largest number of deaths [26; 27];

3) information obtained about the health of students and their relatives during the educational process is kept confidential by teachers, and is provided for scientific analysis in a generalized form [28–31];

4) the purpose of teaching subjects is to form valeological competence in students, which the authors of the subjects consider to be the ability to

lead a healthy lifestyle, practice safe behavior models, and provide emergency care in critical conditions [32–36].

The analysis of risk factors for socially significant diseases included their significance for the disease development (causes the disease in the first place or enhances the effect of other decisive risk factors), preventability (the ability to take certain actions to prevent the *negative realization* of the factor or, conversely, to abandon certain actions). In fact, the realization of the risk means the transition from the potential probability of getting sick to the actual development of the disease. The consequences of negative realization are complications, deterioration in the quality of life, disability or even death. Examples of negative realization are: the influence of smoking on the development of lung cancer, COPD); the influence of an unhealthy diet on the development of obesity, type 2 diabetes [37]; the influence of physical inactivity on the development of cardiovascular diseases [38]; the influence of genetic predisposition on Alzheimer's disease, the development of atherosclerosis, hypertension, diabetes mellitus [39; 40].

The risk management system included prevention (e.g., vaccination, healthy eating, physical activity), early diagnosis of diseases (regular medical examinations, tests), their treatment and correction of functional disorders (medication, rehabilitation). Trends in the prevalence of socially significant diseases in the world and the WHO European region, in different populations and countries depending on income levels of the population were studied [9; 39; 41].

We also took into account, firstly, social factors of disease development, associated with low incomes of the population, low accessibility to prevention and treatment, long-standing unresolved issues in the organization of health care, widespread chemical addictions (primarily smoking and alcohol abuse), low adherence of the population to a healthy lifestyle, and population aging, which are inherent in the population of Ukraine, especially since the beginning of the full-scale war. Thus, it is known that the number of strokes is significantly higher and survival after vascular crises is lower in countries with low incomes of the population due to insufficient prevention [42; 43]; that population aging increases the number of dementias in the population, in particular because of Alzheimer's disease [40; 44]; that the high number of car accidents and deaths in these accidents is caused by the poor quality of roads [45; 46]; that perinatal diseases and prematurity are largely associated with insufficient medical care [47; 48]. Secondly, we took into account regional features of disease prevalence. Thus, Europe and North America are characterized by high rates of IHD, cancer and dementia; Asia and Africa are characterized by high mortality due to infections (malaria, tuberculosis), road accidents and severe perinatal conditions; Latin America – due to diabetes and violence (homicide) [26; 49]. Thirdly, we took into account the main trends in morbidity in 2024: an increase in the number of deaths from chronic diseases (+12% since 2010) due to the population aging; because of COVID-19, which remains in the TOP-5 of deaths in countries with low vaccination rates; due to antibiotic resistance, which causes approximately 1.3 million deaths annually and is expected to increase [50; 51]. Fourth, we focused on the main preventive areas recommended by the WHO: reducing salt intake (<5 g/day) and constant blood pressure monitoring – for the prevention of cardiovascular diseases; screening examinations (colposcopy, mammography, colonoscopy) and smoking cessation – for the reduction of cancer mortality; reducing sugar and trans fat intake – for the prevention of diabetes mortality [52–54].

This approach is consistent with the guidelines for assessing the impact of risk factors on global health and disease indicators, the Global Health Estimates 2024 (WHO) and the Global Burden of Disease Study 2024 (IHME) [55; 56], which are key documents for analyzing global health trends and are used to shape health policies. Our approach to risk factor analysis is based on a comprehensive methodology that integrates quantitative and qualitative indicators. We pay particular attention to the interactions between different levels of health determination – from individual behavioral factors to macrosocial conditions. An important aspect is the dynamic nature of these interactions, especially in the context of modern global challenges. In particular, we observe how socioeconomic crises amplify the impact of traditional risk factors, creating a "double burden" effect. This is especially noticeable in populations that simultaneously face the consequences of aging and deteriorating access to health care. The current approaches to prevention that we review increasingly shift the emphasis from individual responsibility to systemic solutions. This includes: 1) creating environments that promote healthy lifestyle choices; 2) developing a "preventive environment" in communities; 3) integrating preventive approaches into all policy decisions. At the

level of social medicine, real-time monitoring of the effectiveness of interventions is of particular importance, which allows for prompt adjustment of strategies. We see prospects in combining traditional epidemiological approaches with modern methods of data analysis, which is especially relevant in conditions of limited resources [57].

In the course of teaching valeological disciplines, we pay special attention to the formation of practical skills in disease prevention, which is based on modern scientific approaches. Our method involves explaining the connection between lifestyle and health, how specific everyday decisions (from eating habits to sleep patterns) affect the likelihood of developing diseases in 10–20 years. Special emphasis is placed on the fact that [75–85]% of premature mortality from non-communicable diseases can be prevented through behavioral changes [58–61]. In practical classes, we model real-life situations where students learn to make informed decisions about their health. For example, we analyze typical dietary mistakes that lead to obesity, or analyze how regular preventive examinations can detect diseases at an early stage [22; 23; 62]. An important element is working with motivation [63; 64], which determines personal motives for leading a healthy lifestyle. We emphasize that prevention is not a limitation, but an investment in one's own future, which allows maintaining quality of life in adulthood and old age. We teach to use modern technologies, such as mobile applications for monitoring physical activity or nutrition, to show how digital tools can help in prevention. But at the same time, we note the need for critical evaluation of the results. In addition, we teach students how to become agents of change in their families and communities, transferring knowledge about prevention to loved ones [65].

The topics of the curricula of the disciplines "Health Pedagogy" and "Fundamentals of Medical Knowledge and Health-Saving" are generally presented by the following questions: personal hygiene; household and medical protection against infectious diseases (anti-epidemic regime and vaccination); rational interaction with medical workers and pharmacists; self-examination skills, determining restrictions and regime according to the state of one's own health; ability to use medicines from the home first aid kit; optimal work and rest regime, sleep; rational regime of physical activity; rational nutrition; optimization of everyday life ecology; choice of work according to the state of one's health; safe traffic behavior; psychological hygiene and conflict resolution; protection from violence, bullying; emergency care, self-help; absence of particularly dangerous harmful habits (tobacco smoking, use of narcotic and toxic psychoactive substances, alcohol abuse); responsible sexual behavior; willingness to donate. With an emphasis on the need for timely medical examinations and visits to the doctor, training is provided in self-diagnosis of individual conditions, physical and psychological: for example, determining the level of blood pressure, weight, height, body temperature, muscle strength and endurance, emotions, stress level, cognitive abilities (memory, intelligence), levels of empathy, fatigue, determining signs of burnout; searching for skin and breast neoplasms; detecting signs of stroke, etc.

To develop a self-diagnostic toolkit, a research group of doctors and teachers carefully studied the issues of cardiovascular diseases, crises (myocardial infarction, cerebral strokes) related to their prevention [66–76]. The result of that study was a series of publications that reflect the directions of prevention of these diseases related to valeological education, as well as the development of the "Test for the detection of arterial hypertension by blood pressure indicators and risk factors of hypertension by genetic factors, lifestyle and nutrition", which was included in the program of the discipline "Health Pedagogy". The predictive validity of the questionnaire was determined by experts. In addition, a validity check in the course of longitudinal studies with factor and correlation analysis is planned and is being carried out.

Besides, keeping on doing the study of the effects of tobacco smoking, which was started by our group more than 20 years ago [77; 78], was also close in its theme. Smoking remains one of the main preventable risk factors for the development of Cardiovascular Diseases (CVD), as well as for the vast majority of other diseases considered in the program of valeological disciplines. In recent years, the negative effects of smoking on the background of the smoker's genetic characteristics have been added to the discussion [79; 80]. Prevention of the negative effects of smoking at the individual, group and population levels in the educational programs of valeological disciplines is considered in accordance with the WHO global strategy and the framework convention [78; 81] and the concept of the state policy of Ukraine on reducing the harm from tobacco products [82].

The negative impact of smoking is considered together with other risk factors, which is presented in *Figure 1*.

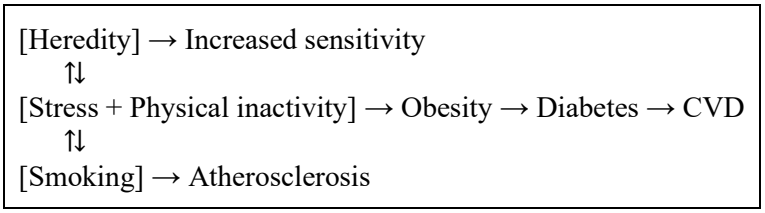


Fig. 1. Visualization of the relationships between risk factors for cardiovascular disease (CVD).

The relationships between risk factors for cardiovascular disease are complex and multifaceted. Hereditary factors play a key role in determining individual susceptibility to the development of metabolic disorders. Studies have shown that certain genetic variants can increase the risk of obesity and insulin resistance [83]. These hereditary characteristics often interact with external factors, such as chronic stress and low physical activity, resulting in a cumulative effect. Chronic stress activates the hypothalamic-pituitary-adrenal axis, which contributes to increased cortisol levels and the accumulation of visceral fat [84]. At the same time, insufficient physical activity contributes to reduced energy expenditure and the development of metabolic syndrome.

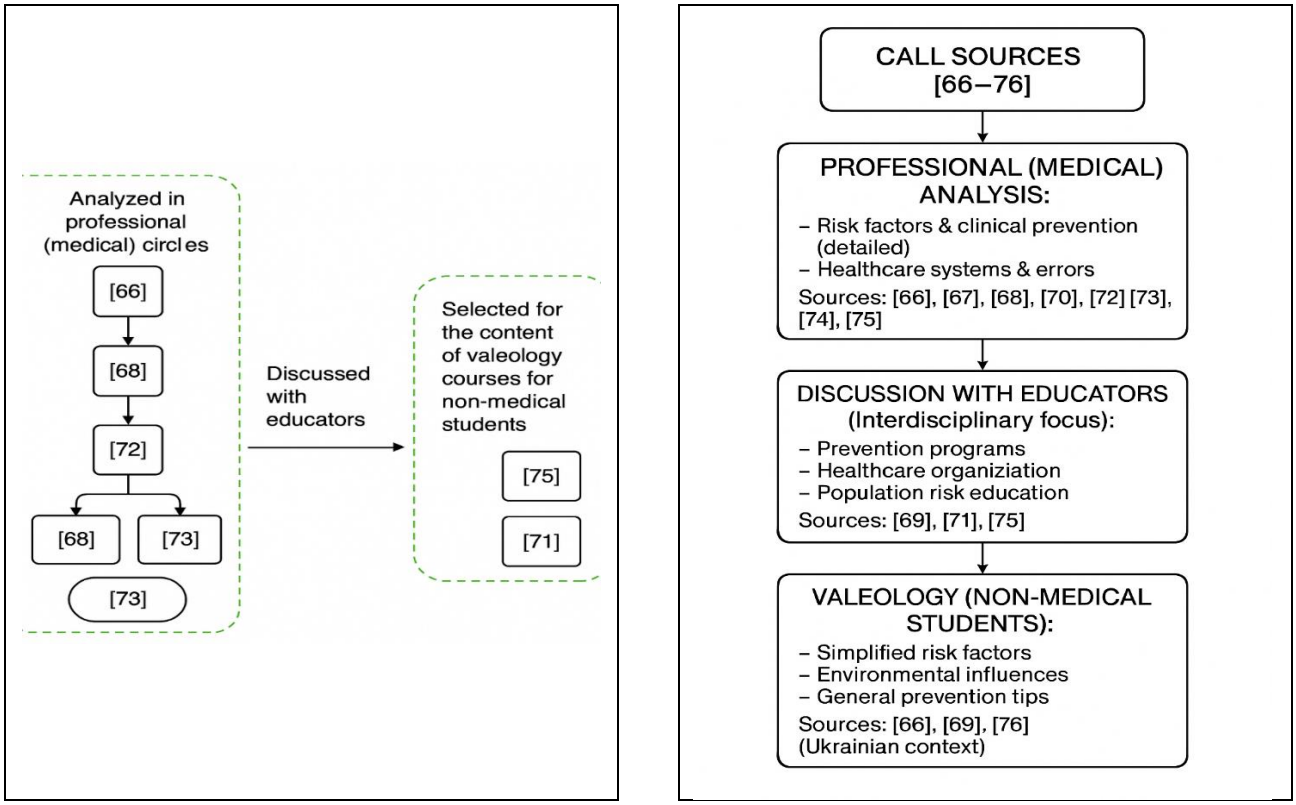
Obesity, which develops under the influence of these factors, is a major driver of insulin resistance and type 2 diabetes. Excess adipose tissue, especially visceral, releases proinflammatory cytokines and free fatty acids that disrupt insulin signaling [85]. Diabetes, in turn, significantly increases the risk of cardiovascular complications through several mechanisms, including endothelial dysfunction, increased oxidative stress, and activation of inflammatory processes [86].

Smoking is an independent risk factor that interacts with other elements of this pathological chain. Tobacco smoke contains numerous toxic substances that damage the vascular endothelium, activate inflammation and accelerate the development of atherosclerosis [87]. The interaction of smoking with other risk factors is particularly dangerous. For example, in patients with diabetes, smoking significantly increases the risk of cardiovascular complications [88]. At the same time, obesity can increase the negative impact of smoking on the body, creating a vicious circle.

It is important to note that genetic predisposition may modulate the effects of all of these factors. Some genetic variants increase stress sensitivity, while others increase the likelihood of developing nicotine dependence or metabolic disorders at the same level of physical activity [89]. This complex network of interactions explains why the same external factors can lead to different clinical outcomes in different individuals.

The methods of *balancing*, *aggregation* and *scaling* developed for the didactic adaptation of complex medical information in the context of generalization by the method of *systems analysis* [4–6] allowed us to study various aspects of the negative implementation of CVD risk factors during 2020–2023, develop an algorithm for didactic adaptation (*Fig. 2* and *3*), and introduce new data on CVD prevention in the educational process of students of engineering and engineering-pedagogical profiles. At the first stage, information on various CVD risk factors was discussed in a professional environment in the form of speeches at scientific and practical conferences, publication of abstracts of speeches [66–76], and with subsequent discussion of the results together in groups with medical workers (scientists) and teachers (*Fig. 2*).

The sequence of using sources and stages of didactic adaptation and validation of data included the following stages: 1) discussion in professional medical circles, 2) in joint groups of medical workers and teachers, 3) in pedagogical circles. Observation of the process of sequential didactic adaptation of data made it clear that professional medical circles were focused on clinical studies of risk factors and on criticism of the organization of the healthcare system [67; 68; 72]. When discussing information at the second stage, with teachers, the scope of the problem review became expanded, but the detailing of risk factors was smaller, which was a manifestation of the simultaneous work of scaling and balancing methods. At this stage, curricula were developed for non-medical students [4; 22; 23], which included characteristics of risk groups with an emphasis on individual publications [69; 71], on a competency-based approach to education [95; 96], namely, the rules for the formation of valeological competence [6; 13; 14; 16; 19; 21; 62; 97–99], some related competencies (primarily environmental) [100; 101]



a b

Fig. 2. Primary algorithm for studying risk factors for cardiovascular diseases for the purpose of their further didactic adaptation for valeological education.

a – taking into account the sequence of use of the main sources and the stages of didactic adaptation and validation of data;

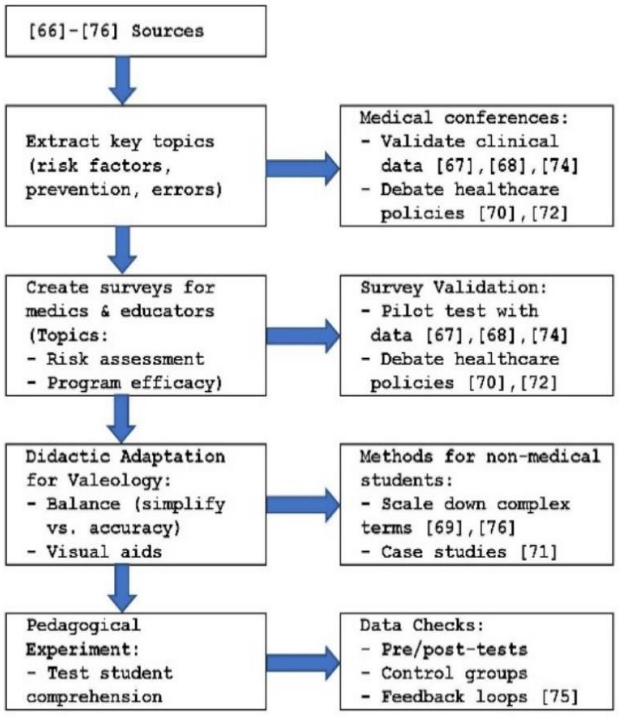
b – taking into account the sequence of use of all sources and with a detailed discussion of the topic.

and additional competencies (e.g., resilient) [102; 103]. At this stage, positive results of interdisciplinary cooperation were obtained. When teaching valeological disciplines at the third stage, simplified, student-friendly content was used (e.g., environmental risks [76], basic prevention of CVD [66]). The creation of this publication implements the principle of feedback necessary for basic algorithms of system analysis.

Further detail of the algorithm is presented in *Fig. 3*. The scheme depicts the distribution of scientific sources by areas of their use depending on the target audience and depth of analysis. The focus is on materials devoted to risk factors for cardiovascular and cerebrovascular diseases, assessment of the effectiveness of preventive programs, the role of medical personnel, and the impact of environmental factors on health. When discussing in medical circles, where publications are analyzed [66–75], the focus is on facts that are important for clinical practice, planning treatment strategies, developing national prevention programs, and improving the management of health care systems. The source materials are combined into a common analytical block that provides a scientific basis for making decisions in the field of health care.

In the second stage, during interdisciplinary interaction and discussion of research results with educators, more attention was paid to sources [71; 76] that allow adapting data from the field of medicine to the field of education, in particular for raising public awareness of risk factors, prevention and environmental safety. These publications can serve as a basis for discussing strategies for medical education, informing the population and developing communication policies in the field of public health.

At the third stage, when using materials in curricula for non-medical students within the framework of valeological disciplines, the emphasis is not on in-depth clinical analysis, but on an acces-



#	Content Focus
66	Cardiovascular risk factors, monitoring medical staff actions
67	Stroke risk factors (clinical focus)
68	Ischemic stroke risks and interconnections
69	Stroke prevention programs (adaptable for educators)
70	Cardiovascular disaster risks, healthcare monitoring
71	Healthcare organization to reduce CVD mortality (policy focus)
72	Errors in national prevention programs (critical analysis)
73	Methods to assess individual/ population CVD risks
74	Stroke risk factors via regional registries (data-driven)
75	Impact of healthcare financing/ staffing on stroke care (Ukraine-specific)
76	Environmental CVD risks (simplified for non-medical audiences)

Fig. 3. Algorithm for analysis and adaptation of medical sources for different target audiences.

Notes: CVD – cardiovascular diseases.
Additional comments on the algorithm:
Input sources [66–76].
Key topics extraction (risk factors, prevention).
Conference validation (clinical data [67; 68; 74]).
Survey development (for physicians [66; 73]).
Didactic adaptation (balance of accuracy and simplicity [69; 76]).
Pedagogical experiment (testing effectiveness [75]).

sible presentation of basic concepts, a simplified understanding of CVD risk factors, in particular myocardial infarction and stroke, the importance of the organization of healthcare system in Ukraine and the impact of environment on health. Sources [66; 67; 71; 76] are the basis for developing the content of relevant educational modules aimed at forming a healthy lifestyle and responsible attitude to their own health among students. The scheme demonstrates the relationships between these levels of application of scientific data, emphasizing how the same studies can have different levels of processing and presentation depending on the target audience.

The presented algorithm demonstrates the full cycle of work with medical sources: from initial analysis through professional validation to the creation of educational materials for non-medical audiences. Key stages include scientific verification, content adaptation, and assessment of learning effectiveness. Types of activities for conducting didactic adaptation are listed in *Table 1*.

Algorithms for didactic adaptation show how to integrate sources for a full cycle of research (from analysis to practical implementation). Sources [67; 68; 74] contain detailed analyses of stroke risk factors, including data from regional registries and clinical trials. This information is critical for discussion at medical conferences, as it allows to verify the relevance of recommendations for prevention and treatment. For example, studies in [74] show how statistical data can be used to predict risks, which is important for planning national health programs.

Table 1. Actions for didactic adaptation of complex medical information

Type of activity	Comments
Conferences	Sources [67; 68; 74] contain data on the validation of clinical guidelines, while [70; 72] are suitable for discussions on health policy.
Poll	Based on [66; 73], questions for doctors are developed, and [69; 71] help create questionnaires for teachers.
Adaptation	Materials [69] (prophylaxis) and [76] (ecology) are simplified through cases and visualization, while maintaining scientific accuracy [68].
Experiment	Data from [75] are used to evaluate the effectiveness of training, for example, through pre-tests and feedback.

For surveys of physicians and educators, key sources are [66] and [73], where methods for assessing individual and population risks of cardiovascular diseases are discussed. These materials will help to create valid questionnaires, for example, on the effectiveness of preventive measures or errors in their implementation [72]. Pilot testing of surveys among physicians will allow to clarify the formulation and eliminate ambiguity.

Materials [69; 76] are suitable for didactic adaptation of complex medical concepts. [69] describes stroke prevention programs that can be simplified through case studies or visualization, and [76] emphasizes environmental factors, which is convenient for teaching non-medical students. It is important to balance scientific accuracy [68] with accessibility of information (e.g., comparison with everyday phenomena).

At the pedagogical experiment phase, data from [75] (on the impact of funding on the quality of health care) will help assess whether the adapted materials are clear to students. The assessment can include pre- and post-tests, as well as group discussions to identify weak points and improve the program. The source [71] is also useful because it offers structured approaches to organizing prevention that can be simulated in educational scenarios.

When forming modern valeological curricula, special attention is required to the constant updating of global statistical data on the main risk factors of socially significant diseases. For example, to update data on risk factors for CVD, we conducted an analysis of statistical sources [90–94] on the prevalence of obesity in the countries of the WHO European Region in terms of the percentage of the population that is overweight and obese (we identified trends, ranking of countries in the list, and dynamics of the indicator). The result is shown in *Table 2*.

Table 2. Dynamics of the prevalence of overweight and obesity among the adult population of the WHO European Region (2019&2023) with their ranking.

Country	2019		2023	
	Rank	%	Rank	%
Albania	20	62.3	20	65.2
Austria	30	54.2	30	56.4
Belgium	24	59.1	25	61.3
Bosnia & Herzegovina	15	64.7	15	67.5
Bulgaria	18	63.9	18	66.7
Croatia	17	64.2	17	67.0
Cyprus	26	58.4	26	60.8
Czech Republic	3	68.0	3	70.4
Denmark	29	54.6	29	56.6
Estonia	22	61.2	22	63.6
Finland	21	62.5	21	64.9
France	27	56.8	27	58.8
Germany	23	59.7	24	62.1
Greece	2	68.3	2	70.7
Hungary	10	65.9	10	68.7
Iceland	25	58.9	23	61.3
Ireland	19	60.1	19	62.5
Italy	28	58.5	28	60.9
Latvia	16	63.4	16	65.8
Lithuania	14	62.7	14	65.1
Malta	8	66.2	8	69.0
Netherlands	31	53.1	31	55.1
Norway	22	57.3	25	59.3
Poland	12	64.5	12	67.3
Portugal	13	59.4	13	61.8
Romania	11	63.1	11	65.9
Slovakia	9	66.4	9	69.2
Slovenia	19	61.9	19	64.3
Spain	7	61.6	7	64.0
Sweden	32	52.3	32	54.3
Switzerland	33	51.8	33	53.8
Turkey	6	66.5	6	69.3
Ukraine	5	67.1	5	69.9
United Kingdom	4	63.7	4	66.5

As shown in *Table 2*, almost all countries in the WHO European Region demonstrated an increase in overweight and obesity rates among adults between 2019 and 2023. The average increase was approximately [2–3]%, indicating a steady downward trend in the region. The highest rates in 2023 were recorded in the Czech Republic, Greece, Malta, Turkey and Ukraine, where more than 69.0% of adult population was overweight or obese. Ukraine ranks fifth in this ranking with a rate of 69.9%, which is a very high level.

Compared to 2019, when this indicator was 67.1% in Ukraine, there is an increase of 2.8%. Only four countries bypass Ukraine in this indicator: Greece, the Czech Republic, Malta and Turkey. The lowest rates of overweight and obesity are recorded in Switzerland, Sweden and the Netherlands, where they do not exceed 55.0%. These countries, despite a slight increase in indicators over the past five years, continue to demonstrate the best results in the region.

Country rankings remain relatively stable throughout the observation period. Countries with high rates such as the Czech Republic and Greece maintain their leading positions, while Switzerland and Sweden consistently rank at the bottom of the rankings. It is worth noting that Eastern European countries, including Ukraine, show higher rates than Northern and Western European countries. This difference may be due to differences in dietary habits, levels of physical activity, and the availability of effective prevention programs.

The situation in Ukraine requires serious attention, as the high level of overweight and obesity is a significant risk factor for the public health. The experience of countries with the lowest rates, such as Switzerland or Sweden, where effective prevention programs are implemented, can be useful for developing a national strategy to combat this phenomenon. The constant increase in rates in most countries indicates that the problem of obesity remains relevant for the entire European region.

Hypodynamia as a risk factor for the development of cardiovascular diseases and obesity is defined as a stereotype of the movement of people without disabilities, which limits or completely deprives of the opportunity to move and perform physical exercises. It is about the habit of moving little, lifestyle, work.

Thus, CVDs are influenced by a variety of risk factors that are closely related to one another. It is important for non-medical students to understand these relationships in order to effectively prevent the disease. The main uncontrollable risk factors that we cannot affect are age (the risk increases after 45 years in men and 55 years in women), gender (men have a higher risk at a younger age), heredity (the presence of CVDs in close relatives), and ethnicity. Studies show that heredity can increase the risk of developing hypertension by [30–50]% [104].

Controllable and ***conditionally controllable*** risk factors are much more important for prevention. Some researchers consider smoking [105], obesity [106] and physical inactivity [107] to be conditionally controllable risk factors because quitting smoking is difficult due to chemical dependence, obesity may be associated with endocrine disorders rather than overeating, and physical inactivity with forced isolation during the COVID-19 pandemic and war. But we consider these three factors to be controllable. Yes, quitting smoking is not as difficult due to addiction as quitting alcohol abuse and drug use [108], overeating is the main cause of most cases of obesity [109], and during the pandemic and war, it is possible to perform a set of physical exercises with sufficient load at home [110].

Conditionally controllable risk factors for the development of CVD at the group and population levels include stress [111], especially acute in war conditions, insufficient sleep [112] associated with war or work schedules (for example, with daily shifts of doctors, rescuers, power engineers, etc.), insufficient medical literacy associated with low accessibility of valeological education for non-medical students of Ukraine. That is, when determining the degree of risk factors controllability, we suggest taking into account not only the ability to eliminate the factor effect through personal efforts (for example, keeping to a balanced diet, avoiding overeating and quitting smoking), but also the socio-economic circumstances of the post-pandemic and wartime. Confirmation of the controllability of risk factors is the availability of valeological tools for correcting their impact on health [113; 114].

Thus, the study by Anderson L. et al. (2016) [114], which is considered the "gold standard" of evidence-based medicine in the field of cardiac rehabilitation, published in the Cochrane Database, is based on a meta-analysis of 63 scientific papers with the participation of 14,486 patients with chronic coronary heart disease. Most of these studies compared usual care with physical rehabilitation programs. The average age of the participants was [55–75] years. In 85% of cases, the stu-

dies had a control group, where patients received only standard care without physical exercise. Most often (72% of studies) used aerobic training (walking, exercise bikes), and in 28% combined aerobic and strength exercises. Scientists found that physical rehabilitation reduces the risk of death by 26% (relative risk 0.74). The number of hospital admissions was reduced by 18%. The patients' quality of life, as measured by the SF-36, improved by an average of 5.8 points. The greatest effect was observed in patients after a heart attack, whose risk of death was reduced by 31%. Women benefited more from workout than men (reduction in mortality was 29% versus 22%). The evidence of influence on mortality is considered high-quality (GRADE A), but the data on life quality are of moderate quality, as different studies used different assessment methods. The best results were obtained with 8–12 weeks of physical exercise, with training 3 times a week. This study shows that even in the presence of cardiovascular disease, physical activity remains an important controllable factor that can significantly improve health. These findings may be useful for the development of heart disease prevention programs in both medical and educational settings.

The impact of controlled and conditionally controlled risk factors on health can be eliminated or significantly weakened by forming non-medical students's valeological competence and commitment to a healthy lifestyle throughout life. Programs for primary prevention of socially significant diseases should include attitudes towards quitting smoking, alcohol abuse, drug use, overeating, overfatigue, leading a sedentary lifestyle or, conversely, engaging in extreme sports, and practicing unprotected sex.

To improve the curricula of valeological disciplines, legal issues and the work of legal experts were used. The legal aspects of the prevention of socially significant diseases in higher education institutions are based on the ability to influence controllable risk factors through regulatory acts and educational programs. According to the Order of the Ministry of Health of Ukraine No.417 of 2018, educational institutions are obliged to implement preventive measures, in particular to combat physical inactivity, unhealthy diet and smoking. For example, a study by Anderson L. et al. (2016) proves that regular physical activity reduces the risk of cardiovascular complications by 26%, which confirms the need to include physical education in educational programs. At the same time, the Law of Ukraine "On Protection of Health from the Harmful Effects of Tobacco" prohibits smoking in university premises, which helps to control this risk factor. For non-medical students, such activities are especially important, since their career includes low physical activity, and valeological education can compensate for this impact.

Given the complex effect of several important risk factors on the development of diseases, which are considered in the curricula of valeological disciplines, at the stage of the pedagogical experiment we used integral risk assessment models. We also noticed that determining the level of risk of one's own diseases increases motivation for valeological education [64], so we involved students in such assessments of their own health. Simple models of risk assessment and prevention are offered to non-medical students. For example, a simplified formula for the integral risk of cardiovascular diseases, proposed by the International Institute of Public Health for valeological education programs:

$$R = \frac{\mathrm{Sm}+\mathrm{PA}_{30}+\mathrm{JF}_2}{3} \times \frac{\mathrm{St}}{10} \qquad (1),$$

where Sm – smoking (1 – yes, 0 – no);
PA_{30} – daily physical activity less than 30 minutes per day;
JF_2 – junk food more than twice a day;
St – stress level (scale 1–10 units).

A high risk requiring correction (R>1.5) during the 2019–2024 years of teaching the valeological discipline "Health Pedagogy" was detected in approximately 3 out of 4 non-medical students, which indicates the feasibility of conducting primary prevention of CVD in institutions of higher non-medical education [115].

To prevent CVD, as a result of didactic information, we can offer students correctly simplified explanations of risk factors and simple advice: sufficient rest, rational nutrition (for example, "health plates", on which 50% are vegetables, 25% are cereals, and the protein content in products should be at least 25%; limiting salt to 5 g per day, avoiding overeating), rational physical activity (not sports, but physical education, 7–8 thousand steps per day to reduce the risk of developing diseases and vascular crises by 20%), stress management (breathing and relaxing exercises, rational time management, avoiding "toxic" people and situations, transforming negative emotions into neutral and positive ones), taking into account heredity (reasonable vigilance with blood pressure

control) and the use of practical valeological tools (risk calculators, mobile applications for tracking physical activity, etc.).

Conclusions

The examples of didactic adaptation of complex medical information on risk factors of socially significant diseases for teaching valeological disciplines to non-medical students indicate the feasibility of using the developed methods of balancing, scaling and aggregation in combination with the method of systems analysis. Didactic adaptation is carried out in three stages, in the first of which the developers of the curriculum describe the risk factors of socially significant diseases according to the rules of medical science and discuss them in the scientific environment. In the second stage, a joint scientific discussion of the material of the educational discipline takes place by doctors and teachers. In the third, testing is carried out in the student environment when teaching valeological disciplines.

Risk factors for cardiovascular diseases are heredity, stress, physical inactivity, obesity and smoking. We propose to consider the first two uncontrollable in war conditions, the other three controllable. An additional non-specific uncontrollable risk factor is the low level of valeological education. The latter problem can be solved by teaching valeological disciplines to non-medical students, with didactic adaptation of medical information.

Prospects for further research

We are planning to continue research into socially significant risk factors, in particular cardiovascular diseases, in order to reduce the number of uncontrollable risk factors at the group and population levels by transferring them to the group of conditionally controllable ones.

DECLARATIONS:

Disclosure Statement

The authors have no potential conflicts of interest to disclosure, including specific financial interests, relationships, and/or affiliations relevant to the subject matter or materials included.

Statement of Ethics

The authors have no ethical conflicts to disclosure.

Data Transparency

The data can be requested from the authors.

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