

BIELECKA, Larysa and BIELECKA, Klaudia. The role of mobile applications and online platforms in the rehabilitation process of patients with coronary heart disease: a literature review. *Journal of Education, Health and Sport*. 2024;71:56179. eISSN 2391-8306. <https://dx.doi.org/10.12775/JEHS.2024.71.56179>  
<https://apcz.umk.pl/JEHS/article/view/56179>

The journal has had 40 points in Minister of Science and Higher Education of Poland parametric evaluation. Annex to the announcement of the Minister of Education and Science of 05.01.2024 No. 32318. Has a Journal's Unique Identifier: 201159. Scientific disciplines assigned: Physical culture sciences (Field of medical and health sciences); Health Sciences (Field of medical and health sciences). Punkty Ministerialne 40 punktów. Załącznik do komunikatu Ministra Nauki i Szkolnictwa Wyższego z dnia 05.01.2024 Lp. 32318. Posiada Unikatowy Identyfikator Czasopisma: 201159. Przypisane dyscypliny naukowe: Nauki o kulturze fizycznej (Dziedzina nauk medycznych i nauk o zdrowiu); Nauki o zdrowiu (Dziedzina nauk medycznych i nauk o zdrowiu). © The Authors 2024; This article is published with open access at Licensee Open Journal Systems of Nicolaus Copernicus University in Torun, Poland  
Open Access. This article is distributed under the terms of the Creative Commons Attribution Noncommercial License which permits any noncommercial use, distribution, and reproduction in any medium, provided the original author (s) and source are credited. This is an open access article licensed under the terms of the Creative Commons Attribution Non commercial license Share alike. (<http://creativecommons.org/licenses/by-nc-sa/4.0/>) which permits unrestricted, non commercial use, distribution and reproduction in any medium, provided the work is properly cited.  
The authors declare that there is no conflict of interests regarding the publication of this paper.  
Received: 13.11.2024. Revised: 20.11.2024. Accepted: 27.11.2024. Published: 27.11.2024.

# The Role of Mobile Applications and Online Platforms in the Rehabilitation Process of Patients with Coronary Heart Disease: A Literature Review

Larysa Bielecka MD1, Klaudia Bielecka MD1

1 John Paul II Hospital, Prądnicka 80, 31-202 Kraków

**Klaudia Bielecka,**

[kl.bielecka@gmail.com](mailto:kl.bielecka@gmail.com)

**Larysa Bielecka,**

[larysa.bielecka@gmail.com](mailto:larysa.bielecka@gmail.com)

**Corresponding author:** Klaudia Bielecka, [kl.bielecka@gmail.com](mailto:kl.bielecka@gmail.com)

## Abstract

### Introduction

Nowadays, diseases of the circulatory system, such as coronary heart disease, are among the leading causes of death worldwide. Cardiac rehabilitation, a complex, interdisciplinary intervention, aims to improve cardiovascular function, enhance quality of life, and reduce mortality risk. In the era of mobile technology development, mobile applications and online platforms supporting cardiac rehabilitation are gaining increasing importance.

### Aim of the study

The aim of this study is to review the literature on the effectiveness of digital tools as support mechanisms in the rehabilitation of patients with coronary heart disease, and to compare their effectiveness with traditional medical care.

## Materials and Methods

A review of randomized clinical trials (RCTs) published in 2024 regarding the use of mobile and online applications in cardiac rehabilitation was conducted. Five studies meeting specific selection criteria were identified.

## Results

Research shows that mobile applications and online platforms effectively support the rehabilitation of patients with coronary artery disease, achieving results comparable to or better than traditional care. Programs such as RehaPlus+ and mHealth improve physical activity, mental resilience, quality of life, and reduce stress and anxiety. Users of applications such as eMOTIVA and MCARE achieve better results in terms of diet, physical activity, and general well-being. These interventions also promote regular communication with the therapist, which supports the individualization of rehabilitation.

## Conclusions

Rehabilitation of patients with coronary heart disease using mobile applications or online platforms is equally effective as, or more effective than, standard medical care.

**Keywords:** Cardiac rehabilitation, Mobile applications, Online platforms

## Introduction

According to the World Health Organization (WHO) report, cardiovascular diseases (CVD), such as coronary heart disease, account for 42.5% of all deaths in Europe, which corresponds to about 10,000 deaths every day. The probability of dying at a young age (30–69 years) due to CVD is higher in Eastern Europe (15.1%) and Central Asia (14.8%) compared to Western Europe (2.9%). In this age group, European men have a 2.5 times higher risk of dying from CVD than women. [1] Cardiac rehabilitation is a complex interdisciplinary intervention aimed at improving psychophysical condition, including the function of the cardiovascular system, and consequently reducing the risk of mortality. [2] It is a multifaceted process, the outcome of which depends on the improvement of heart function and efficiency, achieved through appropriately tailored physical activity and the reduction of risk factors for the progression of atherosclerotic disease, which is facilitated by psychoeducation during the process of habit change and regular medical check-ups. Cardiac rehabilitation is a key tool for preventing secondary CVD and should be initiated immediately after the completion of acute treatment. [3] Clinical indications for starting cardiac rehabilitation are presented in Table 1. [4, 5]

Indications for starting cardiac rehabilitation
Condition after acute coronary syndromes
Condition after myocardial revascularization
Chronic coronary syndrome
Heart failure
Condition after CIED implantation: PM, CRT or ICD
Condition after heart valve repair/replacement
Condition after heart transplant

Condition after implantation of ventricular assist devices Presence of congenital heart disease Peripheral artery diseases Condition after cerebrovascular incidents* In patients with paresis or aphasia, neurorehabilitation is necessary.
Abbreviations: CIED (cardiovascular implantable electronic device); CRT (cardiac resynchronization therapy); ICD (implantable cardioverter defibrillator); PM (pacemaker)

**Table 1.** Indications for starting cardiac rehabilitation

Secondary prevention primarily involves lifestyle modifications based on patient education (including changes in eating habits), regular, individually tailored physical activity, and optimal pharmacotherapy under the supervision of a physician. Cardiac rehabilitation should be carried out in an interdisciplinary manner, tailored to the individual needs of the patient. The team involved in secondary prevention of CVD may include a physician, nurse, physiotherapist, dietitian, and psychologist. It is important that rehabilitation is implemented early and conducted over the long term.

In the era of widespread availability of mobile phones and computers, the potential uses of these devices have expanded. Most smartphones and smartwatches available on the market are equipped with additional functions, such as magnetometers, light intensity sensors, GPS, proximity sensors, and accelerometers. These modern features have enabled the development of applications that monitor physical activity and vital parameters, including blood oxygen saturation and heart rate.

**Aim of the study**

The aim of this study is to review current scientific reports and summarize the state of knowledge regarding the use of mobile applications and internet platforms that support the rehabilitation process in patients with ischemic heart disease. The review examines the effectiveness of psychoeducation through digital interventions compared to standard medical care.

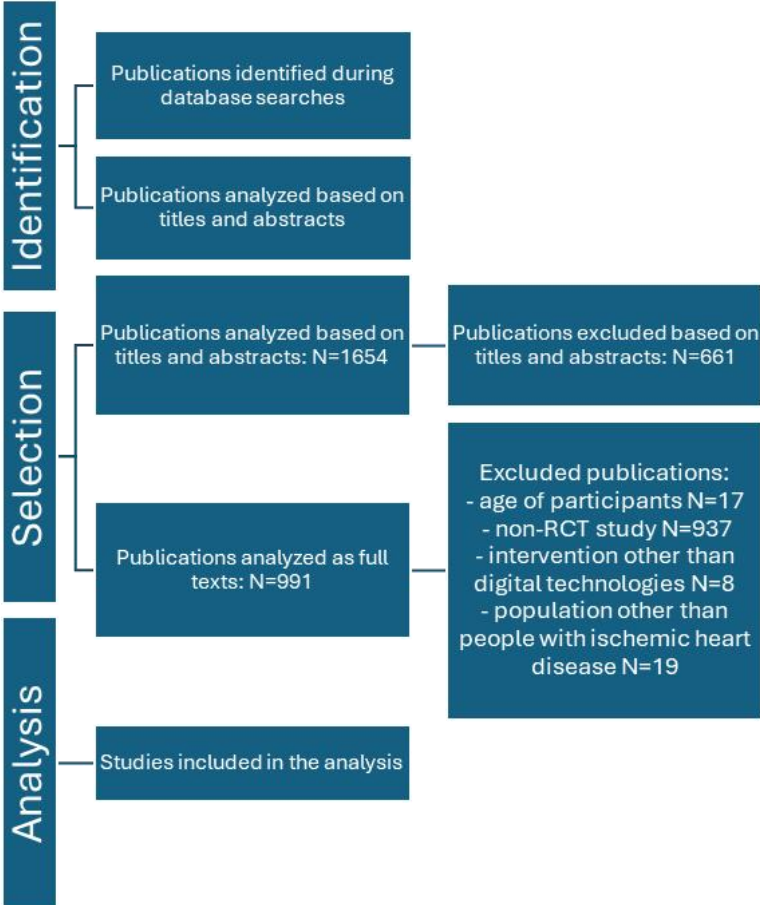
**Review methods**

A review of the available literature was conducted in October 2024 using the PubMed database. Articles were searched using the keywords “cardiac rehabilitation,” and the analysis was limited to publications published in 2024. The search results were restricted to clinical trials conducted in adults. Following the initial selection, 35 randomized controlled trials (RCTs) were identified.

The following inclusion criteria were applied: (1) RCTs, (2) interventions using a mobile application, online platform, or social media aimed at supporting the rehabilitation process, (3) a group of patients with ischemic heart disease, (4) studies published in peer-reviewed journals. The exclusion criteria were: (1) studies other than RCTs, (2) a group of patients with conditions other than ischemic heart disease, (3) participants under 18 years of age.

The following categories were distinguished in the analysis of the studies: type of digital technology used, authors, number of participants, name of the application, purpose of the application, intervention period, control group and obtained results.

**Fig. 1.** Summary of the search and study selection process in the PRISMA framework



**Source:** Author’s own study.

**RESULTS**

The final analysis was performed on 5 works published in 2024. The characteristics of the discussed works in chronological order are presented in Table 2.

First author, month, year of publication	Number of participants, age (average, median)	Duration of the study	Inclusion criteria	Intervention group	Control group
Waranski M, 01.2024 [6]	169, 56, 7,3	24 weeks	Within 6 weeks of a	24-week caregiver-	standard physician-

			cardiac event or intervention, including ST-elevation myocardial infarction, non-ST-elevation myocardial infarction, stent implantation, bypass surgery, or a combination of these procedures, patients were required to declare their willingness to change their health behaviors.	assisted e-health program (RehaPlus+; n=84)	assisted outpatient program (usual care; n=85).
Salarvand S., 02.2024 [7]	56, 73,14 (4,36) vs 73,50 (5,59)	1 week	Patients aged 60 years and older, who were hospitalized due to myocardial infarction, had family caregivers, had access to a smartphone, did not have other serious diseases, had a left	Online support twice a week by a nursing student.	Routine post-hospital care.

				ventricular ejection fraction of at least 35%, and were able to answer the phone and participate in video chats.		
Zou H., 02.2024 [8]	178, 58,7; 8,9	6 weeks	age: 18 to 75 years; clinical diagnosis of coronary heart disease; ability to read, understand, communicate, and complete questionnaires in Chinese; possession of an operational smartphone and an active WeChat account.	the MCARE program consists of six weekly sessions focused on learning about the disease and lifestyle modifications, with participants also engaging in mindfulness exercises.	Routine post-hospital care.	
[9] Cruz-Cobo C., 07.2024	287; 62,53, 8,65	6 weeks	Condition after myocardial infarction, condition after revascularization with stent implantation,	Using the eMOTIVA application, which focuses on educating users about a healthy lifestyle, risk factors for	Standard post-hospitalization care	

			age below 75 years, and possession of a smartphone or tablet with internet access for the duration of the study.	cardiovascular diseases, the importance of adhering to prescribed treatments, and providing recommendations regarding target body weight, diet, blood pressure, blood glucose levels, and smoking.	
Ma L, 09.2024 [10]	76; 61,46; 8,15	24 weeks	Confirmed diagnosis of low-risk coronary artery disease based on the 2019 European Society of Cardiology criteria; time since hospital discharge following a cardiovascular event within one year; age 18 to 75 years; smartphone ownership;	Educational courses and self-assessment tasks on acquired knowledge, performed every two weeks; patient supervision with individualized support and guidance; and direct communication with the researcher in case of	Access to educational materials within the application in the form of text, images, videos, and other multimedia formats, enabling patients to self-educate.

			an active WeChat account; and no cognitive impairment.	difficulties in acquiring knowledge.	
--	--	--	--	--------------------------------------	--

**Table 2.** Analysis of the works included in the study

M. Waranski's team analyzed the effectiveness of the personalized e-health program **RehaPlus+** in promoting regular physical activity to support the rehabilitation process in patients with coronary artery disease, compared with usual care. Participants were assigned to two groups. The **RehaPlus+** app users received motivational messages twice a week for 6 months, while the control group participated in a 6-month outpatient program, which included twenty-four 90-minute strength and endurance training sessions. Outcomes were assessed using questionnaires that evaluated the frequency of physical activity, mental and physical well-being, and work capacity. Data from 105 patients were analyzed (RehaPlus+: n=44, 41.9%; usual care: n=61, 58.1%). After 6 months of follow-up, the RehaPlus+ group was found to be physically active for 182 (SD 208) minutes per week, while the control group was active for 119 (SD 175) minutes per week (P=0.15). The **RehaPlus+** intervention was shown to be non-inferior to standard care.

Another study by S. Salarvand's team analyzed the effect of using the personalized mobile health application **mHealth** in cardiac rehabilitation for elderly patients after myocardial infarction, focusing on their sense of inner strength and mental resilience. Patients were randomly assigned to two groups. The intervention group (n=28) received online mHealth nursing care sessions, while the control group received routine post-hospital care. Support for the experimental group consisted of regular online meetings with the researcher, during which personalized training on health-promoting behaviors was provided, and an open communication channel with the patient was established. After 1 month, all patients underwent the Mini-Mental State Examination (MMSE), a questionnaire on demographic and clinical characteristics, the Inner Strength Scale (ISS), and the Connor-Davidson Resilience Scale (CD-RISC). The study showed no statistically significant difference in the sense of resilience and inner strength in the control group before and after the intervention (P>0.05). In contrast, the intervention group showed a significant increase in both resilience and inner strength (P ≤ 0.001). This suggests that the introduction of the mobile application can have a beneficial effect on the rehabilitation of patients with coronary heart disease.

The aim of the study by H. Zou [8] was to investigate the effect of a social media-based psychobehavioral intervention (MCARE) on psychological stress, health-related quality of life (HRQoL), and cardiovascular risk factors among patients with acute coronary syndrome (ACS). Participants were randomly assigned in a 1:1 ratio to either the intervention or control group. The intervention group received weekly sessions through the WeChat mobile application, which included psychoeducation (focused mainly on the course of the disease and recommendations for patients) and mindfulness exercises, such as breathing exercises and techniques for coping with thoughts and difficulties. The control group received standard



post-hospital care. After analyzing the results, it was noted that the intervention group showed a significantly greater reduction in depression ( $p<0.001$ ) and anxiety ( $p<0.001$ ).

Greater improvements were also observed in psychological stress perception ( $p<0.001$ ), physical HRQoL ( $p=0.03$ ), emotional HRQoL ( $p<0.001$ ), changes in eating behavior ( $p=0.04$ ), and physical activity levels.

Another study was conducted in a group of adults after acute coronary syndrome [9]. The aim was to compare the effectiveness of the eMOTIVA mobile application with usual care, in accordance with cardiac rehabilitation guidelines, in terms of lifestyle, cardiovascular risk factors, and quality of life. Researchers assessed adherence to the Mediterranean diet, level of physical activity, smoking behavior, knowledge of cardiovascular disease risk factors, and satisfaction with and usability of the application. Significant improvements were observed in eMOTIVA users compared to the control group after 6 months of follow-up, specifically in diet adherence ( $p<0.001$ ), selection of appropriate nutritional components, frequency of physical training ( $p=0.04$ ), and knowledge level ( $p<0.001$ ). Satisfaction with the application and its usability were rated highly by users.

L. Ma's team conducted a study aimed at assessing the impact of blended education using an online educational platform among patients undergoing rehabilitation for coronary heart disease. Patients in the control group were given access to the WeChat platform, where educational materials on CHD were provided. In addition to content access, participants in the intervention group received personalized care, took tests to assess their level of knowledge, and had regular contact with researchers. After analyzing the data, it was observed that the intervention group achieved better results in terms of lifestyle changes ( $p<0.05$ ) and reported lower levels of anxiety and poor well-being ( $p<0.05$ ) [10].

## **DISCUSSION**

Coronary heart disease, one of the most common diseases of civilization [11], leads to numerous negative consequences for both the individual (including reduced quality of life) and society at large (including financial losses). In response to the increasing prevalence of this condition [12], various rehabilitation methods have been developed to prevent disease progression and reduce further complications. One such method is rehabilitation, which, by definition, includes a range of activities (therapeutic, psychological, social, or educational) designed to restore physical and mental fitness for the individual [13].

Despite the widespread promotion of rehabilitation in healthcare, the statistics remain pessimistic: in the United States, over 80% of patients do not participate in cardiac rehabilitation programs [14]. Factors contributing to this lack of engagement may include a lack of awareness about the benefits, insufficient motivation, limited understanding of the rehabilitation process, and a lack of adequate support from healthcare providers. As a result, a priority has emerged to develop modern methods that enhance the effectiveness of educational strategies to improve the prognosis and quality of life for patients with coronary heart disease. One such approach is care based on mobile or computer applications, which have become increasingly prevalent in recent years.

The role of mobile devices in patient therapy has been increasingly recognized, primarily due to their easy accessibility and the possibility of direct communication [15].

Modern smartphones are equipped with functions such as sensors, position sensors, microphones, and cameras, which enable not only direct contact with medical personnel but also the monitoring of vital parameters. A significant advantage of these devices is their widespread availability among the populations of developed countries.

Among all the studies reviewed, online educational interventions achieved comparable or even better results compared to standard care. In the publications examined, online educational platforms proved to be valuable tools for providing patients with information on therapy, lifestyle changes, and behavioral strategies. The individualized approach facilitated by direct contact with therapists allowed for the resolution of unexpected difficulties that may not have been anticipated initially. This form of communication also offers treating physicians valuable insights into the challenges patients may be facing.

It is also worth noting that expanding care with online communication as a form of support and monitoring can reduce financial costs by decreasing the frequency of in-person doctor visits. Although the studies presented in this review focus on a specific area of healthcare, the results suggest that the effectiveness of digital technologies, such as mobile applications or online platforms, may extend far beyond this scope. Currently, the availability of analyses on the effectiveness of such digital therapeutic tools remains relatively limited.

The conclusions drawn from our review align with the recommendations of the World Health Organization (WHO), which advocates for the use of digital technologies to complement and enhance healthcare activities by facilitating the exchange of information, monitoring the treatment process, and improving cooperation between doctors and patients, thus increasing access to medical personnel [16].

In the era of widespread digitalization, user safety, including the protection of personal data, is a particularly important concern. Systems to protect against cybercrime must be introduced, and ensuring a high level of protection requires significant financial investment, which presents a greater challenge to the healthcare system. Despite the advancements in digitalization and information and communication technology (ICT), there remains a risk of errors in data recording, underscoring the need for legal regulations regarding liability in such cases [17].

## **Conclusions**

Coronary heart disease is one of the leading causes of death in Poland and Europe. Epidemiological studies indicate that its occurrence is influenced by both modifiable and non-modifiable risk factors [18]. Educational activities and patient monitoring are crucial for eliminating existing risk factors, which is essential in halting disease progression. Implementing psychoeducation through teleinformatics in the rehabilitation process enhances patients' knowledge, thereby improving treatment effectiveness. Medical care for patients with coronary heart disease is a complex process that should extend beyond hospital discharge. The use of mobile applications and online platforms has been shown to increase the effectiveness of patient rehabilitation compared to standard medical care.

## **Disclosure**

### **Authors contribution**

Conceptualization, methodology: Klaudia Bielecka

Validation: Klaudia Bielecka, Larysa Bielecka

Investigation: Klaudia Bielecka, Larysa Bielecka

Writing: Klaudia Bielecka, Larysa Bielecka

Original Draft Preparation: Larysa Bielecka

*All authors have read and agreed with the published version of the manuscript.*

## **Funding**

This research received no external funding.

## **Institutional Review Board Statement**

Not applicable.

## **Informed Consent Statement**

Not applicable.

## **Data Availability Statement**

Not applicable.

## **Conflicts of Interest**

The authors declare no conflict of interest

## **References**

- [1] World Health Organization. Regional Office for Europe. (2024). Action on salt and hypertension: reducing cardiovascular disease burden in the WHO European Region. World Health Organization. Regional Office for Europe. <https://iris.who.int/handle/10665/376580>. [dostęp 25.10.2024]
- [2] Jegier A, Szalewska D, Mawlichanów A, et al. Comprehensive cardiac rehabilitation as the keystone in the secondary prevention of cardiovascular disease. *Kardiol Pol* 2021; 79(7–8): 901–916, doi: 10.33963/KP.a2021.0066.
- [3] Pelliccia A, Sharma S, Gati S, et al. ESC Scientific Document Group. 2020 ESC Guidelines on sports cardiology and exercise in patients with cardiovascular disease. *Eur Heart J*. 2021; 42(1): 17–96, doi: 10.1093/eu-rheartj/ehaa605.
- [4] Cowie A, Buckley J, Doherty P, et al. British Association for Cardiovascular Prevention and Rehabilitation (BACPR). Standards and core components for cardiovascular disease

prevention and rehabilitation. *Heart*. 2019; 105(7): 510–515, doi: 10.1136/heartjnl-2018-314206.

[5] Ambrosetti M, Abreu A, Corrà U, et al. Secondary prevention through comprehensive cardiovascular rehabilitation: from knowledge to implementation. 2020 update. A position paper from the Secondary Prevention and Rehabilitation Section of the European Association of Preventive Cardiology. *Eur J Prev Cardiol*. 2020, doi: 10.1177/2047487320913379.

[6] Waranski M, Garbsch R, Kotewitsch M, et al. A Behavioral Change–Based Mobile Intervention for Promoting Regular Physical Activity in Medical Rehabilitation Maintenance of Patients With Coronary Artery Disease: Controlled Trial, *J Med Internet Res* 2024; 26, doi: 10.2196/56480.

[7] Salarvand S, Farzanpour F, Gharaei HA. The effect of personalized mobile health (mHealth) in cardiac rehabilitation for discharged elderly patients after acute myocardial infarction on their inner strength and resilience. *BMC Cardiovasc Disord*. 2024 Feb 19; 24: 116. doi: 10.1186/s12872-024-03791-5.

[8] Zou H, Chair SY, Feng B, et al. A Social Media-Based Mindfulness Psycho-Behavioral Intervention (MCARE) for Patients With Acute Coronary Syndrome: Randomized Controlled Trial. *J Med Internet Res*. 2024 Feb 20; 26. doi: 10.2196/48557.

[9] Cruz-Cobo C, Bernal-Jiménez MÁ, Calle G, Gheorghe LL, et al. Efficacy of a Mobile Health App (eMOTIVA) Regarding Compliance With Cardiac Rehabilitation Guidelines in Patients With Coronary Artery Disease: Randomized Controlled Clinical Trial. *JMIR Mhealth Uhealth*. 2024 Jul 25; 12. doi: 10.2196/55421.

[10] Ma LC, Liu J, Jiao CL, et al. Exploring the effects of an online learning platform in stage III cardiac rehabilitation for individuals with coronary heart disease: Randomized controlled study. *Medicine (Baltimore)*. 2024 Sep 13; 103. doi: 10.1097/MD.00000000000039497.

[11] Nichols M., Townsend N., Scarborough P., et al. Cardiovascular disease in Europe 2014: epidemiological update. *Eur. Heart J*. 2014; 35: 2950–2959.

[12] GBD 2021 Causes of Death Collaborators. Global burden of 288 causes of death and life expectancy decomposition in 204 countries and territories and 811 subnational locations, 1990-2021: a systematic analysis for the Global Burden of Disease Study 2021. *Lancet*. 2024 May 18; 403: 2100-2132. doi: 10.1016/S0140-6736(24)00367-2

[13] Fundacja Avalon [https://www.fundacjaavalon.pl/abc/rehabilitacja\\_poradnik/](https://www.fundacjaavalon.pl/abc/rehabilitacja_poradnik/) [dostęp 25.10.2024]

[14] Balady GJ, Ades PA, Bittner VA, et al; American Heart Association Science Advisory and Coordinating Committee. Referral, enrollment, and delivery of cardiac rehabilitation/secondary prevention programs at clinical centers and beyond: a presidential advisory from the American Heart Association. *Circulation*. 2011 Dec 20; 124: 2951-2960. doi: 10.1161/CIR.0b013e31823b21e2.

[15] Kozak J., Goral A., Daniol M., *Acta Bio-Optica et Informatica Medica Inżynieria Biomedyczna*, 24, 2, 2018.

[16] Wytyczne WHO *Zalecenia dotyczące interwencji cyfrowych na rzecz wzmocnienia systemu opieki zdrowotnej*, Genewa: Światowa Organizacja Zdrowia; 2019. <https://www.ncbi.nlm.nih.gov/books/NBK541902/> [dostęp 25.10.2024]

[17] Oficjalna strona internetowa systemów informatycznych postDICOM, <https://www.postdicom.com/pl/blog/pros-and-cons-of-electronic-health-records> [dostęp 22.10.2024]

[18] Berry J.D., Dyer A., Cai X. Et al. Lifetime risk of cardiovascular disease. *N. Engl. J. Med.* 2012; 266: 321–329.