

Research article

# How do physicians estimate cardiovascular risk in the elderly using E-health - a pilot study

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**Abstract:** Cardiovascular pathology encompasses a wide range of diseases characterized by common risk factors such as atherosclerotic disease, diabetes, and arterial hypertension. These conditions can be effectively mitigated through the adoption of a healthy lifestyle. Additionally, telemedicine, along with other forms of direct or indirect electronic interaction, may play a significant role in the prevention of cardiovascular diseases. In order to evaluate the perception of doctors and elderly patients from Bucharest county, as cardiovascular risk and the preventive role of telemedicine means, we created a specific questionnaire. We collected by an online questionnaire: demographic data, level of education, medical software applications used, cardiovascular parameters, telemedicine compliance. The obtained data were processed using Windows Office program. The surveyed doctors performed telemedicine using WhatsApp (in 55% of cases), phone short message text (in 40% of cases), and platform ASSMB (0.5%). Doctors' preferences in telemedicine were to assess the cardiovascular pathology (75%), cognitive disorders (65%), and functional (60%) evaluations. The majority of 50% of patients will resort to alternative consultations (through physical examination and telemedicine) in the future only if it is strictly necessary. Doctors and patients were predominantly women, with the majority residing in the urban environment. Telemedicine was carried out using WhatsApp for doctors and patients. Most doctors believe that telemedicine will improve the doctor-patient relationship and therapeutic compliance and monitoring and consultations will take place at the office and via telemedicine. The majority of patients will resort to alternative consultations methods (physical examination/telemedicine) in the future when deemed necessary; a significant number of the patients would encompassing both in-person visits and telemedicine options.

**Keywords:** cardiovascular risk; elderly patient; telemedicine

## 1. Introduction

Occasionally, individuals utilise the terms 'telemedicine,' 'telehealth,' and 'e-health' synonymously. The term 'telemedicine' originally denoted the provision of medical care remotely. The proliferation of telemedicine resulted in the creation of the word 'telehealth', which today includes a broader spectrum of health-related activities, including education and administration. Recently, the notions of e-health, m-health, and connected health have emerged. We coined the term e-health to describe a broad spectrum of data processing and computer networking applications, including Internet utilisation, within the healthcare domain. Countries with English

as the official language, including the UK, USA, Canada, and Australia, predominantly use the term telehealth. Canada exhibited the highest percentage of documents containing the term “telehealth”(30%) and the lowest for telemedicine (37%) [1][2].

Cardiovascular pathology refers to a complex array of conditions that significantly impact the quality of life for patients and are associated with high mortality rates [3]. In Europe, according to WHO statistics from 2016, approximately 45% (4 million) of deaths in a year are caused by cardiovascular diseases [4][5][6]. In Romania, WHO statistics from 2019 show that the main cause of mortality is ischemic heart disease (370.16 deaths/100,000 inhabitants), and cerebrovascular disease (256.22 deaths/100,000 inhabitants) is in 2nd place, in 3rd place arterial hypertension (56.74 deaths/100,000 inhabitants)[7].

The risk of cardiovascular disease is highly correlated with a variety of risk factors: non-modifiable individual (race, age and gender – cardiovascular risk increases with age and in men), modifiable (related to lifestyle: obesity, smoking, sedentary lifestyle and diet). The risk factors related to the patients' pathologies are arterial hypertension, type 2 diabetes, dyslipidemia, and sleep apnea syndrome [8].

Numerous models have been developed based on long cohort studies, following which algorithms have been developed to predict the risk of onset of cardiovascular pathology in adults; such as SCORE and SCORE2. The SCORE2 score is an updated version of the SCORE, based on the parameters: gender, age, current smoking status, systolic blood pressure, diabetes, total cholesterol, and high-density lipoprotein (HDL) cholesterol. Romania falls into category D of SCORE2, the group with the highest risk of cardiovascular mortality [9]. For the elderly, the SCORE2-Older Persons (SCORE2-OP) score was created to assess cardiovascular risk in patients between 70 and 84 years of age in Europe. In SCORE-OP, Romania is classified in the maximum risk group: the entire population over 70 years old in our country has a minimum 25% risk of cardiovascular disease in the next 10 years/within the next decade [9][10,11].

Telemedicine and means of direct (via calls/conferences/messages) or indirect electronic interaction, in real-time (via smartphone/smartwatch devices, electronic patient record) can be updated in real-time with data collected by the devices and can contribute to the prevention of cardiovascular diseases [12,13][14]. This technology allows for the continuous updating of electronic patient records with data gathered by these devices, thereby contributing significantly to the prevention of cardiovascular diseases.

Along with the digital development, the following were created: online software platforms (Zoom, Google Meet) for remote consultations (for the assessment of blood pressure, glycemia and international normalized ratio (INR)); software applications for automatic calculation of certain risks/scores (eg ESC CVD Risk Calculation App); "smartwatch" with connected sensors for pulse oximetry, heart rate and heart rhythm regularity. Randomized clinical trial studies have been conducted to evaluate the effectiveness of obesity monitoring and treatment using smartphone/tablet software applications via telemedicine, tracking study subjects' body mass index for education and dietary adaptation (with reduced overeating/ of sugary products/alcohol). The data collected from these sensors can then be transmitted/shared directly with the healthcare provider [15–17]

The increasing digitization of individuals' lives and the particular healthcare context have broadened the topic of fairness in healthcare to encompass digital environments, termed "digital health equity" (DHE). In the 2021 and 2022 publications, the World Health Organization delineates "digital health" and emphasizes "DHE," thereby establishing a strategic framework that prioritizes the promotion of equity and the mitigation of discrimination and marginalization threats[18]. While the digitization process progressed slowly over the past decade, it experienced a rapid ac-

celeration in the last three years due to the COVID-19 pandemic; telemedicine methods and e-health tools proliferated to ensure partial continuity in health service delivery. Advancements in digital health, telemedicine, and e-health demonstrate significant potential for enhancing health outcomes, but they may also inadvertently exacerbate inequities[19]. Healthcare professionals encounter distinct risks; they may face difficulties executing clinical skills with telemedicine tools (devices, software, e-platforms, and e-environments), necessitating specialized training and/or support to adapt their skills to these tools and environments [20] [21].

In recent years, novel technological instruments have infiltrated the medical domain and revolutionized the field of rehabilitation. Known in the healthcare sector as "digital therapeutics," the integration of gaming, virtual reality (VR), and augmented reality (AR) has emerged as a promising approach to enhance traditional rehabilitation methods. These technologies provide a distinctive combination of immersive experiences and personalized therapies for patients undergoing musculoskeletal, neurological, and various types of cardiovascular rehabilitation. The digital age represents a transformative period in healthcare systems, particularly for the elderly population[22].

Monitoring elderly patients through eHealth can be challenging due to their generally lower levels of technical proficiency. However, numerous studies have been conducted to evaluate clinical outcomes and to identify relevant risk factors associated with this demographic.

## 2. Materials and Methods

### 2.1 Data collection

In order to evaluate the perception of telemedicine, the possibility to assess the cardiovascular risk in elderly patients from Bucharest catchment area and the preventive role of telemedicine means, we created a specific questionnaire.

### 2.2 Measures

The questionnaire was structured into the following categories: demographic questions concerning the respondents' general information; inquiries specifically directed at patients regarding their experiences with digital applications used for clinician engagement; and questions aimed at medical students and physicians pertaining to their perceptions of software applications utilized in interactions with elderly patients. (Table 1).

Table 1. On line-Questionare section about software application in doctor patient interactions

| Which platforms have you utilized in the past year for physician-patient interaction?             |                                                                     |                |                            |                  |       |
|---------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|----------------|----------------------------|------------------|-------|
| WhatsApp                                                                                          | ASSMB Patient Platform                                              | Phone SMS Text | Zoom                       | Other platforms  |       |
| Which cardiovascular parameters were most frequently monitored?                                   |                                                                     |                |                            |                  |       |
| Edema                                                                                             | Six-minute walk distance                                            | INR            | SaO2                       | BP               | Pulse |
| How challenging was the use of these applications?                                                |                                                                     |                |                            |                  |       |
| Not challenging at all                                                                            | Moderately challenging                                              | Challenging    |                            | Very challenging |       |
| Would you prefer to continue receiving consultations from your physician via online applications? |                                                                     |                |                            |                  |       |
| Yes, consistently                                                                                 | I would prefer a hybrid model of online and in-person consultations |                | Only if strictly necessary |                  | No    |
| Would you prefer to continue being monitored by your physician via online applications?           |                                                                     |                |                            |                  |       |
| No                                                                                                | I would prefer a hybrid model of online and in-person monitoring    |                | Only if strictly necessary |                  | No    |

For a population consisting of 70 participants, we validated 68 people (26 patients, 22 medical students, 7 resident doctors, and 13 specialist physicians) we collected by questionnaire: demographic data, level of education, medical software applications used, cardiovascular parameters evaluated, and telemedicine compliance.

### 2.3 Statistical Analyses

Descriptive statistics and frequency distributions were used to describe the single-choice and multiple-choice questions. A Pearson product-moment correlation was run to determine the relationship between satisfaction with the implementation of eHealth and the vision of using eHealth. The obtained data were statistically processed using the Excel Windows Office program (an).

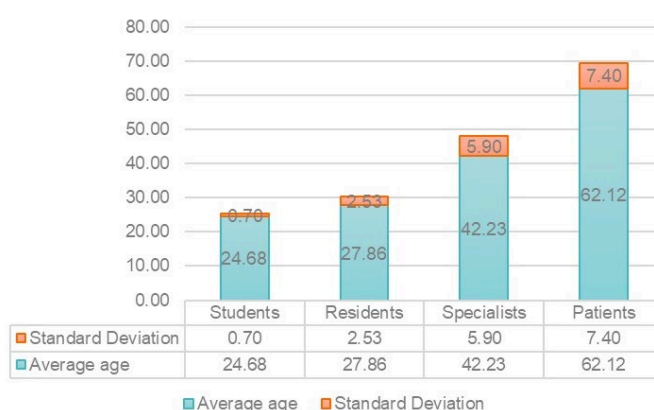
### 2.4 Ethical Considerations

This study was approved by the Ethical Committee from the Hospital of Chronic Diseases "Sf. Luca", Bucharest, Romania. All participants signed the informed e-consent by clicking a dedicated button available in the invitation link, stating that they were aware that participation was voluntary.

## 3. Results

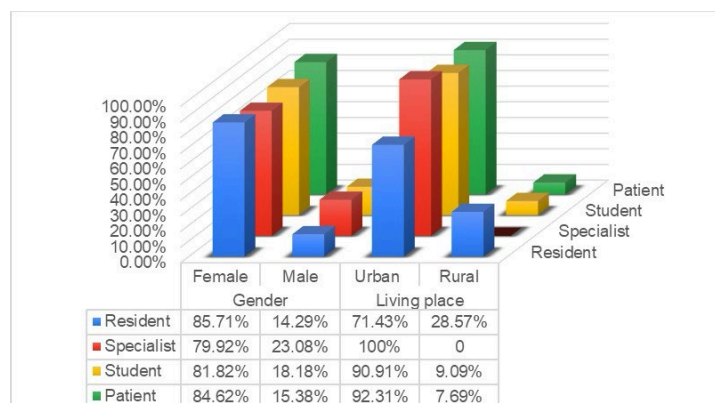
### 3.1. Demographic data

The average ages of the respondents were  $24.68 \pm 0.70$  years for students,  $27.86 \pm 2.53$  years for resident doctors,  $42.23 \pm 5.90$  years for specialist physicians, and  $62.12 \pm 7.40$  years for patients (Fig. 1).



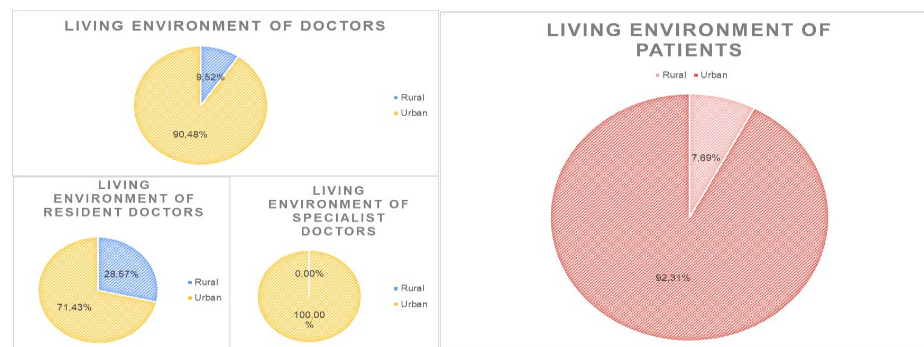
**Figure 1.** The ages of the respondents

A response rate of 19% of male physicians and 89% of female physicians answered the questionnaire. 14% of resident doctors were male, and the remaining 86% were female. In the case of specialist physicians, 23% were male and 77% were female. Additionally, 15% of the patient population was male, whereas 85% was female (see Fig. 2).



**Figure 2.** Distribution of participants according to gender and living place

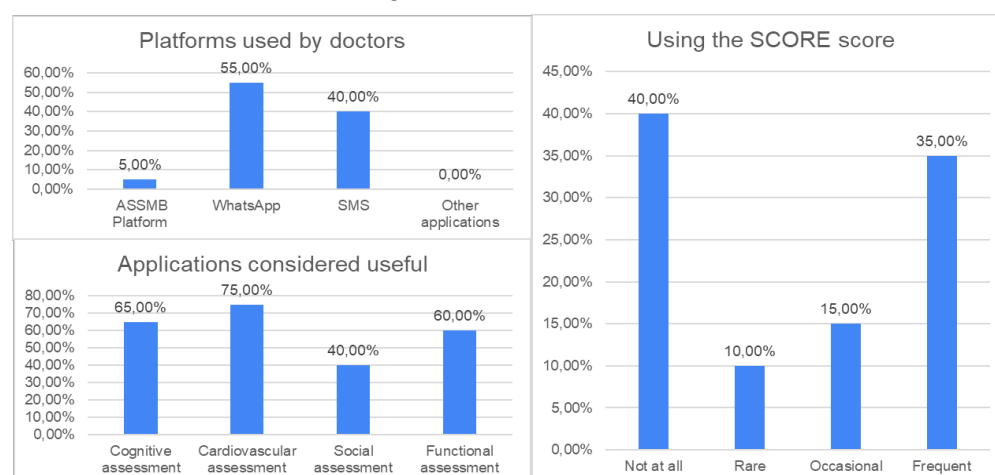
Ninety percent of the physicians surveyed, which includes 71% of resident doctors and all specialist practitioners, reside in urban areas. Conversely, ten percent, comprising 29% of resident doctors, live in rural regions. Furthermore, it is noted that 92% of the surveyed patients inhabit urban environments, while 8% originate from rural settings (Fig. 3).



**Figure 3.** The living environment of the respondents

### 3.2. Functional data

The surveyed doctors performed telemedicine using WhatsApp (in 55% of cases), phone messaging (in 40% of cases) and the Administration Hospitals and Medical Services Bucharest (platform (in 5% of cases). Doctors' preferences in telemedicine were to assess the cardiovascular pathology (75%), cognitive disorders (65%), and functional (60%) evaluations (Fig. 4).



**Figure 4.** Doctors and telemedicine

The prevailing consensus among medical professionals is that telemedicine has the potential to enhance the doctor-patient relationship and improve therapeutic compliance, provided that both monitoring and consultations integrate traditional office visits with telemedicine interactions.

For telemedicine, 68.38% of patients used WhatsApp, and 23.08% of them used phone messaging. Blood pressure values (in 80.77% of cases), pulse (57.69% of cases), oxygen saturation (in 38.46% of cases) and INR (in 3.85% of cases) were monitored. (Fig. 5)

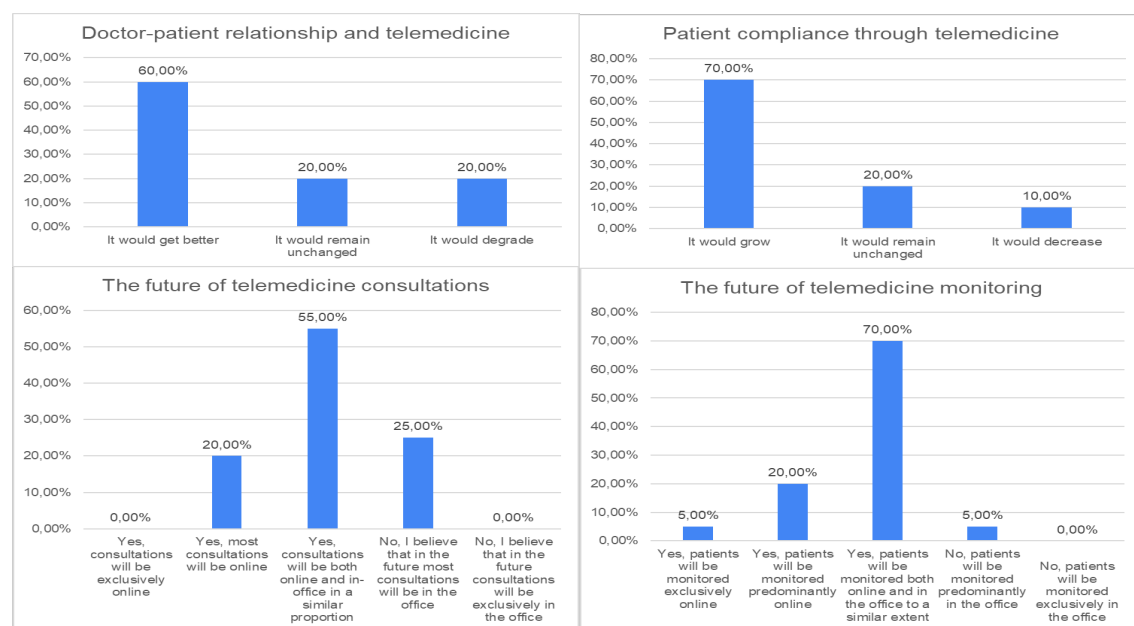


Figure 5. Doctors and the future of telemedicine

The majority of 50% of patients will resort to alternative consultations (through physical examination and telemedicine) in the future only if it is strictly necessary; and 53.85% of the surveyed patients would opt for combined monitoring in the future (with physical presence or via telemedicine). (Fig. 6)

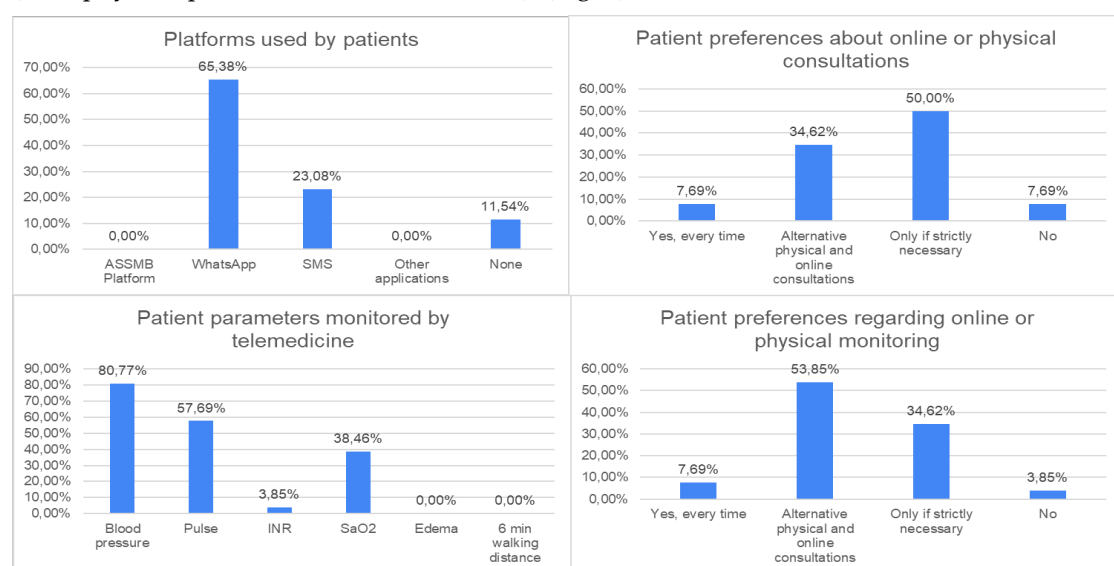
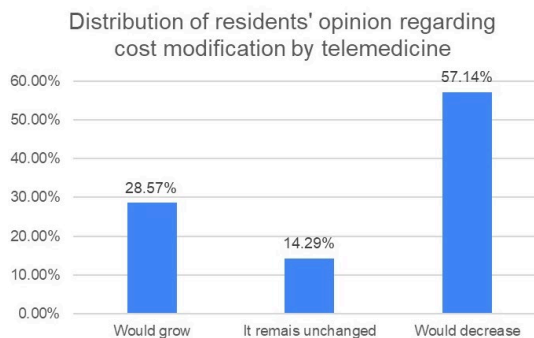


Figure 6. Patients and telemedicine



**Fig 7. Distribution of residents' opinions regarding the change in costs through telemedicine**

Figure 7 also demonstrates citizens' perceptions of the cost shift caused by telemedicine in the medical field. While over fifty percent of respondents anticipate a decline in costs, nearly one-third (28.57%) believe that costs will increase. This projected rise may be attributed to the acquisition or development of specialized telemedicine software and equipment by healthcare providers, as well as the necessity for a reliable Internet connection and the availability of Internet-capable devices for patients. Additionally, an increase in costs may also arise from the need to provide training programs for both healthcare personnel and patients to effectively utilize these systems.

#### 4. Discussion

Digital Health (DH) provides useful data in cardiovascular monitoring and prevention with the help of telemedicine, but the studied groups were numerically statistically insignificant, which requires the future extension of the evaluations. The coronavirus pandemic has provided a new impetus for changes in delivering medical assistance across the world. The potential support of DH technology may have a special role in patients living with health status limitations due to aging. Aging is a natural process that poses several challenges and threats to the preservation of independence. Almost 50% of our older patients are not so friendly with telemedicine for assessment. As digitalization grows more prevalent in our lives, shifting to a patient-physician relationship that integrates telemedicine is an important consideration. Despite ranking second-to-last in digital competency, the COVID-19 pandemic accelerated the adoption of online consultations to comply with infection-control measures aimed at reducing infections.[23]. Thus, this enforced and rapid implementation may account for the limited adaptability observed among elderly individuals, as indicated by the responses from physicians participating in the study.

Research indicates that students exhibit a greater preference for utilising applications across several domains, demonstrating a diminished interest in traditional pen-and-paper methodologies. If the student experiences separation from peers throughout the medical exemption period, they may become demotivated or feel alienated [24] [25].

On the other hand, telemedicine is a highly significant field within Western societies, with growing scientific literature in the field. Among groups that voluntarily enrolled in telemedicine studies, satisfaction levels were notably high, with minimal issues regarding technical difficulties, such as challenges in hearing or seeing the healthcare provider [26]. Furthermore, in the same study, the incidence of complications associated with chronic conditions was lower, and medication adherence rates were higher among patients consulted via telemedicine. The advantages of physician-patient interactions through telemedicine mutually consented to and preferred by both parties, are numerous, ranging from cost reduction (for both the healthcare provider and the



patient) to increased consultation frequency and the possibility of implementing "memo" or "reminder" applications to improve therapeutic adherence [27]).

A 2021 systematic review also highlights the importance of implementing telemedicine interactions in nursing homes in Western Europe and the United States in the context of the COVID-19 pandemic ([28]). Given that nursing homes are high-risk communities for infectious outbreaks, eliminating the need for elderly residents to travel to hospitals or outpatient clinics for specialist consultations has reduced both healthcare-associated costs and the risk of SARS-CoV2 transmission.

Regarding the use of telemedicine to improve cardiovascular health in geriatric patients, studies remain limited. However, in France, there is an ongoing project to implement a monitoring system for elderly patients with heart failure through a digital platform, employing internet-connected electronic devices (e.g. spirometer, glucometer, blood pressure monitor). These devices alert healthcare providers to potential changes that may indicate decompensation or worsening of the patient's condition [29].

The use of text message programs has been shown to support the management of chronic disease and cardiovascular risk factors. These include smoking cessation, weight loss, physical activity, blood pressure lowering, and diabetes care [30,31].

Cardiac rehabilitation is a crucial approach for the social reintegration of individuals with cardiovascular illnesses. With the ageing population, an increasing number of individuals own implantable cardiac devices utilised for the management of sinus node illness, atrioventricular blocks, ventricular tachyarrhythmias, or heart failure with reduced ejection fraction. These devices affect exercise capacity and necessitate the reprogramming of parameters in patients participating in cardiac rehabilitation programs to enhance outcomes[32].

In the current context of a likely reappearance of illnesses with pandemic implications, Anghelescu et al. provide some predictions about possible novel educational directions for the future of medical education in the physiotherapy specialization. The use of technology, virtual reality, simulation, and other technology-based methods in medical education is expected to rise [33][25][34].

Because the prevention, detection and treatment of cardiovascular (CV) disease including atrial fibrillation (AF) and heart failure (HF) are closely related to improving health decline in older subjects. DH technology management of these diseases is becoming part of the routine CV care in older adults [35][36].

The research by Ciucă-Pană et al. indicated that an online survey of 1115 Romanian participants regarding cardiac rehabilitation showed that most respondents possess home internet access and use at least one technological device daily; however, the majority have never engaged with a telemedicine service. The study participants predominantly held a favorable view of cardiac recovery treatments delivered through wearable devices and indicated a preference for the availability of these services, contingent upon coverage by the National Health Insurance House[37][38].

Age-related impairments, including cognitive, physical, and visual limitations, commonly observed in older adults, can substantially affect an individual's ability to utilize eHealth solutions effectively. [39,40, 41].

Older persons with various chronic diseases require knowledge to effectively manage and coordinate their treatment. eHealth can effectively provide adequate information, facilitate communication, and enable self-management of chronic illnesses. However, it remains challenging to integrate the health preferences of older individuals and ensure their active participation. Enhanced understanding is essential to ensuring effective involvement and utilization of eHealth in care coordination[42,42].



### *Limitation of the study*

The main limitation of the study is represented by the small number of respondents in the analyzed group. Also, the category of resident doctors is significantly under-represented in this group, as are male respondents and those from rural areas. Another study limitation is the technique of data collection. Self-administered online questionnaires have inferior answer quality because of interindividual variability in the interpretation of some items and subjective ratings. The questionnaire's lack of standardization and validation is an additional drawback, as this is an original.

Furthermore, because the study was cross-sectional, it does not allow for the determination of causal links between the factors studied.

In conclusion, it is recommended to continue the study in accordance with the requirements for conducting robust investigations on a representative lot with a similar distribution of the categories mentioned.

## 5. Conclusions

Both groups studied (of doctors and patients) were predominantly made up of women, who mostly live in the urban environment. Doctors believe that the elderly have adapted a little to telemedicine (only 13.64%). A majority of doctors and medical students believe that both consultations and monitoring of patients will also be done online in a proportion at least similar to physical ones. The communication platform preferred by medical professionals in interacting with patients was WhatsApp. Most patients would accept an alternative regimen of in-office and online monitoring, while half would accept online consultations only if absolutely necessary. The SCORE is used to a lesser extent by resident physicians than by medical specialists. The parameters that are easiest to monitor in the conception of patients belong to cardiovascular symptomatology. Timely communication of blood pressure values, pulse or, in the future, even the electrocardiogram will be considered primary prevention measures with a decrease in the number of cardiovascular decompensations and/or presentations to the emergency room.

Most doctors believe that telemedicine will improve the doctor-patient relationship and therapeutic compliance; under the conditions that both monitoring and consultations will take place at the office and via telemedicine.

**Author Contributions:** For research articles with several authors, a short paragraph specifying their individual contributions must be provided. The following statements should be used “Conceptualization G.O, S.M.A. and J.A.; methodology, G.O, S.I.S.; software, S.I.S.; validation, S.M.A., J.A. and A.Z.; formal analysis, A.I.V.T.; investigation, S.I.S., A.Z.; resources, J.A.; data curation, A.Z., A.I.V.T.; writing—original draft preparation, S.M.A.; writing—review and editing G.O and J.A.; visualization, S.I.S.; supervision G.O. and S.M.A. All authors have read and agreed to the published version of the manuscript.” Please turn to the [CRediT taxonomy](#) for the term explanation. Authorship must be limited to those who have contributed substantially to the work reported.

**Informed Consent Statement:** Informed consent was obtained from all subjects involved in the study.

**Data Availability Statement:** Not applicable here.

**Conflicts of Interest:** The authors declare no conflict of interest.

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