

Research article

# Assessment of on-site and remote cardiac rehabilitation in Romania

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**Abstract: Introduction:** It is well known that cardiovascular diseases are the leading cause of death worldwide. In Romania in 2015, cardiovascular diseases led to 153.953 deaths, representing 59.3% of deaths from all causes. Most people in Romania today have an unhealthy lifestyle, characterised mainly by a poor nutritious diet, low physical activity and a lack of medical screening.

**Purpose:** Considering these deficits of secondary prevention in the treatment line of the Romanian cardiovascular patient, we aimed through this study to assess the current access of the Romanian population to on-site and remote cardiac rehabilitation programs as well as their opinion regarding the telemedicine for future cardiovascular care modelling.

**Methods:** It was a prospective observational study, which was carried out by means of an online questionnaire composed of 26 items. It was dispersed in the online environment, including Social Media platforms, where it was active for ten weeks.

**Results:** Our online evaluation questionnaire had 1115 participants, with a minimum age of 18 years old, a preponderance of female sex and a predominantly urban background. The study participants were from all educational levels, from low to superior. We observed that most participants have an internet connection at home and use at least one form of technology daily, but most have never used a telemedicine service.

**Conclusions:** In conclusion, the access of cardiovascular patients to on-site cardiac rehabilitation services is extremely low and for remote ones, it is almost non-existent. For a middle-income country like Romania with such a high incidence of cardiovascular disease, it is almost mandatory to provide publicly funded cardiac telerehabilitation services also for the future.

## 1. Introduction

It is well known that cardiovascular diseases (CVDs) are the leading cause of death worldwide. In Europe, a rather crucial epidemiological difference emerges between Western and Eastern Europe, with the latter having a much higher incidence of CVD, a younger age at onset and a more severe complication rate (1) (2).

In the European Union in 2017, CVDs were responsible for 1.8 million deaths, representing 37% of all deaths. The same data support increased mortality associated with ischemic heart disease and stroke in Central and Eastern Europe, in contrast to Northern, Southern and Western areas. In Romania in 2015, cardiovascular diseases led to 153.953 deaths, representing 59.3% of deaths from all causes. The variability according to sex in deaths from cardiovascular causes is higher among Romanian men than women, with 1103.0 male deaths versus 841.3 female deaths per 100.000 inhabitants. Unfortunately, in terms of incidence, associated complications and mortality due to cardiovascular diseases, Romania presents some of the worst indicators among all European Union countries (1) (3) (4).

According to the Romanian Institute of Statistics, the most frequently associated cardiovascular risk factors with CVDs are represented by arterial hypertension (31.8%), dyslipidemia (14.4%), smoking (16.3%), obesity (13.9%), unhealthy eating habits (7.1%) and sedentariness (6.6%) (5).

After the fall of communism, Romania presented an accelerated but uneven development, a situation that led to significant discrepancies between the medical, educational and socio-economic spheres. Thus, today we have a population with a higher standard of living from a socio-economic point of view. Still, we need adequate medical education and equal access to medical services. Most people in Romania today have an unhealthy lifestyle, characterised mainly by a poor nutritious diet, low physical activity and a lack of medical screening. Furthermore, the incidence of an alarming increase in childhood obesity will lead in the next 20 years to an explosion of CVDs, in the absence of primary prevention programs (3) (6) (7).

Regarding the secondary prevention of cardiovascular diseases, a considerable gap has also emerged between pharmacological development and non-pharmacological opportunities for patients. While we have aligned ourselves with the European standards regarding surgical, minimally invasive and pharmacological therapy of cardiovascular pathologies, there still needs to be more funding for the follow-up of these patients post-discharge. One of the essential points of the secondary prevention of these patients is represented by the lack of cardiac rehabilitation programs. First and foremost, this significant deficit will have a massive impact in the coming years due to the lack of funds by the Romanian National Health Insurance House, whose budget is only 4.8% of the gross domestic product. Out of this budget, the management of cardiovascular diseases receives only 4.5%, a sum which is 14 times less than that for oncological disease and eight times less than for dialysis. Furthermore, the public Romanian healthcare system is underfinanced but still pressured to provide a quality of services similar to those in the private sector (6) (8) (9) (10).

A cost-effective way to implement cardiac rehabilitation services on a large scale would be remote cardiac rehabilitation. The technology to perform telecardiac rehabilitation is within reach, allows the enrollment of many patients, does not present time-space limitations, is very convenient for patients and requires minimal medical human resources. In addition, according to studies, if done right, it is at least as effective as classic cardiac rehabilitation. The main disadvantage would be that high cardiovascular-risk patients could not be enrolled. However, enrollment of intermediate and low-risk patients would lead to a significant decrease in associated cardiovascular risk factors and cardiovascular morbidity and mortality over the next ten years (11) (12) (13) (14) (15).

Currently, Romania faces the absence of a registry and a national center dedicated to cardiovascular rehabilitation. The cardiovascular rehabilitation programs, crucial in managing such conditions, are predominantly concentrated in the university centers of Bucharest, Constanta, Covasna, and Iasi. A significant issue requiring attention and appropriate medical intervention is the lack of a nationwide cardiovascular rehabilitation program. It is imperative to develop and implement effective strategies at the governmental level to establish a formal and systematic framework for cardiovascular rehabilitation, ensuring equitable access to rehabilitation services for patients regardless of their geographical location. This initiative would significantly contribute to improving the quality of life for patients and reducing the incidence of complications associated with cardiovascular conditions.

Considering these deficits of secondary prevention in the treatment line of the Romanian cardiovascular patient, we aimed through this study to assess the current access of the Romanian population to on-site and remote cardiac rehabilitation programs as well as their opinion regarding the telemedicine for future cardiovascular care modelling.

## **1. Materials and Methods**

### **1.1. Study Design and Objectives**

This study aimed to evaluate on-site cardiac rehabilitation and telemedicine services in Romania. It was a prospective observational study, which was carried out by means of an online questionnaire composed of 26 items. We opted for a prospective observational study in order to obtain an accurately control data collection with increased specificity and fewer potential sources of bias. Moreover, choosing this study design will positively impact the obtained results by the lack of research interference in the part of data collection and manipulation. The medical team conducting the medical research and processing data is part of "Carol Davila" University of Medicine and Pharmacy in Bucharest, Romania.

### **1.2. Structure of the survey questionnaire**

The medical team of the "Carol Davila" University of Medicine and Pharmacy structured the questionnaire through the Google Forms platform. It was dispersed in the online environment, including Social Media platforms, where it was active for ten weeks between 13 March-22 May 2023.

The 26 items that formed the survey led to obtaining social, demographic and medical information, to evaluating the level of technology used at home, knowledge related to cardiac rehabilitation programs and the interaction with telecare services. Impediments associated with the impossibility of participating in classic cardiac recovery programs were also evaluated.

The questions are structured to obtain comprehensive data for the present study, which will be conducted solely with the patient's voluntary participation. Variables to be recorded include age, gender, urban or rural residence, living arrangements (whether the patient resides alone), current educational attainment, and the availability of internet access. The latter is pertinent for determining the patient's ability to engage in a medical consultation using a camera-equipped computer or solely through telephonic communication.

Additionally, data will be collected concerning the patient's medical history pertaining to cardiovascular pathology, awareness of the condition (whether it is pre-existing or recently diagnosed). Of paramount importance is the inquiry into whether the patient has been recommended to undergo cardiovascular rehabilitation upon discharge and whether they are aware of the nearest medical facility providing such rehabilitation services.

The study aims to solicit patients' perspectives on the perceived benefits of cardiovascular rehabilitation and their inclination towards pursuing such rehabilitation. Given the significant financial implications, the investigation seeks to ascertain patients' opinions regarding the party deemed responsible for covering the costs associated with these procedures.

The structure of the questionnaire can be found in detail in Table 1.

**Table 1. Questionnaire structure**

Number	Question
1	Do you agree to participate in this study?
2	I have read the personal data processing policy and agree to its processing.
3	What is your age range?
4	Please specify your gender.
5	What is your environment of origin?
6	Please specify your city/town of residence.
7	Who do you live with?
8	What is the last form of education completed?
9	Do you have internet access at home?
10	What types of technology do you typically use (daily/weekly)?
11	Have you ever performed a medical consult using telemedicine (by phone, message, or Internet)?
12	If you performed a medical consult using telemedicine, how would you characterise its quality?
13	Do you have a history of diagnosed cardiovascular disease?
14	What history of cardiovascular disease do you have?
15	Did you know that after being diagnosed with one of the diseases mentioned above, it is recommended to perform cardiac rehabilitation to reduce your need for hospitalisations and cardiovascular mortality risk?
16	Select which of the following are components of a cardiac rehabilitation program.
17	Have you received a recommendation for a cardiac rehabilitation program upon discharge from a cardiology or cardiovascular surgery department?
18	If you answered yes to the previous question, state whether you were referred to a specialised unit for enrollment in a cardiac rehabilitation program:
19	What is the nearest cardiac rehabilitation centre to your home?
20	What was the waiting period before starting the cardiac rehabilitation program?
21	Why have you not been able to enrol in a cardiac rehabilitation program?
22	How long was the duration of the cardiac rehabilitation program?
23	What are the reasons that led you to abandon the cardiac rehabilitation program?
24	Do you consider a cardiac rehabilitation program beneficial for your medical status?
25	Would telemedicine services using wearable devices to monitor heart rate, blood pressure, weight, etc. support you in performing cardiac rehabilitation at home (telerehabilitation)?
26	For the use of such digital cardiac telerehabilitation services, I would like the costs to be covered by one of the following:

The questionnaire's answers were of the predefined YES/NO type or of the multiple choice type and only 1 question was open-ended to ensure the uniformity of the data collection.

### 1.3. Ethical Considerations

Data collection was performed anonymously and complied with the European Union General Data Protection Regulation (GDPR) provisions. Thus, no response collected through our questionnaire represents information about an identifiable living person.

#### 1.4. Statistical analysis

The responses from study participants were collected automatically in Google Forms and later transferred to Microsoft Office Excel, thus leading to the creation of the database. The collected variables were real, integer or boolean type and processed in Microsoft Office Excel. Statistical analysis performed using Microsoft Office Excel included the use of count, mean, median, and standard deviation functions. These were later represented either in the form of a table or in the form of a chart in order to have the best representation of the results obtained.

#### 2. Results

In the ten weeks that our research study questionnaire was active in the virtual space, we collected 1193 responses. Out of these, 78 people did not agree with the EU GDPR, being automatically excluded from completing the questionnaire to ensure personal data protection. We thus included a total of 1115 people who answered the questionnaire.

Regarding age, the largest share of responses was represented by people in the 51-60 age category (347 participants) followed by the 41-50 year-old category (282 participants). The fewest answers were given by people over 81 years old (6 replies) (Fig.1.) (Table 2.).

Figure.1. Age distribution of study participants

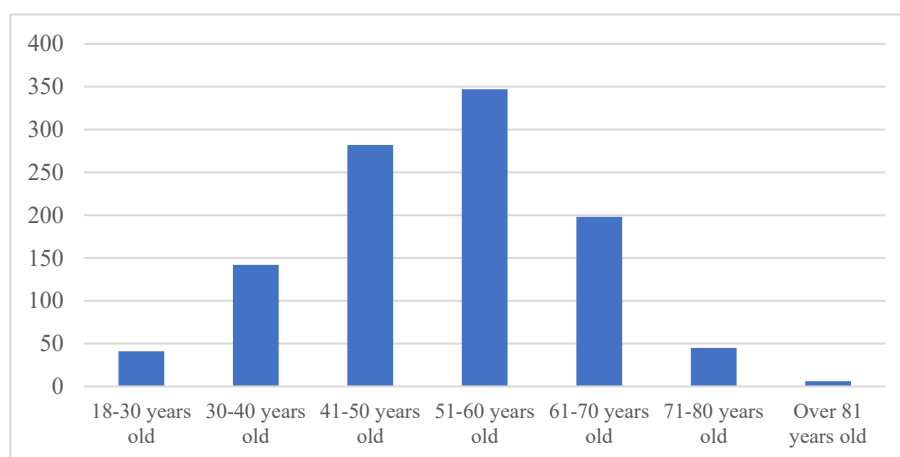


Table 2. The age range of study participants

Age range	Frequency	Percent	Valid percent	Cumulative percent
18 - 30 years	41	3.677	3.677	3.677
31 - 40 years	196	17.578	17.578	21.256
41 - 50 years	282	25.291	25.291	46.547
51 - 60 years	347	31.121	31.121	77.668
61 - 70 years	198	17.758	17.758	95.426
71 - 80 years	45	4.036	4.036	99.462
Over 81 years	6	0.538	0.538	100.000
Missing	0	0.000		
Total	1115	100.000		

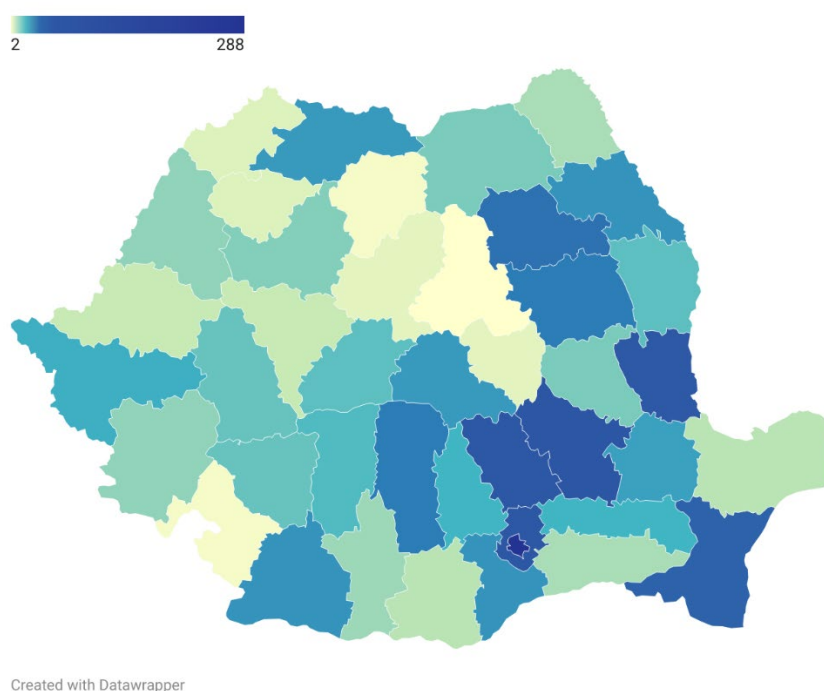
From the point of view of gender distribution, an extremely high share of female versus male participants was observed, with 870 and respectively 245 responses recorded (Table 3.).

Table 3. Gender distribution of study participants

Gender	Frequency	Percent	Valid percent	Cumulative percent
Female	870	78.027	78.027	78.027
Male	245	21.973	21.973	100.000
Total	1115	100.000		

As shown in Figure 2, the study participants were from the entire territory of Romania, creating a uniformity of the collected data, thus eliminating the possible biases associated with higher or lower economic resource areas.

Figure 2. Romanian counties of study participants



The environment of origin of study participants was predominantly urban, with only 240 persons from rural areas (Table 4).

Table 4. The environment of origin of study participants

Environment of origin	Frequency	Percent	Valid percent	Cumulative percent
Rural	240	21.525	21.525	21.525
Urban	875	78.475	78.475	100.000
Total	1115	100.000		

We considered educational level an essential parameter in our study because, despite the development of technology, minimal knowledge is needed to use it. Consequently, we observed that out of a total of 1115 people who were interested in participating in the study, 647 had a high educational level (university/master's degree/PhD), and 460 had a medium academic level (high school) and just 8 had a low academic level (middle school) (Table 5).

Table 5. Education level of study participants

Form of education	Frequency	Percent	Valid percent	Cumulative percent
PhD	24	2.152	2.152	2.152
Master degree	205	18.386	18.386	100.000
Bachelor degree	418	37.489	37.489	39.641
Highschool	460	41.256	41.256	81.614
Middle school	8	0.717	0.717	40.359
Total	1115	100.000		

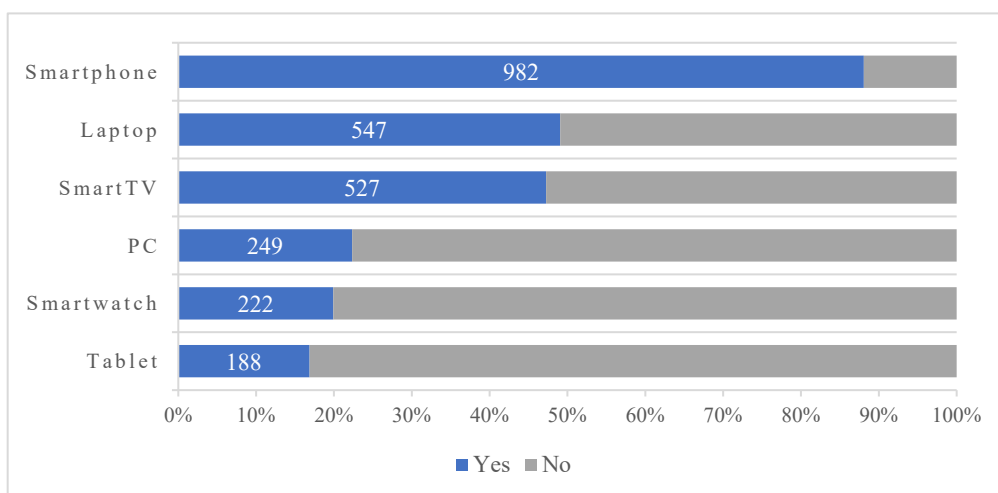
According to the answers collected in our study, access to the internet at home is not an impediment, with 1099 persons (98.56%) stating that they have internet in their personal homes (Table 6).

Table 6. Home internet access of study participants

Answer	Frequency	Percent	Valid percent	Cumulative percent
Yes	1099	98.565	98.565	98.565
No	16	1.435	1.435	100.000
Total	1115	100.000		

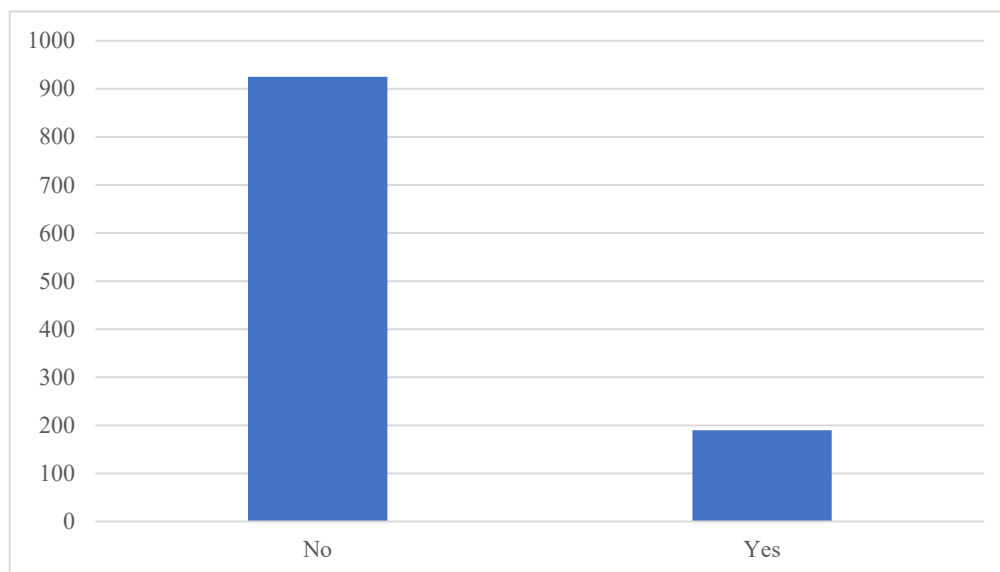
Currently, telecare services can be provided through various devices, so we evaluated the frequency of use of each gadget in the study population. Thus, the question with multiple answers, "What types of technology do you typically use (daily/weekly)?" had as answer options: smartphone, laptop, smart tv, personal computer, smartwatch and tablet. Figure 3 is the graphic representation of the collected responses, where we can see that more than 80% of the study participants use a smartphone and almost 50% of them a laptop and/or a smart TV (Fig.3.).

Fig.3. Types of technology used daily/weekly by study participants



The availability of telemedicine services in Romania is quite limited, but it experienced a more accelerated implementation rate after the COVID-19 pandemic, especially in the private health sector. However, out of a study group of 1115 people, only 190 people used telemedicine services (Fig.4.).

Fig.4. Use of telemedicine services in the study population



Study participants who stated that they had used telemedicine services in Romania were subsequently asked to rate the services' quality. Out of 190 people who used telemedicine services, 134 stated an excellent quality of service and only four persons encountered technical errors and problems interacting with the doctor. On the other hand, many participants indicated that they felt the absence of physical doctor-patient interaction, even though it did not impact the consultation outcome and the course of treatment (Table 7).

Table 7. Quality characterisation of telemedicine services in Romania

Telemedicine consult quality	Frequency	Percent	Valid percent	Cumulative percent
Good quality (everything went very well)	134	12.018	12.018	12.018
Medium quality (I felt the absence of doctor-patient interaction)	45	4.036	4.036	16.054
Medium quality (I encountered technical problems)	7	0.628	0.628	16.682
Low quality (there were technical and interrelationship problems with the medical framework)	4	0.359	0.359	17.040
I did not perform such a medical consult	925	82.960	82.960	100.000
Total	1115	100.000		

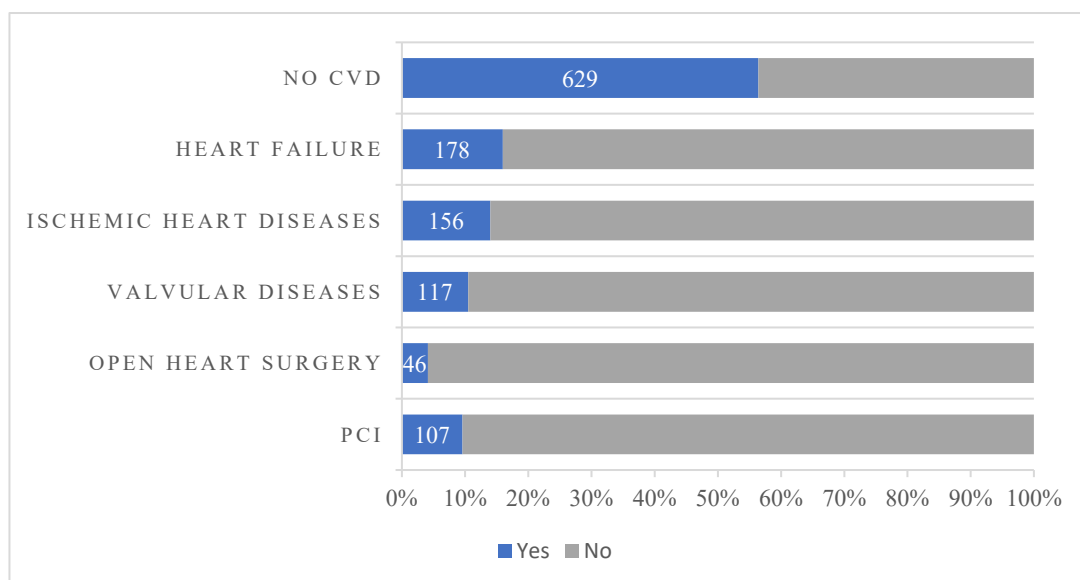


In the study, the population was evaluated for the incidence of cardiovascular disease both in general and by pathology and treatment modality. Thus, out of 1115 participants, 486 were stated to be diagnosed with cardiovascular disease. By listing the most common cardiovascular pathologies with an indication for cardiac rehabilitation, we identified 156 participants with ischemic heart disease, 117 with valvular pathology and/or 178 with heart failure. Of the 156 patients with ischemic heart disease, 107 had a history of percutaneous stent angioplasty. Of all 486 patients with diagnosed cardiovascular disease, 46 had a history of open heart surgery (Table 8)(Fig.5).

Table 8. History of a diagnosed cardiovascular disease in the study population

Answer	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	486	43.587	43.587	100.000
No	629	56.413	56.413	56.413
Missing	0	0.000		
Total	1115	100.000		

Figure 5. Characterization of cardiovascular disease in the study population



We assessed the knowledge level of study participants regarding the indication of cardiac rehabilitation programs. Although out of 1115 people, only 486 were known to have cardiovascular disease, a much larger number (566) knew that the previously listed pathologies had to be followed post-discharge by a cardiac rehabilitation program (Table 9).

Table 9. Knowledge of the cardiovascular rehabilitation recommendation in the study population

Answer	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	566	50.762	50.762	50.762
No	549	49.238	49.238	100.000
Missing	0	0.000		
Total	1115	100.000		

Out of 1115 participants, only 75 received a recommendation for cardiac recovery. Considering that only 486 people had an actual indication, we excluded from the analysis the people without diagnosed cardiovascular disease. However, even in the percentage of patients with cardiovascular disease, the discharge referral to cardiac rehabilitation was extremely low, at only 15.43% (Table 10).

Table 10. Incidence of cardiac rehabilitation recommendation in the study population

Answer	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	75	6.726	6.726	6.726
No	1040	93.274	93.274	100.000
Missing	0	0.000		
Total	1115	100.000		

Out of 75 patients recommended for a cardiac rehabilitation program, only 32% were explicitly referred to cardiac rehabilitation centers (Table 11).

Table 11. Incidence of referral to cardiac rehabilitation centers

Answer	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	24	2.152	32.000	32.000
No	51	4.574	68.000	100.000
Missing	1040	93.274		
Total	1115	100.000		

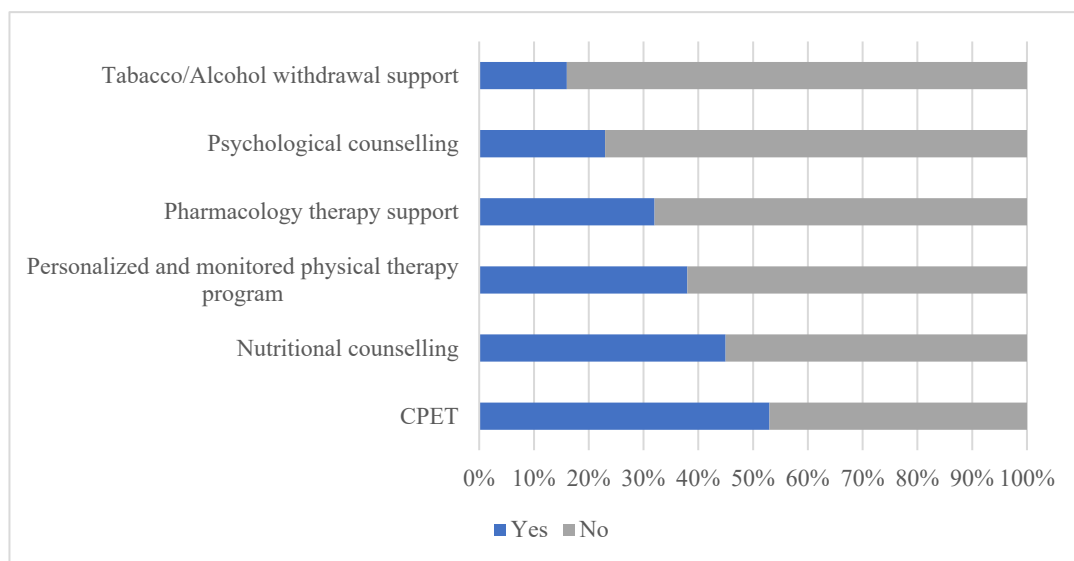
When asked which is the closest cardiac rehabilitation center to their home, 779 (69.86%) participants stated that they do not know, 208 that they are in their home town and 128 in neighbouring towns (Table 12).

Table 12. Location of cardiac rehabilitation centers

Answer	Frequency	Percent	Valid Percent	Cumulative Percent
I do not know	779	69.865	69.865	69.865
In the city of residence	208	18.655	18.655	88.520
In the neighboring towns	128	11.480	11.480	100.000
Missing	0	0.000		
Total	1115	100.000		

When assessing study participants' knowledge of the components of a cardiac rehabilitation program, it was observed that less than 50% of the participants knew the structure of such a program. The most frequently checked components were the cardiopulmonary stress test (CPET), nutritional counselling and the monitored exercise program. The least known part of a cardiac rehabilitation program to study participants was represented by tobacco/alcohol withdrawal support (Fig.6).

Figure 6. Components of cardiac recovery programs



Regarding the waiting period until the actual enrollment of patients in a cardiac rehabilitation program in Romania, the answers varied from a few days to a few months. Still, a number of 429 patients could not enrol in such a centre. Regarding the patients who could not enrol in such a program, the cause of this situation was evaluated through a question with free answers. The most frequent response of the participants was that "they could not identify a cardiovascular rehabilitation centre", followed by "too great distance" or "services were not settled by the National Health Insurance House" (Table 13).

Table 13. Participants waiting period for cardiac rehabilitation enrollment

Answer	Frequency	Percent	Valid Percent	Cumulative Percent
Several months	24	2.152	2.152	2.152
Several weeks	23	2.063	2.063	4.215
Several days	29	2.601	2.601	6.816
I did not perform	610	54.709	54.709	61.525
I could not enroll	429	38.475	38.475	100.000
Missing	0	0.000		
Total	1115	100.000		

Of the patients who completed a cardiac rehabilitation program, only 6 patients had an adequate 8-12 weeks duration. Also, affirmatively 5 patients abandoned along the way (Table 14).

Table 14. Cardiac rehabilitation program duration

Answer	Frequency (n)	Percent	Valid Percent	Cumulative Percent
1-2 weeks	13	1.166	1.166	1.166
2-4 weeks	1	0.090	0.090	1.256
4-6 weeks	3	0.269	0.269	1.525
6-8 weeks	2	0.179	0.179	1.704
8-12 weeks	6	0.538	0.538	2.242
I abandoned along the way	5	0.448	0.448	2.691
I did not perform	1085	97.309	97.309	100.000
Missing	0	0.000		
Total	1115	100.000		

When evaluating the study participants' perception of telerehabilitation services via wearable devices, 777 people stated that they consider it beneficial in terms of medical monitoring and time saved. In second place as responses (181) was the also positive statement that yes, because otherwise, they would not have access to cardiac rehabilitation and monitoring services anyway. Out of 1115 participants, only 157 presented a negative perception of telerehabilitation services, either due to a lack of technological knowledge or physical interaction (Table 15).

Table 15. Study participants' perspectives on the benefits of telemedicine services

Answer	Frequency	Percent	Valid percent	Cumulative percent
Yes, because otherwise, I do not have access to cardiac rehabilitation services anyway.	181	16.233	16.233	16.233
Yes, because a specialised team will supervise me, and I will also save time	777	69.686	69.686	85.919
No, I could not handle using them.	59	5.291	5.291	91.211
No, because I prefer a physical version with a daily presentation in the clinic for performance	59	5.291	5.291	96.502
No, because I prefer a cardiac rehabilitation program with hospital admission	39	3.498	3.498	100.000
Missing	0	0.000		
Total	1115	100.000		

Despite the positive perception of remote cardiac recovery services, only 174 patients (15.6%) would be willing to pay for such services, the remaining 941 wanting these types of medical services to be included in their general health insurance (Table 16).

Table 16. Cost coverage of remote cardiac rehabilitation programs

Answer	Frequency(n)	Percent	Valid Percent	Cumulative Percent
I would like full cost coverage through the National Health Insurance House (NHIH)	941	84	84.395	84.395
I would be willing to pay for such services as long as NHIH will not include them in the insurance plan	174	16	15.605	100.000
Missing	0	0.00	0	
Total	1115	100.	000	

### 3. Discussions

This study aimed to evaluate on-site and remote cardiac rehabilitation services in the Romanian population, as well as people's perceptions towards telecare services in cardiology.

Our online evaluation questionnaire had 1115 participants, with a minimum age of 18 years old, a preponderance of female sex and a predominantly urban background. The study participants were from all educational levels, from low (middle school), medium (high school) to superior (university/master degree/ PhD). We observed that most participants have an internet connection at home and use at least one form of technology daily, but most have never used a telemedicine service.

Less than 50% of participants had a history of cardiovascular disease, the most common of which was heart failure. However, more than 50% of people knew the indications for a cardiac rehabilitation program. Of the patients in need of such a program, only 75 received a discharge recommendation; out of these, only 24 were referred to a specialised centre. Most participants were unaware of a cardiac rehabilitation centre or the components of a cardiac recovery program. Participants who completed a cardiac rehabilitation program had a medium to long waiting period prior to enrollment; some did not perform it for an adequate period of time.

The general perception of the study participants on cardiac recovery services via wearable devices was positive, wanting the availability of such a service but with cost coverage by the National Health Insurance House.

The World Bank defines Romania as a middle-income country with an increased incidence and morbidity-mortality of cardiovascular disease with too few primary and secondary prevention programs. In 2019, according to an article published in the European Journal of Preventive Cardiology regarding the availability and delivery of cardiac rehabilitation services in Europe, Romania had a mean cardiac rehabilitation of 10 hours. With this value, Romania ranks at the bottom of the European list regarding access to cardiac rehabilitation services for patients with cardiovascular disease. The only countries with weaker indicators were represented by Bosnia Herzegovina, Northern Ireland and Hungary (16).

From 2019 to present, patients' enrollment in cardiac rehabilitation programmes has not increased, and as indicated by our study, their current knowledge of this secondary prevention method remains rather low.

Furthermore, according to the previous study, Romania did not offer alternative models to on-site cardiac rehabilitation programmes until 2019. Remote cardiac rehabilitation services have begun to be introduced into the range of medical services, especially in large cities such as Bucharest, Cluj or Timișoara, but only on a payment basis. An adequate legislative framework has not been created to include this type of service in the patient's national health insurance. According to our current indicators, this should be considered a high priority, given the many patients needing a cardiac rehabilitation program. The infrastructure of installing such a service should not be a problem, considering Romanians high access to internet services.

Romania is only one of the countries in Eastern Europe where the enrollment of patients in cardiac recovery programs is extremely low and the alternative of remote cardiac recovery is practically absent. In a study carried out in the Czech Republic, the long distance from the centers, the lack of public transport infrastructure and the fixed schedule were identified as main factors associated with low enrollment (17).

The absence of a digitized network for individual record-keeping in the context of cardiovascular rehabilitation is observed in Romania. This deficiency highlights a significant gap in the systematic healthcare infrastructure, where there is no integrated and efficient digital framework for monitoring and detailed documentation of participants in cardiovascular rehabilitation programs. This aspect denotes a vulnerability in the healthcare system, where the lack of a unified digital platform for recording individuals participating in cardiovascular rehabilitation programs limits the capacity for data collection, storage, and analysis of relevant information. Consequently, the implementation of a digitized system becomes imperative, enabling the efficient integration of information concerning patients engaged in cardiovascular rehabilitation processes. This, in turn, facilitates continuous monitoring and assessment of the impact of these programs on cardiovascular health at the population level. This deficiency in the digital infrastructure represents a substantial issue, underscoring the need to prioritize investments in medical technology and information systems to enhance the management and coordination of cardiovascular rehabilitation programs on a national scale.

Considering the meagre budget that the Romanian government allocates to cardiovascular diseases, the only real possibility of increasing the access of cardiovascular patients to adequate secondary prevention programs is through telemedicine. In addition to the fact that these services are shown to associate low implementation costs, they also offer the opportunity to enroll a considerable number of patients with the possibility of minimal medical human resources. In an Eastern European country where the shortage of doctors is felt in daily medical practice, it may prove to be the best alternative to reduce the burden of cardiovascular disease in the next ten years (18) (19) (20) (21) (22) (23) (24).

#### **4. Conclusion**

In conclusion, the access of cardiovascular patients to on-site cardiac rehabilitation services is extremely low and for remote ones, it is almost non-existent. For a middle-income country like Romania with such a high incidence of cardiovascular disease, it is almost mandatory to provide publicly funded cardiac telerehabilitation services also for the future. Internet access is neither a problem for the Romanian population nor technological knowledge, so the optimal solution for secondary prevention of cardiovascular disease is represented by cost coverage of remote cardiac services by public insurance through the National Health Insurance House.

## 5. Limitations

The study limitations are represented primarily by the virtually obtained data, the preponderance of female sex participants and the urban environment of origin. While we aim to mitigate the impact of these limitations on the conclusions of this study, it is crucial to underscore the significance of gathering data on both genders of patients, particularly those residing in rural areas. Identified as individuals with diminished resources, these patients face substantial constraints regarding access to information and medical services. In light of this context, a heightened focus and expansion of research efforts are proposed to enhance understanding of the needs and challenges specific to these patient subgroups.

A detailed analysis of data collected among patients in rural settings may reveal significant disparities concerning access to medical information and participation in cardiovascular rehabilitation programs. Consequently, tailored strategies and targeted interventions could be developed to improve the availability and effectiveness of medical services for this vulnerable segment of the population.

This heightened attention to gender and rural considerations not only contributes to bolstering the validity of the obtained results but may also provide relevant guidance for future research directions, concentrating on ways to optimize access to information and medical services for categories of patients with limited resources.

## 6. Data available on request due to privacy/ethical restrictions

The data that support the findings of this study are available on request from the corresponding author, L.I.S.. The data are not publicly available due to GDPR restrictions - their containing information that could compromise the privacy of research participants.

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