

**THE USE OF THE LATEST COMPUTER TECHNOLOGIES IN CARDIOLOGY: A  
SYSTEMATIC REVIEW AND ANALYSIS OF MODERN RESEARCH**

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**Abstract.** Cardiovascular diseases are the leading cause of mortality worldwide. Recent advances in computer technologies including artificial intelligence machine learning telemedicine and digital visualization have significantly expanded the possibilities for diagnosing monitoring and treating cardiology patients. The purpose of this study is to conduct a systematic review of modern research devoted to the use of the latest computer technologies in cardiology and to evaluate their effectiveness in clinical practice.

**Introduction.** According to the World Health Organization more than 18 million people die every year from cardiovascular diseases which accounts for about 32 percent of all deaths worldwide. The main forms of cardiovascular diseases include ischemic heart disease arterial hypertension heart rhythm disorders heart failure and stroke.

Early diagnosis and timely treatment of these conditions play a key role in reducing mortality and disability. In recent years the rapid development of computer technologies has made it possible to introduce innovative diagnostic and treatment methods based on digital platforms artificial intelligence and telemedicine solutions into clinical practice.

**Etiology and Pathogenesis of Cardiovascular Diseases.** The main risk factors for the development of cardiovascular diseases include arterial hypertension dyslipidemia diabetes mellitus obesity smoking physical inactivity and chronic stress.

Under the influence of these factors damage to the vascular endothelium occurs which leads to the formation of atherosclerotic plaques impaired microcirculation and the development of myocardial ischemia. These pathological processes lead to structural and functional changes in the heart and blood vessels.

**Main Directions of the Use of Computer Technologies in Cardiology.**

**1. Artificial Intelligence and Machine Learning**

Artificial intelligence algorithms are used to analyze electrocardiograms echocardiography computed tomography and magnetic resonance imaging of the heart.

Artificial intelligence makes it possible to detect hidden forms of arrhythmias predict the risk of myocardial infarction diagnose heart failure at early stages and automatically interpret large volumes of medical data.

The diagnostic accuracy achieved with the use of artificial intelligence reaches 90 to 98 percent which is comparable to the level of highly qualified specialists.

**2. Telemedicine and Remote Monitoring**

Telemedicine technologies provide the opportunity for remote monitoring of patients with chronic cardiovascular diseases.

With the help of wearable devices such as smart watches fitness bracelets and portable ECG recorders it is possible to monitor heart rate control blood pressure detect rhythm disturbances and assess the physical activity of the patient.

This makes it possible to detect deterioration of the patient's condition in a timely manner and adjust treatment accordingly.

#### 3 Digital Visualization and 3D Modeling

Modern computer programs make it possible to create three dimensional models of the heart and blood vessels which significantly increases the accuracy of diagnosing congenital and acquired heart defects and facilitates the planning of surgical interventions.

#### 4 Robotic and Navigation Systems

Robotic systems are actively used in interventional cardiology allowing coronary procedures to be performed with high precision and minimal risk of complications.

#### **Clinical Significance of Computer Technologies**

The use of digital technologies contributes to increasing diagnostic accuracy reducing medical errors optimizing treatment strategies shortening hospitalization time and improving the prognosis and quality of life of patients.

**Research Methods.** In this study a systematic analysis of scientific literature devoted to the use of modern computer technologies in cardiology was carried out.

Scientific articles published in international databases including PubMed Scopus and Web of Science as well as materials from the World Health Organization were used for analysis.

The inclusion criteria for the review were publications from the last five to ten years studies devoted to the use of artificial intelligence and digital technologies in cardiology as well as clinical studies and systematic reviews.

More than 50 scientific publications were analyzed with particular attention paid to the effectiveness of implementing computer technologies in the diagnosis treatment and monitoring of cardiovascular diseases.

**Results of Modern Research.** The analysis of modern scientific studies showed that the introduction of computer technologies significantly improves the quality of diagnosis and treatment of cardiovascular diseases.

Research results demonstrate that the use of artificial intelligence in ECG analysis increases the diagnostic accuracy of arrhythmias up to 95 to 98 percent the use of telemedicine systems reduces the risk of rehospitalization in patients with heart failure by 20 to 30 percent digital algorithms for analyzing medical images allow pathological changes to be detected at early stages and wearable devices make it possible to monitor the patient's condition around the clock.

In addition machine learning technologies help analyze large volumes of medical data and identify hidden patterns in the development of cardiovascular diseases.

#### **Advantages of Using Computer Technologies.**

Modern digital technologies have a number of advantages in cardiological practice.

High diagnostic accuracy computer algorithms are able to analyze huge amounts of medical information and detect pathological changes with high precision.

Fast data processing the use of digital systems significantly accelerates the processing of research results.

Personalized medicine computer programs allow individual patient characteristics to be taken into account and the most effective treatment to be selected.

Improved patient monitoring wearable devices and mobile applications make it possible to monitor the patient's condition in real time.

### **Limitations and Problems of Technology Implementation.**

Despite significant advantages the introduction of computer technologies in cardiology is associated with several challenges including the high cost of equipment the need for training medical personnel issues related to the protection of medical data and limited access to technologies in developing countries.

In addition artificial intelligence cannot completely replace a physician and is currently used as an auxiliary tool for clinical decision making.

### **Prospects for the Development of Digital Cardiology**

In the future further development of artificial intelligence and digital medicine technologies is expected.

The main directions include the creation of more accurate diagnostic algorithms the development of mobile medical applications the use of Big Data technologies in the analysis of medical information and the use of virtual and augmented reality technologies in medical education and surgical planning.

Personalized medicine is also actively developing in which treatment is selected individually for each patient based on genetic and clinical data.

### **Practical Significance of the Study.**

The results of this review can be used in the educational process of medical universities in the clinical practice of cardiologists in the development of new medical technologies and in programs for the prevention of cardiovascular diseases.

The use of modern computer technologies makes it possible to improve diagnostic efficiency enhance the quality of treatment and reduce mortality from cardiovascular diseases.

**Conclusion.** The latest computer technologies play a key role in the development of modern cardiology.

Their implementation contributes to early diagnosis personalized treatment and effective monitoring of cardiovascular diseases. Further development of artificial intelligence and telemedicine solutions opens new prospects in the prevention and treatment of cardiac pathologies.

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