



# Improvement in patient and medical staff safety by using telemedicine capabilities in cardiology

Poprawa bezpieczeństwa pacjentów i personelu medycznego poprzez wykorzystanie możliwości telemedycyny w kardiologii

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## Abstract

**Introduction and Objective.** Cardiovascular diseases are the leading cause of death in Poland and worldwide. Medical services together with telemedicine provide complex health care for patients with cardiovascular diseases. The aim of this study is to analyze the use of telemedicine options for reimbursed cardiac services between 2018–2021.

**Materials and method.** From the database of the National Health Fund (the sole public payer of health services), teleconsultations between primary care physicians (PCPs), specialists, stationary consultations of primary care physicians with a cardiologist, and hybrid cardiac telerehabilitation were identified. Analysis was based on the number, age and gender of patients, as well as provincial health centres.

**Results.** The largest number of teleconsultations of primary care physicians were with cardiologists, accounting for 25% of telemedicine consultations, 96% of which involved patients living in an area with 5–10 000 healthcare beneficiaries. Only 21% of all consultations between the primary care physicians and the cardiologists were stationary consultations. Hybrid cardiac telerehabilitation involved patients from 13 provincial centres (VCs), with the highest number of services recorded in the 60–64 age group.

**Conclusions.** Telemedicine services are the main means of consultation between specialists and primary care physicians. An increasing trend in the use of hybrid cardiac telerehabilitation was found.

## Key words

telemedicine, primary health, teleconsultation, telecardiology, cardiovascular disease

## Streszczenie

**Wprowadzenie i cel pracy.** Choroby sercowo-naczyniowe są główną przyczyną zgonów w Polsce i na świecie. Świadczenia medyczne wraz z telemedycznymi zapewniają kompleksową opiekę zdrowotną pacjentom ze schorzeniami układu sercowo-naczyniowego. Celem pracy jest analiza wykorzystania możliwości telemedycznych w zakresie refundowanych świadczeń kardiologicznych w latach 2018–2021.

**Materiał i metody.** Z bazy danych otrzymanej z Narodowego Funduszu Zdrowia (jedynego płatnika publicznego świadczeń zdrowotnych) wyodrębniono telekonsultacje pomiędzy lekarzami podstawowej opieki zdrowotnej (POZ) a lekarzami specjalistami, stacjonarne konsultacje lekarza POZ-u z kardiologiem oraz kardiologiczną telerehabilitację hybrydową. Analizy dokonano na podstawie liczby, wieku oraz płci pacjenta, a także ośrodków wojewódzkich.

**Wyniki.** Największą liczbę telekonsultacji lekarza POZ-u odnotowano z kardiologiem, co stanowiło 25% konsultacji telemedycznych, z czego 96% dotyczyło pacjentów zamieszkujących obszar obejmujący opieką 5–10 tys. świadczeniobiorców. Jedynie 21% wszystkich konsultacji lekarz POZ-u-kardiolog stanowiły konsultacje przeprowadzane w warunkach stacjonarnych. Kardiologiczna telerehabilitacja hybrydowa dotyczyła pacjentów z 13 ośrodków wojewódzkich, a największą liczbę świadczeń odnotowano w grupie wiekowej 60–64 lat.

**Wnioski.** Świadczenie telemedyczne są głównym sposobem konsultacji pomiędzy lekarzami specjalistami a lekarzami POZ-u. Stwierdzono tendencję wzrostową w korzystaniu z kardiologicznej telerehabilitacji hybrydowej.

## Słowa kluczowe

telemedycyna, podstawowa opieka zdrowotna, telekonsultacja, telekardiologia, choroby układu sercowo-naczyniowego

## INTRODUCTION

Telemedicine is defined as the remote provision of health services. It focuses on the provision of clinical services, as opposed to telehealth involving non-clinical services (including, tele-education). The advantages of the implementation of telemedicine services have been

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particularly noticeable in rural areas, where such solutions have minimized difficulties and disparities in the access to healthcare services [1]. It has been stated that by integrating information technology into health care, the quality of care will be significantly improved [2]. To provide complex medical care to the patient, telemedicine solutions have found their applications in all medical fields.

According to the World Health Organization (WHO), an average of 17.9 million people worldwide die each year from cardiovascular diseases (CVD), with as many as 85% of deaths resulting from myocardial infarction and stroke. Significantly, more than 75% of all deaths occurred in low- or middle-income countries [3]. In developing countries, CVD accounted for twice as many deaths as HIV, tuberculosis and malaria together [4,5]. According to the Central Statistical Office (CSO), cardiovascular disease was the leading cause of death in Poland [6]. By providing complex medical health care based on prevention and monitoring of cardiovascular diseases, the number of deaths can be reduced.

Telemedicine solutions can be divided according to how they are financed. Telemedicine services can be financed by the National Health Fund (NFZ), the sole public payer of health services. In this manner, cardiac teleconsultation and hybrid cardiac telerehabilitation are reimbursed in Poland [7,8]. Patients also have the opportunity to take advantage of non-reimbursed telemedicine solutions (financed from non-public sources) offering telecare, tele-education, teleconsultation or telemonitoring of implantable devices [9,10].

Cardiology teleconsultations were introduced for people with cardiac conditions living in areas with difficult access to specialist centres. The teleconsultation takes place between the specialist and the PCP, who is supported in the management of the patient without having to visit a distant centre in person [7].

Cardiac rehabilitation or hybrid cardiac telerehabilitation is the care and support of a patient's recovery from a cardiovascular event. The first stage of complex cardiac rehabilitation begins during the patient's hospitalisation and continues until the acute phase of the disease is over. Depending on the patient's criteria and consent, the second stage of rehabilitation can be provided either in a ward or specialist centre, or in a home setting. The final stage of rehabilitation, independently of the second stage, is carried out in a hospital setting and includes the patient's education on health monitoring [8,11].

Hybrid cardiac telerehabilitation is a service during which the second stage of rehabilitation takes place at home, and is supervised remotely through the use of advanced medical and telecommunication technologies [12,13].

In Poland, a number of telemedicine solutions are offered to both healthcare providers and beneficiaries. The 2021 report 'Top Disruptors in Healthcare' provides an overview of innovative medical startups in Poland. The most common area of activity for all the featured startups was cardiology which accounted for 24% of those surveyed. For startups being developed using artificial intelligence, cardiology accounted for 31% of those surveyed [14].

**OBJECTIVE**

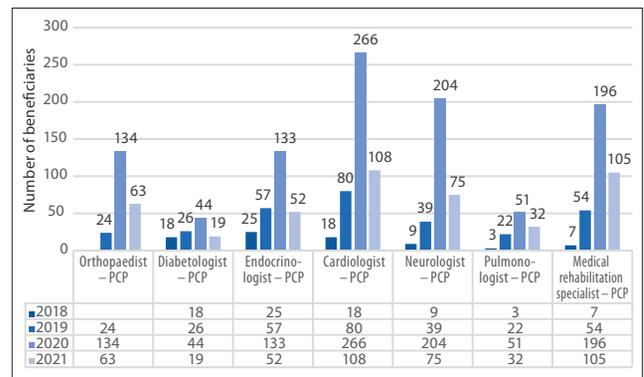
The aim of this study is to analyze the use of telemedicine options for reimbursed cardiology services between 2018–2021.

**MATERIALS AND METHOD**

Based on information from the database of the National Health Fund which contains a summary of health services, teleconsultations between PCPs and medical specialists, stationary (at a medical facility) consultations between PCPs and cardiologists, and hybrid cardiac telerehabilitation, were distinguished. Aanalysis was performed on an Excel spreadsheet, based on the number of services between 2018–2021, taking into account the age and gender of the patient, as well as the provincial centre (VC) to which the beneficiaries belong. The division into age groups was made in accordance with the Central Statistical Office's public statistics. In compliance with sensitive data protection requirements, beneficiary data were aggregated and not analyzed individually,.

**RESULTS**

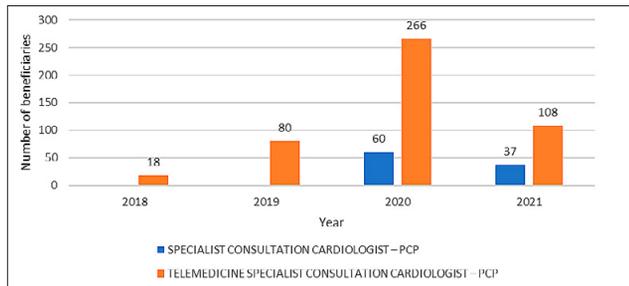
Figure 1 shows a comparative summary of teleconsultations between specialists and PCPs. The highest number of teleconsultations was recorded between cardiologists and PCPs, accounting for 25% of all specialist teleconsultations; as many as 96% of teleconsultations between cardiologists and PCPs concerned patients residing in urban, rural or rural-urban areas with 5,000–10,000 care beneficiaries. Four percent of teleconsultations were in connection with patients living in areas with 10,000–20,000 healthcare beneficiaries. In areas with up to 5,000 healthcare beneficiaries, the teleconsultation took place once.



**Figure 1.** Number of teleconsultations between medical specialists and PCPs, 2018–2021

The highest number of telemedicine specialist consultations for all consultations between PCPs and medical specialists was recorded in 2020. There was a marked increase in the number of teleconsultations in 2020 compared to the previous year, and a decrease in this number compared to 2021 (Fig.1). In the case of teleconsultations between cardiologists and PCPs, there was a more than threefold increase in the number of teleconsultations in 2020, compared to 2019.

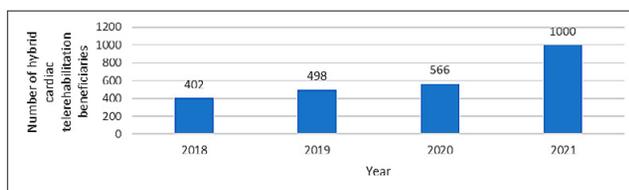
Figure 2 compares the number of consultations and specialist teleconsultations between cardiologists and PCPs. Services performed in a stationary setting were not recorded in the period 2018–2019. Stationary specialist consultations account for less than 26% of stationary and telemedicine consultations performed in the period 2020–2021, and 21% including the period 2018–2021.



**Figure 2.** Comparison of the number of telemedicine specialist consultations between cardiologists and PCPs and those carried out in a stationary setting

The highest number of both telemedical and stationary consultations between all specialists and PCPs concerned patients residing in the Kujavian-Pomeranian province. Stationary consultations with a cardiologist were recorded in the case of patients from only two VCs – Kujavian-Pomeranian (97.9%) and Pomeranian (2.1%). Telemedicine consultations concerned patients of 9 VCs – Lower Silesia (0.8%), Kujavia-Pomerania (54.7%), Lublin (0.2%), Łódź (0.2%), Lesser Poland (1.7%), Mazovia (35.8%), Podlasia (2.5%), Pomerania (0.2%) and Silesia (0.4%).

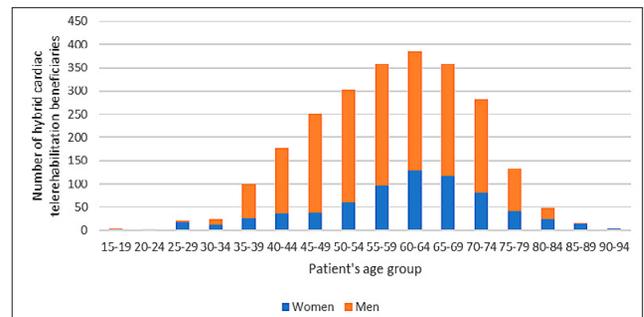
Under the Comprehensive Care after Myocardial Infarction and under the ‘cardiac rehabilitation or cardiac telerehabilitation hybrid’ benefit, patients have the opportunity to benefit from cardiac telerehabilitation. Figure 3 shows the number of beneficiaries of both cardiac telerehabilitation hybrid services between 2018–2021.



**Figure 3.** Number of beneficiaries of hybrid cardiac telerehabilitation, 2018–2021

Thirteen of the 16 NFZ VCs recorded the provision of hybrid cardiac telerehabilitation in 2018–2021. As many as 44.4% of all beneficiaries were residents of the Mazovian province. The remaining 55.6% were recorded in the following provinces: Lesser Poland (15.7%), Pomerania (7.6%), Lublin (5.6%), Łódź (5.3%), Kujavia-Pomerania (5%), Silesia (4.6%), Greater Poland (4.5%), Lower Silesia (3.2%), Subcarpathia (3%), Holy Cross (0.9%), Warmia-Mazuria (0.1%) and Western Pomerania (0.1%). Men accounted for 72% of all beneficiaries. The breakdown by age group and patient gender is shown in Figure 4.

The age group 60–64 years was found to have the highest number of patients overall. Also in the case of women, the largest number of beneficiaries were in the 60–64 age group. In contrast, the largest number of male beneficiaries of the telerehabilitation services between 2018–2021 were aged



**Figure 4.** Number of hybrid cardiac telerehabilitation patients by the age criterion, 2018–2021

55–59. For men, the standard deviation value for the age groups included in the 50–69 age range was 10.5, indicating little difference in values (Fig. 4).

## DISCUSSION

Telemedicine services certainly allow for faster consultations, which is associated with quicker diagnosis and less morbidity due to timely prevention [15–18]. The lack of need for transport reduces the costs associated with health care. In the case of telerehabilitation, they allow avoidance of exposure to pathogens, and to increase the number of available places in day centres/wards for stationary rehabilitation. Communication problems and interference with the communication system are barriers to telemedicine services [19]. A limitation to the use of telemedicine services is the need for the informed consent of the beneficiary, and knowledge of the tools necessary to use the telemedicine service [20].

In the case of teleconsultation, the highest number of services was recorded between the PCP and the cardiologist (Fig. 1). This result can be linked to the fact that the most common cause of death is cardiovascular disease [6]. Furthermore, in 2018, patients were hospitalized most frequently due to cardiovascular diseases [21]. In 2019, among the group of patients over 18 years of age, cardiovascular disease was the most common new diagnosis [16]. The apparent increase in teleconsultations in 2020, but also in consultations, may be due precisely to the treatment of patients diagnosed with cardiovascular disease in the previous year, and as a result of increased prevention (Fig. 2). It should be noted that the possibility of cardiologist teleconsultation was introduced in 2015, when the intensity of cardiovascular mortality had been gradually decreasing since 2015 [21,22].

The increasing number of hybrid cardiac telerehabilitation services may be the result of gradual adaptation to this type of telemedicine solution (Fig. 3). Preparatory activities for rehabilitation in the patient’s home setting include education on how to observe his/her health, and how to use specialized equipment. The patient’s family also receives appropriate guidance and is trained in first aid. If a facility does not have adequate facilities to implement adequate preparation (during stage 1) for telerehabilitation at home (stage 2) – it cannot offer a hybrid cardiac telerehabilitation service [15,16,23–26].

The differences in the highest patient rates by age group and gender (Fig. 4) may be due to mortality at different ages in men and women. Most men die from cardiovascular

disease at ages 45–54 and over 70 years, while women die at ages over 74 years. Men are also 2.5 times more burdened by premature mortality than women. Cardiovascular diseases are reported to be the main cause of premature mortality among men [21].

## CONCLUSIONS

Telemedicine services are the main means of consultation between specialists and PCPs. The benefit for all beneficiaries in terms of saving time spent travelling to the specialist centre is confirmed by the number of teleconsultation beneficiaries living in areas with up to 10,000 healthcare beneficiaries.

The results show an upward trend in the use of hybrid cardiac rehabilitation. Cardiac hybrid telerehabilitation provides comprehensive care for patients and, through education within the benefit, patients and their families gain knowledge about health monitoring, symptom recognition, and have the opportunity to learn about telemedicine tools that they can use for subsequent telemedicine services.

## Disclosure

The authors declare no conflict of interest

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