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The new modern screening complex for preventive medicine

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Abstract. Cardiometabolic diseases are a major global health problem affecting millions of people worldwide. Addressing this problem requires a multifaceted approach that includes lifestyle changes, medical interventions, and public health strategies to reduce the prevalence and impact of these diseases. A comprehensive examination is a key element of prevention and early detection of cardiometabolic diseases. Thanks to careful anamnesis and diagnosis, we can identify risks in time and develop individual treatment and prevention programs that significantly improve the prognosis and patients´ quality of life. **Aim.** To develop a diagnostic system for determining the risks of cardiovascular, metabolic and renal diseases. **Materials.** The analysis was conducted in the PubMed Central database using the keywords «cardiometabolic diseases», «diagnosis and prevention of cardiometabolic diseases» for the period from 2019 to 2023. **Results.** There was developed the IDIS2GO diagnostic system to automate the collection and evaluation of medical and diagnostic data based on the latest recommendations of world professional associations, using artificial intelligence algorithms and training own neural networks. IDIS2GO consists of three parts: the first part is the patient's history (questions included in the examination are aimed at identifying risk factors and potential health problems); the second part – diagnostic procedures (based on the answers to the above questions, users can perform the following diagnostic procedures for a more detailed assessment of the patient's state of health); the third part is risk assessment scales (cardiovascular disease, lipids, diabetes and emergencies). Thus, IDIS-2GO is a new diagnostic system designed to optimize the medical examination process. It is a portable, integrated solution that includes advanced diagnostic tools and a powerful software platform for real-time health monitoring and clinical decision support. IDIS2GO combines cardiovascular risk scoring algorithms (SCORE2 and SCORE2-OP) and diabetes screening for a comprehensive risk assessment. The IDIS2GO system helps to collect all these data in a single examination file. The data are automatically entered into the cloud storage and can be transferred to any information system, ensuring their availability to the doctor at a convenient time. The doctor can interpret the data, evaluate them and give the necessary recommendations.

Keywords: cardiometabolic diseases, IDIS2GO, prevention, risk assessment.

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The concept of cardiometabolic patients and their prevalence in the world

Patients with cardiometabolic diseases (CMDs) are individuals who suffer from a group of conditions that include cardiovascular diseases (CVDs) and metabolic disorders such as diabetes, obesity, and hypertension. These conditions are often interconnected and share common risk factors, such as poor diet, lack of physical activity, and genetic predisposition [1-7].

The concept of CMDs includes:

1. CVDs: heart diseases such as coronary artery disease, heart attack, and stroke.

2. Metabolic Disorders:

- Diabetes mellitus: particularly type 2 diabetes, which is often associated with obesity and insulin resistance;
- obesity: excess body fat that increases the risk of various health problems, including CVDs and diabetes;
- hypertension: high blood pressure, which is a major risk factor for heart disease and stroke;
- dyslipidemia: abnormal levels of lipids in the blood, such as high cholesterol or triglycerides, contributing to atherosclerosis and CVDs.

CMDs are a leading cause of mortality and morbidity worldwide. According to the World Health Organization, CVDs are the number one cause of death globally [1-7]. The International Diabetes Federation reports that approximately 537 million adults aged 20-79 were living with diabetes in 2021, and this number is expected to rise to 643 million by 2030 and 783 million by 2045. High-income countries often have a higher prevalence of obesity and diabetes due to lifestyle factors such as sedentary behavior and high-calorie diets. However, they also have better access to healthcare, which can mitigate some of the impacts of these diseases. Low- and middle-income countries have a rising prevalence of CMDs in these regions due to urbanization, changing diets, and increased sedentary lifestyles. These countries often face challenges in healthcare infrastructure, making it harder to manage and treat these conditions effectively.

It is known that older adults are at a higher risk of CMDs due to the cumulative effects of risk factors over time. Men are generally at higher risk for CVDs at an earlier age, but the risk for women increases and often surpasses that of men after menopause.

CMDs are a significant global health challenge, affecting millions of people worldwide. Addressing these conditions requires a multifaceted approach that includes lifestyle changes, medical interventions, and public health strategies to reduce the prevalence and impact of these diseases.

To prevent and manage we need 2 ways:

1. Lifestyle modifications:

- healthy eating (rich in fruits, vegetables, whole grains, and lean proteins);
- regular physical activity;
- smoking cessation;
- moderate alcohol consumption;
- weight management.

2. Medical interventions:

- medications to manage blood pressure, cholesterol, and blood sugar levels;
- regular health check-ups for early detection and management of risk factors;
- surgical interventions in severe cases (e.g., angioplasty, bypass surgery).

Comprehensive examinations are a key element for prevention and early detection of cardiovascular, metabolic, and renal diseases. Through meticulous history-taking and diagnostic tests, we can timely identify risks and develop individualized treatment and prevention programs, which significantly improve the prognosis and patients´ quality of life.

SK-Telemed GmbH has assembled a group of scientists and qualified specialists in the **Health Algorithms project** to develop tools for automating the collection and evaluation of medical and diagnostic data based on the latest recommendations from global professional associations, using artificial intelligence algorithms and training our own neural network. This significantly intensifies preventive examinations. We create such comprehensive diagnostic system for these purposes – IDIS2GO – to determine the risks of cardiovascular, metabolic, and renal diseases **(Fig.)**.

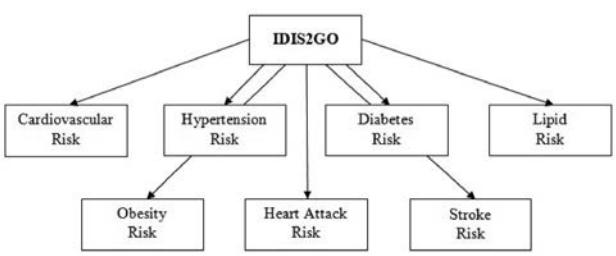

Fig. IDIS2GO is new important instrument for prevention screening.

IDIS2GO consists of 3 parts. **First is history of patient**. The questions included in the

examination are aimed at identifying risk factors and potential health problems.

Below are the main questions included in the diagnostic algorithm:

1. Age: An important factor for assessing disease risk.
2. Gender: Men and women have different risks for various diseases.
3. Do you smoke? Smoking significantly increases the risk of CVDs.
4. How much do you walk in a day? Physical activity is important for heart health.
5. Do you have thyroid diseases? Can affect metabolism and the cardiovascular system.
6. How often do you eat vegetables, fruits, berries? Nutrition plays a key role in maintaining health.
7. Do your close relatives have diabetes? Family history of diabetes increases the risk.
8. Do your close relatives have heart attack or stroke? Family history increases the risk of heart attack.
9. Have you had hyperglycemia? It is an important marker for diabetes diagnosis.
10. Have you had atrial fibrillation? It is associated with an increased risk of stroke.
11. Do you have familial hypercholesterolemia? It is a genetic risk factor for atherosclerosis.
12. Do you have chronic kidney disease? It affects overall health and cardiovascular risk.
13. Do you take medications for high blood pressure? Blood pressure control is important for preventing complications.
14. Do you experience shortness of breath or chest pain during exertion? Symptoms indicating possible heart problems.

The second part is diagnostic procedures. Based on the answers to the above questions, users can conduct the following diagnostic procedures for a more detailed assessment of the patient's health:

1. Electrocardiogram: Assessing the electrical activity of the heart, detecting arrhythmias and ischemia.
2. Blood glucose measurement: Diagnosing diabetes and controlling glucose levels.
3. Lipid profile: Determining cholesterol and lipid levels in the blood, assessing atherosclerosis risk.
4. Blood creatinine measurement: Assessing kidney function.
5. Urinalysis: Detecting kidney and other systemic diseases.
6. Height and weight measurements, Body Mass Index calculation: An important indicator for assessing overall health and metabolic risks.
7. Waist circumference measurement and its ratio to hip circumference: An important indicator for determining metabolic risks.
8. Cardiac troponin level measurement: If there is a positive response to questions about shortness of breath or chest pain during exertion.
9. Glycated hemoglobin measurement: If there are positive responses to questions about family diabetes or hyperglycemia in the medical history and currently elevated blood glucose levels.

The third part is Risk Assessment Scales (cardiovascular, lipids, diabetes and emergency situations).

Thus, IDIS2GO – a new diagnostic system designed to optimize the medical examination process. This is a portable, integrated solution that includes advanced diagnostic tools and a powerful software platform for real-time health monitoring and clinical decision support. IDIS-2GO combines the scoring algorithms for cardiovascular risk (SCORE2 and SCORE2-OP) and diabetes screening for a comprehensive risk assessment.

The IDIS2GO system helps to collect all these data into a single examination file. The data automatically goes to cloud storage and can be transmitted to any information system, ensuring its availability to the doctor at a convenient time. The doctor can interpret the data, assess them, and make the necessary prescriptions.

We are already training our own artificial intelligence and will soon introduce the function of automatic interpretation of examination data and prediction of cardiovascular, renal, and metabolic risks, which will significantly ease and speed up the doctor's work.

With the use of IDIS2GO, processes that previously took 30-35 minutes can be reduced to 20 minutes or less due to automation and support from medical staff:

1. Examination and measurements are performed by a nurse, the results are entered into the system – 5 minutes.
2. Patient survey can also be performed by a nurse with automatic data entry – 5 minutes.

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3. Examinations with IDIS2GO are performed by a nurse, their time is reduced due to the speed of the devices and automatic data transmission – up to 15 minutes.
4. Data recording, transmission to the cloud, and HIS are done automatically.
5. Interpretation and assessment of data by the doctor from ready results – up to 5 minutes (the doctor does not need to be present during the examination procedures and can do this at a convenient time).

If a doctor wants to conduct such an examination today, it would take at least 350 working hours or about 50 working days per year for 700 patients (30 minutes per patient). With the distribution of functions, collection of history, and objective data allowed by the new technology, the doctor will spend only 58.3 hours or about 8.5 working days (up to 5 minutes per data evaluation and prescription).

Organization of Pre-medical Reception Office

It is advisable to organize a pre-medical reception office where patients will be referred for annual preventive examinations.

Potential capacity of such an office:

- serving one patient – up to 25 minutes;
- 20 people per day;
- 100 people per week;
- 400 people per month;
- 4500 people per year.

Serving multiple family doctors: Considering the need for annual health evaluation of 1500 to 2000 citizens per family doctor, with a 40% necessity for examinations, this will average 700 patients per year. Thus, one pre-medical reception office can serve up to 7 family doctors.

Economic Efficiency

Saving 41.5 working days of a doctor per year will allow freeing up time for more productive work with patients. The savings in working time for 7 doctors will amount to 2042 hours or 291 working days. The cost of such working time will fully pay off the investment in the organization of such an office with new technology and the salary of the nurse working there within a year.

Implementing the IDIS2GO comprehensive diagnostic system not only saves doctors' working time but also allows for rational use of resources. Thanks to process automation and reduced doctor workload, medical institutions can reduce operational costs and improve the quality of services provided. The quick return on investment and reduction in labor costs make the implementation of IDIS2GO an economically effective solution.

Today examinations are conducting by doctors. It takes a lot of time, several visits, and it is not always convenient to enter and save all the data in the patient's record. This greatly affects the effectiveness of preventive diagnostics, due to the shortage of medical personnel in the European Union and in the world. Offering a comprehensive diagnostic system using express methods, in one visit, with automatic data collection and evaluation, significantly reduces the labor costs of the doctor and all medical staff, reduces the risk of errors, and provides a complete diagnostic report for the doctor, the patient and his medical documentation.

The IDIS2GO system is an innovative solution that significantly reduces the working time of family doctors during annual preventive examinations. It does not only improve work efficiency but also enhances the quality of medical care, leading to better patient outcomes. Organizing a pre-medical reception office and using the IDIS2GO system will allow efficient allocation of medical staff working time and improve the results of preventive examinations.

The potential of implementation IDIS2GO as comprehensive examination to determine the risks of cardiovascular, metabolic, and renal diseases

IDIS2GO is an innovative portable diagnostic system designed to conduct comprehensive examinations for assessing the risks of cardiovascular, metabolic, and renal diseases. Its potential lies in its ability to provide accurate, real-time health assessments in various settings, including remote and underserved areas.

Here's a closer look at its potential implementation:

1. Comprehensive Health Assessment:

- cardiovascular: IDIS2GO can monitor blood pressure, heart rate, and electrocardiograms, helping detect hypertension, arrhythmias, and other heart conditions;
- metabolic: By measuring blood glucose and cholesterol levels, it can identify individuals at risk for diabetes and dyslipidemia.

- renal: It can assess kidney function through markers like creatinine and estimated glomerular filtration rate, identifying early signs of kidney disease.

2. Accessibility:

- remote areas: IDIS2GO's portability makes it ideal for use in remote or underserved regions where access to healthcare facilities and comprehensive diagnostic tools is limited;
- mobile clinics: It can be used in mobile health clinics to reach populations that might not have regular access to healthcare services.

3. Real-time Data and Monitoring:

- Immediate Results: The device provides real-time results, allowing for immediate analysis and decision-making;
- Continuous Monitoring: It can be used for continuous monitoring of patients with chronic conditions, enabling better management and timely interventions.

4. Cost-Effectiveness:

- Reduced Healthcare Costs: Early detection of diseases can lead to earlier and more effective treatments, potentially reducing long-term healthcare costs;
- Efficiency: Combining multiple diagnostic tests into one portable device streamlines the diagnostic process, saving time and resources.

5. Improved Patient Outcomes:

- Early Detection: Identifying risk factors and diseases early can lead to better patient outcomes through timely treatment and lifestyle interventions;
- Personalized Care: The data collected can be used to tailor personalized treatment plans for patients.

We need to provide following implementation strategies:

1. Pilot Programs:

- Conduct pilot programs in diverse settings to evaluate the effectiveness, accuracy, and user experience of IDIS2GO;
- Gather data on its impact on early disease detection, patient outcomes, and healthcare costs.

2. Partnerships:

- Collaborate with healthcare providers, governments, and non-governmental organizations to facilitate widespread adoption and deployment;
- Partner with technology companies to enhance device capabilities and integrate with digital health platforms.

3. Education and Training:

- Develop comprehensive training programs for healthcare providers and community health workers;
- Provide educational materials and resources for patients to understand their health data and take proactive steps in disease prevention and management.

4. Regulatory Approvals:

- Ensure compliance with relevant regulatory standards and obtain necessary approvals from health authorities.

Conclusion

IDIS2GO holds significant potential as a comprehensive diagnostic tool for assessing the risks of cardiovascular, metabolic, and renal diseases. Its portability, real-time data capabilities, and comprehensive assessments can enhance healthcare delivery, especially in remote and underserved areas. With proper implementation, training, and integration, IDIS2GO can play a pivotal role in early disease detection, improving patient outcomes, and reducing healthcare costs. SK-Telemed GmbH has assembled a group of scientists and qualified specialists in the Health Algorithms project to develop tools for automating the collection and evaluation of medical and diagnostic data based on the latest recommendations from global professional associations, using artificial intelligence algorithms and training our own neural network. This significantly intensifies preventive examinations. We create such comprehensive diagnostic system for these purposes – IDIS2GO – to determine the risks of cardiovascular, metabolic, and renal diseases.

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Abbreviations

CMD – cardiometabolic diseases
CVD – cardiovascular diseases
IDIS2GO – Integrated diagnostic intelligent system

Новий сучасний скринінговий комплекс профілактичної медицини

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Резюме. Кардіометаболічні захворювання є серйозною глобальною проблемою для здоров'я, яка вражає мільйони людей у всьому світі. Розв'язання цієї проблеми потребує багатогранного підходу, який включає зміни способу життя, медичні втручання та стратегії охорони здоров'я для зменшення поширеності та впливу цих захворювань. Комплексне обстеження є ключовим елементом профілактики та раннього виявлення кардіометаболічних захворювань. Завдяки ретельному збору анамнезу та діагностиці ми можемо вчасно визначити ризики та розробити індивідуальні програми лікування та профілактики, які значно покращують прогноз та якість життя пацієнтів. **Мета.** Розробити діагностичну систему для визначення ризиків серцево-судинних, обмінних та ниркових захворювань. **Матеріали.** Аналіз проведено по базі PubMed Central за ключовими словами «кардіометаболічні захворювання», «діагностика та профілактика кардіометаболічних захворювань», за період з 2019 року по 2023 рік. **Результати.** Розробили діагностичну систему IDIS2GO для автоматизації збору та оцінки медичних і діагностичних даних на основі останніх рекомендацій світових професійних асоціацій, використовуючи алгоритми штучного інтелекту та навчаючи власні нейронні мережі. IDIS2GO складається з трьох частин: перша частина – історія пацієнта (питання, включені до обстеження, спрямовані на виявлення факторів ризику та потенційних проблем зі здоров'ям); друга частина – діагностичні процедури (на підставі відповідей на вищезазначені питання користувачі можуть провести наступні діагностичні процедури для більш детальної оцінки стану здоров'я пацієнта); третя частина — це шкали оцінки ризиків (серцево-судинні захворювання, ліпіди, діабет і надзвичайні ситуації). Таким чином, IDIS2GO – нова діагностична система, призначена для оптимізації процесу медичного огляду. Це портативне інтегроване рішення, яке включає передові інструменти діагностики та потужну програмну платформу для моніторингу стану здоров'я в реальному часі та підтримки прийняття клінічних рішень. IDIS2GO поєднує в собі алгоритми оцінки серцево-судинного ризику (SCORE2 і SCORE2-OP) і скринінг діабету для комплексної оцінки ризику. Система IDIS2GO допомагає зібрати всі ці дані у єдиний екзаменаційний файл. Дані автоматично потрапляють в хмарне сховище і можуть бути передані в будь-яку інформаційну систему, забезпечуючи їх доступність для лікаря в зручний час. Лікар може інтерпретувати дані, оцінити їх і дати необхідні рекомендації.

Ключові слова: кардіометаболічні захворювання, IDIS2GO, профілактика, оцінка ризику.

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