NOVA IMS Information Management School

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Master Degree Program in

Information Management

Overcoming Barriers to the Adoption of Remote Patient Monitoring

Strategies and Perspectives in the Portuguese Context

Joana Rodrigues Pereira Frota de Oliveira

Master Thesis

presented as a partial requirement for obtaining a Master's Degree in Information Management

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Instituto Superior de Estatística e Gestão de Informação

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by

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Master Thesis presented as a partial requirement for obtaining the Master's degree in Information Management, with a specialization in Business Intelligence

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September, 2024

STATEMENT OF INTEGRITY

I hereby declare having conducted this academic work with integrity. I confirm that I have not used plagiarism, any form of undue use of information, or falsification of results along the process leading to its elaboration. I further declare that I have fully acknowledged the Rules of Conduct and Code of Honor from the NOVA Information Management School.

[Lisbon, September 2024]

Joana Oliveira

DEDICATION

To my parents,

who planted in me the discipline to build, the curiosity to explore, and the courage to write it down.
Your example, more than your words, shaped the way I approached this journey — with quiet resilience, intellectual honesty, and the belief that the things we start are worth finishing. This work carries more of you than it shows.

ACKNOWLEDGEMENTS

This dissertation marks the culmination of an important academic and personal journey, and I am deeply grateful to all those who contributed to its completion.

First and foremost, I would like to thank my supervisor, Prof. Dr. Vítor Santos, for his continuous guidance, availability, and valuable insights throughout this process. His support was fundamental in helping me stay focused and push the work forward with clarity and purpose.

A very special thank you to my cousin, Dr. Henrique Domingos, whose medical background, and personal encouragement were essential in shaping this thesis. It was his insight and passion for innovation in healthcare that first inspired me to explore the topic of Remote Patient Monitoring. His perspective helped me to see the relevance of this topic and his support has been a constant source of motivation throughout this journey.

I would also like to express my sincere appreciation to the four distinguished experts who generously shared their time, knowledge, and experience during the data collection phase of this research: Prof. Dr. Arlindo Oliveira, who offered invaluable insights into the role of artificial intelligence in healthcare innovation, Prof. Dr. Ricardo Baptista Leite, who contributed with his perspective on public health policy and digital transformation, Prof. Dr. Henrique Martins, who shared his extensive experience in the implementation of eHealth solutions within national healthcare systems, and Prof. Dr. Fernando Araújo, who provided a practical and management point of view on the real-world application of Remote Patient Monitoring in hospital settings. Their contributions added significant depth, diversity, and relevance to this study.

Lastly, I would like to extend my gratitude to my family, friends, colleagues, and the academic community of NOVA IMS whose encouragement, support, and belief in me have made this achievement possible.

To all of you — Thank You.

ABSTRACT

Remote Patient Monitoring (RPM) technologies have emerged as a key enabler for more accessible, efficient, and patient-centered healthcare systems. Despite its growing importance, the widespread adoption of RPM in Portugal remains limited and hindered by several structural, technological, and human factors. This dissertation aims to identify the main barriers to RPM adoption and develop feasible strategies to overcome them. The research methodology included a comprehensive literature review and qualitative interviews with national experts in digital health, policy, and clinical practice. The study identified five main categories of barriers: lack of technological interoperability, financial and reimbursement challenges, low user digital literacy, resistance from healthcare professionals, and organizational inertia. In response, a framework of strategic recommendations was developed around four key areas: the application of artificial intelligence (AI) to improve clinical data management; health policy reforms to support sustainable funding and integration of RPM into national systems; investment in education and digital literacy programs for both professionals and patients; and the redesign of clinical workflows to accommodate new models of remote care. These strategies aim not only to facilitate the adoption of RPM technologies, but also to reduce inequalities in healthcare access, promote digital inclusion, and improve chronic disease management. By addressing these multiple barriers through an integrated approach, this dissertation contributes to the broader goal of promoting innovation and sustainability within the Portuguese healthcare system.

KEYWORDS

AI in Healthcare; Artificial Intelligence; Healthcare; Remote Patient Monitoring; Telehealth

SUSTAINABLE DEVELOPMENT GOALS (SDG)

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LIST OF ABBREVIATIONS AND ACRONYMS

AI	Artificial Intelligence
COVID-19	Coronavirus Disease of 2019
DPOC	Doença Pulmonar Obstrutiva Crónica
EHR	Electronic Health Records
GDPR	General Data Protection Regulation
HIT	Health Information Technology
IoT	Internet of Things
LIS	Laboratory Information System
ML	Machine Learning
NHS	National Health System
PENTS	Plano Estratégico Nacional para a Telesaúde
RPM	Remote Patient Monitoring
SARS-CoV-2	Severe Acute Respiratory Syndrome Coronavirus 2
SMS	Short Message Service
SNS	Serviço Nacional de Saúde

1 INTRODUCTION

Artificial intelligence (AI) has made considerable progress in several sectors, including healthcare. The application of AI in the field of healthcare has led to significant changes in the methods used by medical professionals to diagnose and treat patients, as well as in the functioning of healthcare systems patients and facilitating timely medical intervention when required. This approach is of particular benefit to patients with chronic conditions, such as diabetes, hypertension, and heart disease, who require continuous monitoring and adjustments to their treatment plans (Nigar, 2024).

The emergence of the SARS-CoV-2 virus (COVID-19) has created an urgent requirement for the rapid implementation of telehealth. Considering the unprecedented surge in demand and limited resources, hospital systems were compelled to identify strategies for optimizing inpatient capacity while minimizing the transmission of the virus and safely redistributing care from the hospital to the community setting (Wang et al., 2023).

The deployment of Remote Patient Monitoring (RPM) tools is set to become a crucial aspect of the future practice of this field, offering substantial advantages. For instance, the capacity to monitor patients' conditions on an ongoing basis between clinic visits enables clinicians to identify deterioration at an earlier stage and provide prompt care. Furthermore, RPM has the potential to reduce the number of unnecessary clinic visits for patients who are recovering well. It is also capable of storing long-term data, which provides an overview of the patient's health status and determines health trends. Additionally, patients who have access to that data may become more educated about their disease, which may result in a perceived sense of control over their condition and an increase in their confidence. Such technologies facilitate the generation of alerts, prompting patients to contact the clinic in the event of any abnormalities in their health status (Palmieri Serrano et al., 2023).

By using AI, healthcare providers can monitor patients in real-time using data from wearable devices, mobile apps, and other digital tools. This strategy not only improves patient outcomes by ensuring timely interventions but also reduces the burden on healthcare facilities, allowing them to direct resources to the most critical cases. By enabling continuous, real-time tracking of vital signs and other indicators of a person's health, these technologies provide valuable data for treatment decisions and preventive measures (Minttihealth, 2023).

As noted above, recent developments in healthcare are largely driven by the COVID-19 pandemic and provide further opportunities for telemedicine as the need for contactless patient monitoring technologies has increased (Baumann et al., 2024). This has resulted in the necessity for sustained expansion of RPM to optimize the advantages for clinicians, but most crucially for patients. To ensure the continued growth of RPM, it is essential to address the existing barriers through changes in payment policies, the implementation of educational and

training programs in digital and health literacy, improvements in staff roles and workflows, and the introduction of new policies to guarantee equitable access (Hailu et al., 2024).

This situation led to the formulation of the following research questions: What are the principal barriers to the extensive implementation of RPM technologies? How might modifications to healthcare policy, educational initiatives, and workforce training programs assist in overcoming these difficulties?

The goal of this dissertation is to identify and analyze the principal obstacles to the extensive adoption of RPM technologies and to propose feasible strategies to overcome these challenges.

The study will pursue the following objectives:

- To examine the use of AI in healthcare contexts.
- To identify critical barriers to RPM adoption.
- To gather insights from healthcare professionals and researchers.
- To propose actionable strategies to overcome these barriers through AI technologies, policy reforms, educational initiatives, and workflow improvements.
- To evaluate the proposed strategies through a critical review of existing literature and documented case studies.

By addressing barriers such as technology literacy, training, and financial concerns, RPM can help ensure wider adoption, particularly in rural areas where there is a shortage of healthcare providers. This promotes better access to care and reduces the burden on healthcare systems by remotely managing chronic patients (World Health Organization, 2023). It is also important to emphasize the importance of considering factors such as age, digital literacy, and socioeconomic status when designing and implementing RPM programs, as these can potentially improve patient engagement and adherence, leading to a more effective program (Baumann et al., 2024).

RPM systems facilitate enhanced healthcare delivery through the continuous monitoring of vital signs, thereby enabling the early detection of health deterioration and timely intervention. Furthermore, evidence suggests that RPM systems improve the speed of diagnosis and reduce healthcare costs by minimizing the need for frequent hospital visits (El-Rashidy et al., 2020). Additionally, it enables researchers to collect valuable patient data in real-time, thereby facilitating studies on disease progression, treatment efficacy, and preventive healthcare.

The incorporation of AI into RPM systems has transformed healthcare by employing sophisticated algorithms to analyze vast quantities of patient data, identifying patterns, irregularities, and potential health concerns, thereby enhancing the quality of care (Shaik et al., 2022). The integration of the Internet of Things (IoT), wearable devices, and sensors in

RPM systems has facilitated real-time health monitoring, thereby enhancing the reliability and efficiency of patient care (Hasan et al., 2018).

RPM enables patients, particularly those with chronic conditions, to continue with their usual daily activities while being monitored, thereby enhancing their quality of life, and reducing the burden on healthcare facilities (Malasinghe et al., 2016). The technology facilitates patient education and reinforces the patient-physician relationship by providing continuous health data and enabling teleconsultation (De Farias et al., 2019).

2 LITERATURE REVIEW

The following literature review is based on a systematic review in which the collection, identification, and critical analysis of available research studies are performed.

2.1 AI IN HEALTHCARE

2.1.1 OVERVIEW

The application of AI in medicine was described first in 1976, in which a computer algorithm was used to identify the causes of acute abdominal pain (Aung et al., 2021). Since then, numerous applications of AI in medicine have been proposed, demonstrating the diverse and manifold potential of this technology (Aung et al., 2021).

AI has the potential to mitigate variability in care, enhance precision, accelerate discovery, reduce disparities, and empower patients, while facilitating connections between healthcare professionals and their patients, supported by the collective knowledge of the best medical research and analytic technology to address all the societal, political, and environmental issues at play (Koski & Murphy, 2021). However, there are several ways in which AI can contribute to increasing efficiency, raising standards of care, delivering on the promise of precision medicine, and supporting research (Koski & Murphy, 2021):

- **Information Synthesis:** The exponential growth in the volume of medically relevant data produced annually has reached a point where manual processing is no longer feasible (Koski & Murphy, 2021).
- **Augmenting Human Performance:** In the context of contemporary clinical practice, it is not feasible to process the entirety of the available information (Koski & Murphy, 2021). In instances of rare diseases or atypical manifestations of common diseases, a patient's presentation may deviate significantly from the typical experience of most clinicians, potentially leading to delays or errors in diagnosis and treatment (Koski & Murphy, 2021).

2.1.2 MAIN AREAS OF APPLICATION

The advent of AI technologies and their applications has enabled the provision of lifestyle interventions and reminders during the day based on an individual's vital signs through digital devices (Hee Lee & Yoon, 2021). It is anticipated that within healthcare organizations, AI-based technologies will significantly transform the way in which healthcare systems operate, optimize, and interact with patients, and provide care services, thereby increasing the overall efficiency of patient outcomes (Hee Lee & Yoon, 2021). There are several key areas within the field of healthcare where the application of AI is becoming increasingly prevalent.

Health Services Management

A significant benefit of AI techniques is their potential to enhance comprehensive health service management, facilitating the work of medical professionals, including doctors, nurses, and administrators (Secinaro et al., 2021). AI applications enable hospitals and health services to work more efficiently by providing clinicians with immediate access to data, allowing nurses to ensure better patient safety during medication administration, and keeping patients informed and engaged in their care through communication with their medical teams during hospital stays (Secinaro et al., 2021).

Disease Diagnosis and Early Detection

It is expected that AI facilitate the diagnosis of patients with specific diseases, as the use of AI-based technologies in various healthcare fields can help reduce errors made by human judgment (Hee Lee & Yoon, 2021).

The Mayo Clinic, a leading healthcare institution in the United States, has employed AI for cervical cancer screening. This has enabled the identification of pre-cancerous changes in a woman's cervix, which is a significant advancement in patient care and health technology. The AI-based solution employs an algorithm that utilizes over 60,000 cervical images from the National Cancer Institute to identify precancerous signs. Researchers have reported that the algorithm functions with a significantly higher accuracy rate (91%) than a trained human expert (69%) (Hee Lee & Yoon, 2021).

Personalized Treatment and Predictive Medicine

The option for personalized treatment will consider genomic variants in addition to contributing elements, including age, gender, location, ethnicity, genetic predisposition, cellular metabolic profile, microbiome, and ecological susceptibility of medical care (Mukherjee et al., 2023). Precision medicine offers the potential to enhance health outcomes while reducing the financial burden of healthcare. It can also mitigate the adverse effects of drug reactions and improve overall drug efficacy (Mukherjee et al., 2023).

The processing of health data collected from patients is conducted using healthcare applications in conjunction with data provided by patients on behaviors, emotional status, and dietary patterns (Mukherjee et al., 2023). Some of these applications employ deep learning algorithms to identify trends in the data, enhance projections, and furnish patients with tailored treatment suggestions (Mukherjee et al., 2023).

Clinical Decision Support

AI techniques can facilitate the extraction of clinically relevant information from the vast quantities of data generated in clinical settings, thereby enhancing the quality of clinical decision-making (Secinaro et al., 2021).

In the context of decision support or decision augmentation, humans serve a complementary role alongside AI systems, which involves supervision and collaboration (Sharma et al., 2022). In this regard, the efficacy of the AI system depends on the human operator's ability to utilize or disregard the recommendations generated by the system (Sharma et al., 2022).

Drug Discovery and Development

The advent of computational technology has facilitated the identification of novel pharmaceutical agents through the provision of more practical and cost-effective alternatives to traditional experimental procedures (Mukherjee et al., 2023).

AI is transforming the process of drug discovery and development, reducing the workload of humans in this field, and achieving targets in a shorter time frame. Furthermore, it is enhancing productivity and the efficiency of clinical trials (Paul et al., 2021). AI can identify hit and lead compounds and provide a more rapid validation of the drug target, as well as optimize the drug structure design. Figure 1 illustrates the diverse applications of AI in the field of drug discovery (Paul et al., 2021).

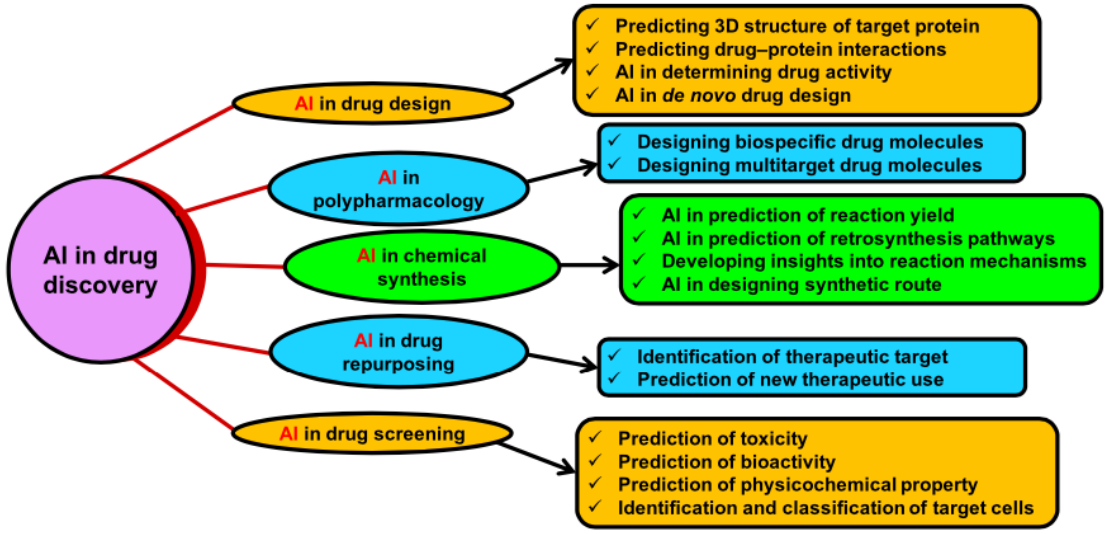

Figure 1 – Applications of AI in Drug Discovery
Proposed by (Paul et al., 2021)

Administrative and Managerial Tasks

Healthcare professionals are frequently overwhelmed with an excessive amount of paperwork during their duties, which has prompted the healthcare industry to transition to electronic systems that integrate and digitize medical records, with the assistance of AI-based technology (Hee Lee & Yoon, 2021).

AI has the potential to facilitate the organization and prioritization of nursing staff workloads at the commencement of a shift, as well as enable adjustments to be made to the planned

interventions throughout the shift in response to new orders and evolving patient needs (Koski & Murphy, 2021).

AI systems can perform routine operational activities with greater efficiency and at a faster pace than human workers, which include the management of maintenance systems, accounting, and information inquiry (Hee Lee & Yoon, 2021). The deployment of AI-enabled chatbots and nursing robots has the potential to markedly enhance the efficiency of operational processes (Hee Lee & Yoon, 2021).

Patient Engagement and Monitoring

The utilization of the IoT can facilitate the assessment and monitoring of patients remotely, thereby reducing the necessity for some home care visits (Koski & Murphy, 2021).

The monitoring of chronic disease requires a regular and consistent approach (Bhattamisra et al., 2023). The use of AI in this context allows for the implementation of virtual medical assistants, which can provide guidance and support through various forms of communication, including text messages and mobile applications (Bhattamisra et al., 2023).

For instance, discharged patients were provided with a Wi-Fi-enabled armband that remotely monitors vital signs, including respiratory rate, oxygen levels, pulse, blood pressure, and body temperature (Hee Lee & Yoon, 2021). This technology was implemented in a group of hospitals that serve a population of 500,000 individuals in southeast England (Hee Lee & Yoon, 2021). In this case, the implementation of AI programs that analyze patient data in real time led to a notable reduction in hospital readmission rates and emergency room visits (Hee Lee & Yoon, 2021). Additionally, the necessity for costly home visits was diminished by 22%, and in the long term, there was a marked increase in adherence to the treatment plan, reaching 96% compared to the industry average of 50% (Hee Lee & Yoon, 2021).

2.1.3 RPM IN PORTUGAL

In recent decades, Portugal has made progress in improving healthcare, but recent crises such as the sovereign debt crisis and the COVID-19 pandemic have increased the pressure on the NHS (Miranda et al., 2023). Problems such as underfunding, a shortage of professionals, an aging population, and fragmented services persist (Miranda et al., 2023). In this context, telemonitoring has emerged as a promising solution to improve access, increase efficiency, and strengthen the doctor-patient relationship, especially in the management of chronic diseases and multimorbidity, by enabling early detection of decompensation and avoiding unnecessary hospitalizations (Miranda et al., 2023).

Remote monitoring of cardiac implantable electronic devices (CIEDs) is a safe and effective alternative to conventional follow-up based solely on outpatient clinical visits (Oliveira et al., 2022). RM safely reduced the burden of in-office visits, with high levels of patient and healthcare professional satisfaction (Oliveira et al., 2022).

2.1.4 OPPORTUNITIES AND CHALLENGES

Hee Lee & Yoon, 2021, have identified several opportunities that have emerged because of the application of AI-based technologies in the healthcare industry, which span a diverse range of potential applications. They have also identified a few challenges that must be managed effectively (Table 1).

Table 1 – Opportunities and Challenges Involved in AI Applications in Healthcare. Proposed by (Hee Lee & Yoon, 2021)

Opportunities	Challenges
Improved Disease Treatments	Accountability of the System Use
Improved Patient Engagement and Participation	AI Divide
Improved Medical Error Reduction and Service Quality	Cybersecurity for Privacy and Security
Improved Operational Efficiency and Reduction of Medical Cost	Loss of Managerial Control
Increased Productivity and New Job Creation	Job Loss, Training/Education Needs, and the Pain of Transformation
Reduced Healthcare Cost	

However, Aung, Wong & Ting, 2021, considered the positive impact of AI using four concepts: relieving, splitting up, replacing, and augmenting.

In terms of **relieving** healthcare professionals, AI plays a crucial role in facilitating routine clerking duties, allowing staff to focus more on complex tasks that require human expertise. It assists the use of IT systems, making the handling of medical data more efficient. Another contribution is synthesizing and summarizing patient records, helping clinicians access relevant information quickly and accurately. Additionally, AI is valuable in the interpretation of scans, aiding in the early detection of abnormalities and improving diagnostic precision.

AI is also **replacing** many administrative functions traditionally performed by physicians and nurses. By automating these tasks, such as appointment scheduling or data entry, AI reduces the burden on healthcare staff. This shift allows physicians to dedicate more time to patient interaction and direct care, streamlining the overall healthcare process and enhancing the patient experience.

Moreover, AI contributes to **splitting up** healthcare workflows by preventing unnecessary hospital admissions through early screening and accurate diagnosis. It can provide real-time medical advice and help tailor chronic disease management to individual patients. This personalized approach improves long-term care and helps avoid complications by intervening earlier in the patient's treatment journey.

Lastly, AI plays an important role in **augmenting** medical knowledge and practice. It improves quantitative precision in diagnosis and treatment, reducing the likelihood of errors and improving overall patient safety. AI systems also mitigate unconscious biases that can affect clinical decisions, ensuring more equitable care. With access to the latest medical research and real-time updates, AI provides up-to-date guidance to healthcare professionals, helping them stay informed about the latest advancements and best practices.

According to Koski & Murphy, 2021, one of the principal obstacles to the adoption of AI is the availability and quality of data used for training, with limited generalizability due to the population from which the model was derived. From a clinical perspective, the key concerns are transparency, explainability, validation, usability, and liability (Koski & Murphy, 2021). A significant challenge in the acceptance of AI systems by clinicians is the lack of transparency in their functioning (Koski & Murphy, 2021). This is exemplified by the term 'black box', which describes the inability of clinicians to understand how recommendations are derived or validated (Koski & Murphy, 2021). A shift in focus is required in medical and nursing education, moving away from knowledge acquisition and toward the management, interpretation, and application of AI (Koski & Murphy, 2021). From a societal perspective, privacy represents a significant concern, although younger patients may be more accustomed to digital life (Koski & Murphy, 2021). Furthermore, considerations of equity and fairness are of paramount importance in determining the manner and demographic groups to whom these systems will be made available (Koski & Murphy, 2021).

2.2 RPM TECHNOLOGIES

2.2.1 CONCEPT

The prevalence of chronic disease has risen in parallel with population growth, yet hospital capacity remains inadequate to accommodate the growing number of patients (El-Rashidy et al., 2020). Furthermore, chronic diseases often necessitate specialized home care to meet patients' needs or administer therapy programs, which many caregivers and families lack the time or expertise to provide (El-Rashidy et al., 2020).

The development of e-health systems (e.g., remote patient monitoring (RPM), electronic health record (EHR) systems, mobile health (m-health), telemedicine, e-visits, e-consultations, etc.) facilitates continuous monitoring, diagnosis, prediction, and treatment (El-Rashidy et al., 2020). Consequently, these systems contribute to a reduction in healthcare costs, enable patients to perform their daily activities while their vital signs are fully monitored, and allow

physicians to follow up with patients at any time, not just when patients are physically present at a hospital (El-Rashidy et al., 2020).

RPM represents a rapidly evolving field within the healthcare sector (Shaik et al., 2022). Its objective is to provide clinicians with additional support, enabling them to deliver care in a range of general hospital medical and surgical wards using flexible materials for wearable sensors (Shaik et al., 2022).

The necessity for high-quality RPM increased significantly with the emergence of COVID-19 (Condry & Quan, 2023). Given the highly contagious nature of the virus, it was not advisable for patients to attend treatment facilities unless it was essential and could not be conducted remotely (Condry & Quan, 2023). Consequently, numerous conventional doctor visits were substituted with online interviews with the patient (Condry & Quan, 2023).

2.2.2 Approaches and Technologies

This section provides an overview of the primary approaches and technologies supporting RPM. It describes the roles of handheld devices, smartphones, mobile health applications, artificial intelligence (AI), machine learning, the Internet of Things (IoT), and blockchain technology, as well as telemonitoring and telehealth services. Each subsection explains how these technologies contribute to more efficient, accurate, and patient-centered healthcare.

Wearable Devices

The advent of new technology, such as wearable sensors, has enabled the implementation of continuous remote monitoring, which can facilitate the optimization of patient monitoring (Posthuma et al., 2020). This technology provides nurses with the ability to measure vital signs with greater frequency and accuracy, thereby enhancing their ability to provide care (Posthuma et al., 2020).

Smartphones and Mobile Health Applications

Smartphone applications provide real-time updates concerning a patient's health status to healthcare professionals via the cloud (El-Rashidy et al., 2020). The system also provided a filter system that compared a patient's vital signs with normal readings saved in a lookup table (El-Rashidy et al., 2020). If a patient's condition was found to be abnormal, the system sent a Short Message Service (SMS) to their doctors automatically, including the patient's health status and a link to the patient's medical record saved on the cloud (El-Rashidy et al., 2020).

Artificial Intelligence (AI) and Machine Learning

In the context of RPM applications, traditional machine learning and deep learning represent two of the most prevalent methods of AI employed for the purpose of detecting and predicting vital signs, as well as classifying patients' physical activities (Shaik et al., 2022).

The main objective of AI is to construct systems that are capable of simulating human thought processes, using a range of technologies, which enable the performance of various healthcare tasks with a level of proficiency that surpasses that of a human (El-Rashidy et al., 2020). Furthermore, AI techniques are employed in the analysis of patient data and the prediction of future occurrences (El-Rashidy et al., 2020). This facilitates the development of an intelligent interface that interacts with the patient and enhances their engagement with the therapy plan (El-Rashidy et al., 2020). Subsequently, this information is employed to augment patient autonomy and awareness (El-Rashidy et al., 2020).

Internet of Things (IoT) and Blockchain

The Internet of Things (IoT) has the potential to facilitate the automatic connection of sensors, devices, and patients without the need for human intervention through the utilization of remote monitoring systems (El-Rashidy et al., 2020).

The integration of the IoT and Blockchain represents a promising solution for the development of a smart RPM system and can enhance the reliability and scalability of IoT systems, while also increasing the interoperability of IoT devices (Ashraf & Reaz, 2021). Blockchain is capable of processing and storing heterogeneous data, while also maintaining data integrity and anonymity (Ashraf & Reaz, 2021).

Telemonitoring and Telehealth

Teleconsultation employs telecommunication technologies between two geographically disparate healthcare providers or a healthcare provider and a patient, with the objective of performing a diagnosis and subsequent treatment (De Farias et al., 2019). Additionally, it enables physicians to monitor their patients at any given moment, thereby enhancing the physician-patient relationship and treatment outcomes (De Farias et al., 2019).

Tele-education can be defined as the capacity of a physician or healthcare team to provide ongoing educational services to a patient (De Farias et al., 2019). Ultimately, this enables patients to gain a more comprehensive understanding of their illness, the treatments they are receiving, and the potential for improvement in clinical outcomes (De Farias et al., 2019).

Telemonitoring, or remote monitoring, represents an innovative strategy for the promotion of health and improvement in patient management and care and includes both teleconsultations and tele-education (De Farias et al., 2019).

2.3 KEY BARRIERS TO THE ADOPTION OF RPM TECHNOLOGIES

Remote Patient Monitoring (RPM) technologies hold great promise for healthcare, enabling better chronic disease management and expanding access to underserved populations. However, there are multiple barriers to widespread adoption. For example, while RPM can increase efficiency, improve health outcomes, and reduce costs, studies report that many

healthcare providers are reluctant to adopt these technologies due to costs, mistrust in technology, or lack of understanding of the benefits of remote monitoring" (Smith et al., 2023).

Patients also face challenges, including issues of accessibility and engagement, as many households lack internet or devices, making it difficult for low-income and rural populations to participate in RPM programs (Chen et al., 2021). In addition, data integration challenges and workflow disruptions continue to discourage providers from integrating RPM systems into clinical practice.

These barriers, which span technological, financial, human, organizational, and equity dimensions, highlight the need for coordinated efforts to overcome systemic barriers and ensure the successful implementation of RPM. These key barriers are discussed in more detail in the following sections.

2.3.1 Technological and Infrastructure Barriers

One of the most significant barriers to the adoption of RPM is the technological infrastructure required for its effective implementation. A key challenge is the lack of interoperability between RPM devices and electronic health record (EHR) systems (Smith et al., 2023), making it difficult for healthcare providers to efficiently access and interpret data trends.

In addition, infrastructure disparities, particularly in rural areas, exacerbate the problem. It is important to note that a considerable proportion of the global population will be unable to access technology or the internet, given that some countries lack the requisite technological infrastructure to support digital health (Houlding et al., 2021).

A considerable number of healthcare facilities lack the requisite connectivity and hardware to support RPM systems. Health Information Technology (HIT) systems require significant investment to improve data availability and interoperability, and the initial costs associated with such infrastructure can be considerable (Chen et al., 2021).

2.3.2 Financial and Economic Barriers

Financial considerations represent a further substantial obstacle to the adoption of RPM. In Europe, the reimbursement of RPM tools is highly fragmented due to the existence of different healthcare systems and insurers. In some countries, healthcare providers or hospitals may enter into an agreement with health insurers regarding the optional provision of RPM tools (Hamann et al., 2023).

Healthcare providers have articulated concerns regarding the exorbitant upfront costs and extended timeframes for return on initial investments, as well as the challenges posed by coverage and reimbursement policies, which are significant obstacles to physicians' adoption of telehealth systems (Bonet Olivencia et al., n.d.).

2.3.3 HUMAN AND SOCIAL BARRIERS

The human and social barriers to RPM adoption are characterized by resistance from both patients and healthcare professionals. The lack of digital literacy among patients and healthcare professionals represents a significant barrier to the optimal utilization of RPM (Hamann et al., 2023).

Many patients and clinicians are reluctant to adopt and use remote monitoring technology, for many different reasons (Smith et al., 2023). Smith et al., 2023, did a survey-based qualitative study, where the top three barriers identified by patient participants were 'interferes with other responsibilities', 'lack of time', and 'difficulty with depression/anxiety/other mental health issues'.

Table 2 – Patient Identified Barriers to Technology Adoption
Proposed by (Smith et al., 2023)

Patient Responses	**Mean score**
Overwhelming	1.73
Feeling what they do doesn't help	1.65
Not covered by my insurance plan	1.62
Difficulty with vision/hearing/ physical movement	1.69
No one to help me	1.81
Not interested	1.35
Lack of information and support	1.62
Lack of support from family and friends	1.85
Interferes with other responsibilities	1.89
Lack of time	1.89
Feeling I can't do things correctly	1.48
Difficulty communicating with the provider	1.63
Lack of help from healthcare professionals	1.58
Lack of trust in my provider	1.19
Difficulty with depression/anxiety/other mental health concerns	1.92
I don't trust technology tools	1.42
I don't understand how to use technology tools to improve my health	1.65
Too tired to at the end of the day to learn new skills	1.69
Feel that there is too much information being given to me	1.31
Fear of being judged by healthcare providers	1.38
Shares too much information about me and my health	1.54
Information can be used to disqualify me from social services they need	1.31
Not able to read or write	1.35
Being a part of a monitoring program is too much work	1.42
Doctors don't understand what's important to me	1.31
Feeling that their illness is not that serious	1.12
Less time with their healthcare provider	1.46

2.3.4 Organizational and Systemic Barriers

From an organizational standpoint, structural and cultural barriers prevent the integration of RPM technologies. It is frequently challenging for healthcare organizations to align RPM initiatives with existing workflows (Bonet Olivencia et al., n.d.).

The necessity for the establishment of quality “best practice" guidelines for the utilization of RPM tools in clinical care represents a crucial priority for further efforts (Houlding et al., 2021).

Previous research has identified concerns regarding the ease of adoption and potential disruption to existing workflows as significant barriers to the uptake of RPM by healthcare providers (Bonet Olivencia et al., n.d.).

2.3.5 Equity and Accessibility Barriers

Equity and accessibility concerns constitute some of the most significant obstacles to the adoption of RPM, particularly among underserved populations. Although telehealth has the potential to enhance the quality, efficiency, and cost-effectiveness of healthcare, the primary obstacle to its adoption in rural hospitals is the financial burden associated with its implementation (Chen et al., 2021). This challenge could be further compounded by the complex and time-consuming reimbursement process for telehealth services (Chen et al., 2021). Additional barriers include technological concerns and the perception that patient needs can be met without telehealth (Chen et al., 2021).

The utilization of electronic health records (EHRs) by healthcare providers in urban and rural settings was comparable (Chen et al., 2021). However, the study also identified a lower level of patient engagement among rural residents (Chen et al., 2021). The authors of the study posited that this discrepancy was attributable to variations in internet access, the availability of a usual source of care, and the presence or absence of provider encouragement to access medical records (Chen et al., 2021).

Some developing countries encounter significant challenges to the effective implementation of digital health solutions in rural and remote areas (Houlding et al., 2021). These include the lack of basic digital infrastructure, such as computers, internet networks, and electricity, as well as a dearth of sustainable funding to develop, operate, and maintain digital platforms (Houlding et al., 2021).

3 METHODOLOGY

The Methodology section provides a detailed description of the systematic approach used in the research. To achieve the research objectives, a qualitative method is used, which includes a systematic literature review and interviews with healthcare professionals. The methodology provides a comprehensive understanding of the research topic from the exploration to the conclusion phase.

As shown in Figure 2, each phase of the research consists of specific steps with the goal of providing actionable recommendations that will accelerate the integration of RPM technologies into healthcare practices, ultimately improving patient care and system efficiency. The following sections provide a detailed description of each phase and its components.

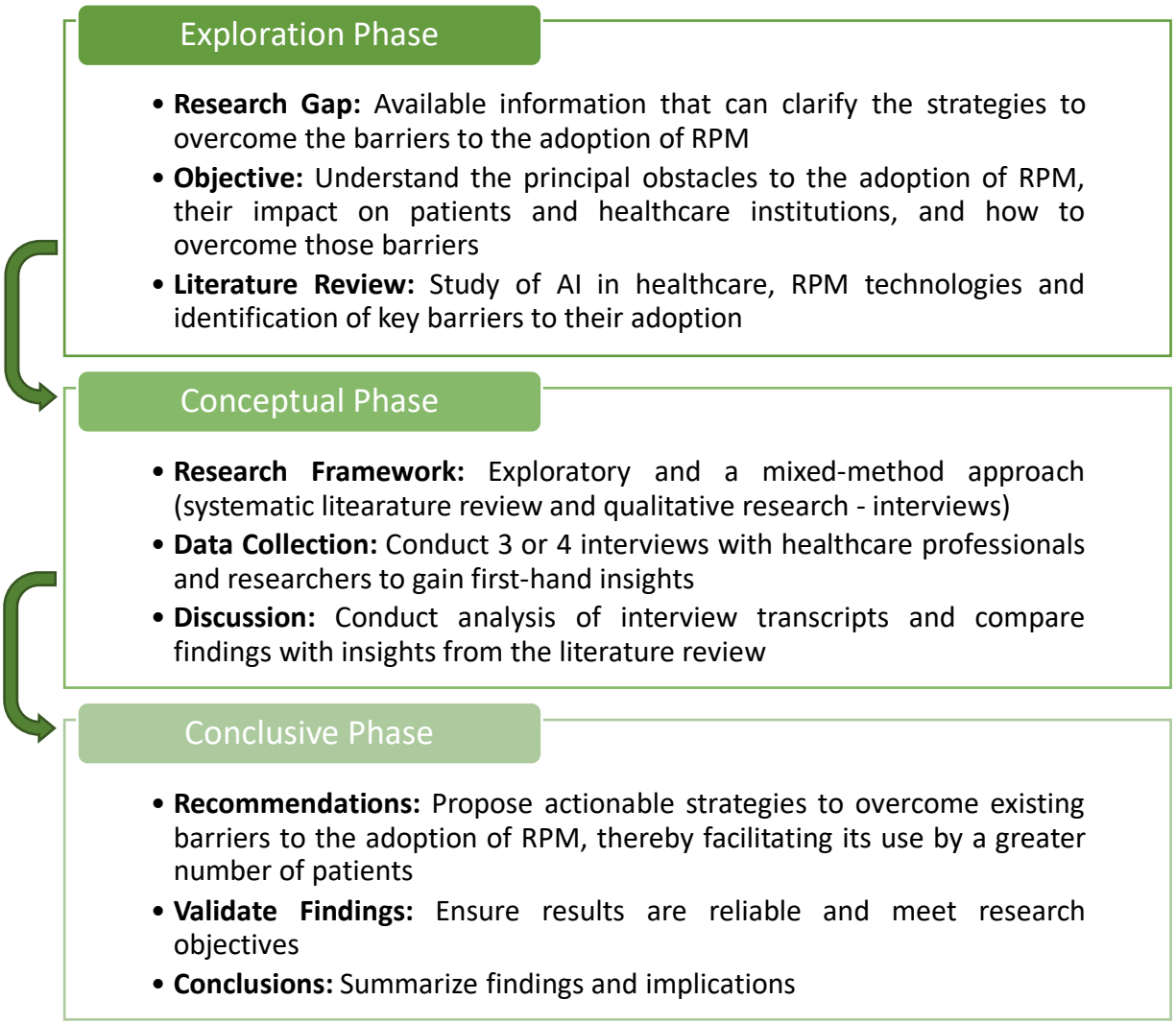

Figure 2 – Phases of the Methodology

3.1 EXPLORATION PHASE

This phase clarifies the research problem, establishes feasible objectives, and gathers background knowledge through a systematic literature review and structured interviews.

The first step is to identify the research gap. In this case, the available information can clarify the strategies to overcome the barriers to the adoption of RPM.

Then, the main objective is to understand the main obstacles to the adoption of RPM and their impact on patients and healthcare institutions, and how modifications in some areas might help to overcome these difficulties.

Finally, a review of academic papers and articles on AI applications in healthcare, their challenges, and opportunities, as well as RPM technologies and their key barriers to adoption by area need to be conducted, followed by interviews with healthcare professionals and researchers to gather first-hand insights.

3.2 CONCEPTUAL PHASE

This is the phase in which the research is structured through the framework of the methodological approach, the collection of data interviews, and the discussion of the analysis of these interviews.

The first step is to define the research framework. This research will follow an exploratory approach, i.e., investigate a new or poorly understood phenomenon, identify patterns, or generate ideas, and a mixed-methods approach, based on systematic literature review and qualitative research (interviews).

The second stage involves conducting 3 or 4 interviews with health professionals and researchers to obtain informed positions that will give a clearer picture of how to overcome the barriers that exist in the adoption of RPM.

The last step requires the discussion of the interview transcripts and the comparison of this information with the findings from the literature review.

3.3 CONCLUSIVE PHASE

The final phase is designed to develop recommendations, validate findings, and draw conclusions.

First, propose viable strategies for overcoming RPM barriers to accelerate the integration of these technologies into mainstream healthcare practices, ultimately improving patient care and system efficiency.

Second, ensure that the results are reliable, evaluate whether they meet all the research objectives, and answer the research questions.

The final step aims to summarize what actions should be taken to overcome the existing barriers to the adoption of RPM, improve the speed of diagnosis, and reduce healthcare costs by minimizing the need for frequent hospital visits, improving the quality of life of patients, and reducing the burden on healthcare facilities.

4 DATA COLLECTION, RESULTS AND DISCUSSION

This chapter presents and discusses the results of a series of semi-structured interviews with key figures in the Portuguese healthcare system. The goal is to explore the obstacles to adopting RPM technologies and to identify potential solutions. The analysis is organized into four sections: an overview of the interview methodology and participant profiles; a discussion of the main implementation challenges; an examination of the main barriers to RPM adoption; and an exploration of the role of artificial intelligence in overcoming these challenges. The chapter concludes with a summary of the proposed strategies to facilitate the wider, more effective use of RPM in Portugal.

4.1 INTERVIEWS

This subchapter, which is based on a review of the extant literature, identifies the key barriers, challenges, and opportunities associated with the adoption of remote patient monitoring (RPM) technologies. The subsequent section explores the primary qualitative data collection method employed: semi-structured interviews. The objective of these interviews is to explore the barriers to RPM adoption in Portugal and to examine their impact on stakeholders, as well as potential solutions.

A comprehensive review of the extant literature identified numerous factors that impede the adoption of RPM. These include technology gaps, poor interoperability, and resistance from patients and providers. Financial constraints also play a role in this phenomenon. The interview questions have been meticulously designed to delve into these findings. The objective of this interview study is to elucidate the manifestation of barriers within the Portuguese healthcare system and to assess the impact on healthcare professionals and patients.

This interview is divided into three thematic areas:

- **Identification and nature of barriers**, exploring the status of RPM in Portugal and identifies key barriers to its adoption.
- **Detail examination of barriers**, investigating specific categories of barriers and their impact on healthcare professionals and patients.
- **Solutions and recommendations to overcome the barriers**, exploring expert suggestions on overcoming these barriers, the role of AI and emerging technologies, and the responsibilities of stakeholders in promoting sustainable RPM adoption.

The structure of the interview is as follows:

A. Identification and Nature of the Barriers

1. What is your opinion on the role of remote patient monitoring in the Portuguese healthcare system? Do you think this technology is gaining traction, or is it still at an early stage?

2. What do you perceive as the main barriers to the adoption of RPM in Portugal?

3. From a policy and regulatory perspective, how do you assess the impact of existing public policies and reimbursement structures on the implementation of RPM?

B. Exploring Key Barriers in More Detail

→ **Technological and Infrastructure Barriers**

1. How do interoperability issues with electronic health records (EHRs) and infrastructure disparities (e.g., internet access, connectivity) impact the adoption of RPM in Portugal?

→ **Financial and Economic Barriers**

2. To what extent do financial costs (e.g., upfront investments, maintenance) and reimbursement policies deter healthcare providers from adopting RPM?

→ **Human and Social Barriers**

3. How do these barriers affect the performance of healthcare professionals in their daily work?

4. What factors do you think contribute most to the potential resistance or non-adherence of patients to remote monitoring?

→ **Organizational and Systemic Barriers**

5. What challenges arise when integrating RPM into existing clinical workflows, and how could standardized guidelines help facilitate adoption?

→ **Equity and Accessibility Barriers**

6. How accessible is RPM for underserved populations, and what role do socioeconomic factors like income and education play in patient engagement?

C. Solutions and Recommendations for Overcoming Barriers

1. What would be the priority measures to overcome the barriers identified?
2. How could artificial intelligence and other emerging technologies help address the challenges associated with RPM adoption?

3. How can we encourage both healthcare professionals and patients to trust and adopt these technologies more quickly?
4. What role should technology companies, governments, and healthcare institutions play in creating a viable and sustainable environment for RPM?

Interviewee Profiles

To provide a range of perspectives on the adoption of remote patient monitoring technologies in Portugal, a series of interviews were conducted with experts from a variety of professional fields, including academia, health policy, eHealth innovation, and hospital administration. The participants' combined experience covers the technological, regulatory, and operational dimensions that are fundamental to this study:

***Interviewee 1*:** A top academic and researcher in AI and data science, and its application in healthcare. This person has led major research initiatives and holds extensive knowledge about the technical challenges and opportunities of remote patient monitoring.

***Interviewee 2*:** A professional with a dual role as a doctor and political leader. With a focus on public health and technology use, this interviewee provides insight into the regulations and patient-centered models that impact the implementation of remote patient monitoring systems.

***Interviewee 3*:** A healthcare IT professional and former leader of national eHealth initiatives. This professional has helped implement digital health and interoperability solutions, providing insights into the barriers to integrating remote monitoring technologies.

***Interviewee 4*:** A senior health administrator with extensive experience in managing public health institutions. This person has an operational view of the organizational challenges and the practical feasibility of adopting remote patient monitoring technologies in healthcare.

4.2 Results and Discussion

The results presented in this section are based on four semi-structured interviews with experts in healthcare, policy, technology, and administration. The full transcripts of these interviews are included in appendices B, C, D, and E. The discussions centered on gathering expert opinions on the main barriers to adopting RPM in Portugal, the impact of these challenges on stakeholders, and potential strategies, such as technological innovations and policy interventions, to support sustainable implementation.

The interviews were productive, providing valuable and in-depth insights into the challenges and opportunities of RPM in Portugal. The interviewees identified structural and technological barriers, such as the lack of interoperability between systems (*interviewee 3*) and the overload of clinical data without adequate filtering (*interviewee 4*), as well as financial obstacles, including high costs and the absence of clear financial incentives (*interviewees 2 and 4*). On a human and social level, resistance on the part of professionals and low digital literacy among

patients were highlighted as barriers to the adoption of RPM (*interviewees 1 and 2*), while unequal access to technology can limit its impact on the most vulnerable populations (*interviewee 3*).

To mitigate these barriers, the interviewees suggest national interoperability standards to facilitate the integration of EHR into hospital systems (*interviewees 3 and 4*), the use of artificial intelligence to screen data and reduce the workload of professionals (*interviewee 4*), funding models based on clinical results to incentivize the adoption of the technology (*interviewee 2*) and continuous training for healthcare professionals, accompanied by awareness campaigns for patients (*interviewees 1 and 2*). In addition, they emphasize the importance of ensuring equity in access to RPM, guaranteeing that all populations can benefit from this technology (*interviewees 1 and 3*).

4.3 DISCUSSION

The discussion is organized into four main areas that emerged from the interviews and literature review: technological and implementation challenges of RPM; main barriers to adoption; the role of artificial intelligence in improving RPM; and strategies to overcome these obstacles. Each subsection integrates interview results with relevant literature to provide a critical, contextualized understanding of RPM's current state and future potential in the Portuguese healthcare system.

4.3.1 RPM TECHNOLOGIES AND IMPLEMENTATION CHALLENGES

The literature review describes the main technologies used in RPM, including wearables, mobile applications, and data transmission systems (Section 2.2). Nevertheless, a recurrent challenge cited in the extant literature pertains to the absence of seamless integration between these tools and electronic health records, a phenomenon that impedes the widespread adoption of RPM.

This assertion is corroborated by interviewees, who attest to the fact that a major technological impediment to the widespread adoption of RPM is the absence of interoperability between hospital systems and RPM platforms. *Interviewee 3* further emphasizes that hospitals' electronic records were not designed to receive RPM data, necessitating substantial adaptations. Furthermore, *interviewee 4* highlights that the inundation of unfiltered data can impede the efficacy of RPM, underscoring the necessity for solutions that prioritize the extraction of salient information.

The convergence of the extant literature and the interviewees' perceptions serves to reinforce the necessity to develop interoperability standards and to invest in adapting hospital systems. The absence of such fundamental modifications will inevitably result in the constrained and disparate implementation of RPM.

4.3.2 MAIN BARRIERS TO THE ADOPTION OF RPM

The adoption of RPM faces several barriers, as identified in both the literature review and the interviews conducted. From a technological and infrastructural point of view, the main challenges include the lack of reliable connectivity, the lack of interoperability standards between hospital systems and RPM platforms, and the abundance of unfiltered data. *Interviewee 3* points out that the lack of integration with electronic hospital records hinders the adoption of RPM, while *interviewee 4* stresses the need to better manage the volume of information generated. *Interviewee 1* also warns of the digital exclusion of the most vulnerable populations, especially in rural areas with limited internet access.

On the financial and economic side, high initial costs and the lack of sustainable reimbursement models are factors that hinder the implementation of RPM. *Interviewees 2 and 4* point to the initial investment in equipment as a significant barrier, while *interviewee 3* argues that although funding is available, many hospitals do not know how to access it, highlighting the need for clearer communication about funding mechanisms.

In terms of human and social barriers, resistance from healthcare professionals and lack of digital literacy among patients are key challenges. Many patients are still unaware of RPM or consider it invasive (*interviewees 1 and 2*), while *interviewee 3* emphasizes that acceptance depends on how the technology is presented. When patients perceive RPM as complementary to face-to-face follow-up, adherence tends to be higher, reinforcing the importance of awareness campaigns and digital training to promote user confidence and involvement.

At an organizational and systemic level, RPM is still not considered a priority by hospital administrators, which makes its structured implementation difficult. *Interviewee 4* mentions that institutional resistance and the lack of clear policies limit adoption, while *interviewee 3* warns of the time and human resources needed to integrate RPM into hospital workflows. These challenges point to the need for national policies to encourage and facilitate implementation.

Interviewee 3 also points to the lack of up-to-date national guidelines and strategic direction, noting that the last major policy document in this area, the *Plano Estratégico Nacional para a Telessaúde* (PENTS) (Annex A), expired in 2023 without being revised or replaced. Although the PENTS set out a comprehensive vision for the integration of telemedicine and remote monitoring into the Portuguese healthcare system, its discontinuation without a follow-up strategy reflects a lack of policy continuity and institutional prioritization. This lack of updated national standards and policy direction reinforces the perception that RPM is being treated as an experimental initiative rather than a structural component of care delivery.

Finally, in terms of equity and accessibility, the literature points to inequalities in access to RPM related to socio-economic and geographical factors. *Interviewee 3* points out that RPM mainly benefits patients with better family support, while *interviewee 2* mentions that the perceived cost can be an obstacle for lower-class patients. These challenges underline the

need for inclusive policies that guarantee access to RPM for the entire population and prevent this technology from exacerbating existing inequalities in the healthcare system.

4.3.3 Artificial Intelligence in Healthcare and its Relevance to RPM

The literature review suggests that AI plays a pivotal role in optimizing RPM, enabling more efficient analysis of clinical data, aiding diagnosis, and improving the predictive capacity of healthcare systems (Section 1.3). Nevertheless, challenges about data privacy and the necessity to train healthcare professionals are often cited as impediments to its implementation.

The interviewees corroborate this view, highlighting AI as a key element for filtering and prioritizing clinical data. *Interviewees 3 and 4* further emphasize that the deluge of data generated by RPM devices can overwhelm healthcare professionals, underscoring the necessity for the implementation of algorithms that can effectively identify only the relevant clinical events. Furthermore, *interviewees 2 and 3* posit that virtual assistants and chatbots can facilitate support for patients, thereby promoting adherence to RPM.

Despite the potential of AI to improve the efficiency of RPM, there are still challenges to overcome, namely in terms of data security, acceptance by professionals, and the development of interoperable systems. The necessity for clear regulations and national guidelines for incorporating AI into remote monitoring is a point emphasized by both the literature and the interviewees.

4.3.4 Proposals and Strategies to Overcome Barriers

The analysis of the interviews and the literature review shows that the adoption of RPM faces challenges on several fronts. However, several strategies to mitigate these barriers were identified in both the literature and the interviewees' suggestions.

Suggested solutions in the scientific literature include the development of interoperability standards, financial incentives, awareness campaigns, and digital inclusion programs. These approaches aim to reduce resistance from healthcare professionals and patients, ensure sustainable funding, and improve the technological infrastructure for RPM.

The interviewees, on the other hand, presented solutions that were more applicable to the Portuguese context, emphasizing the need for national protocols for system integration, better use of available funds, training of health professionals, and involvement of the private sector. They also mentioned the importance of an educational approach for patients and a more equitable distribution of RPM services.

Table 3 summarizes the barriers identified and the strategies proposed to overcome them:

Table 3 – Strategies to Overcome RPM Barriers

Barrier Category	Barrier Description	Solutions Proposed in the Literature Review	Solutions Proposed by Interviewees
Technological and Infrastructure	Lack of integration between hospital systems and RPM platforms; Too much unfiltered data; Dependence on stable connectivity	Development of interoperability standards; Implementation of AI algorithms for data filtering; Expansion of digital infrastructure	Definition of national interoperability protocols (*interviewee 3*); Better management of clinical data to avoid overload (*interviewee 4*)
Financial and Economic	High implementation costs; Lack of clear financial incentives; Absence of a sustainable reimbursement model	Creation of financial incentives for hospitals; Definition of sustainable reimbursement models; Public-private partnerships	Greater clarity on the funds available to finance RPM (*interviewee 3*); Involvement of the private sector in implementing the technology (*interviewee 2*)
Human and Social	Resistance on the part of healthcare professionals to adopting RPM; Lack of digital literacy among patients; Fear of losing human contact	Awareness-raising campaigns on the benefits of RPM; Digital empowerment of professionals and patients; Development of virtual assistants	Continuous training for healthcare professionals (*interviewee 1*); Pedagogical approach to increase patient acceptance (*interviewee 4*)
Organizational and Systemic	Institutional resistance to change; Lack of training for health professionals; Absence of clear policies for the adoption of RPM	Revision of national health policies to include RPM as a priority strategy; Continuous training for professionals; development of clear guidelines	Creation of institutional incentives to promote the adoption of RPM (*interviewee 2*); Gradual implementation to reduce resistance to change (*interviewee 3*)
Equity and Accessibility	Inequality in access to RPM due to socio-economic and geographical factors; Greater difficulty for more vulnerable populations	Digital inclusion programs and equitable distribution of resources; Government support to ensure connectivity and accessibility to RPM	Better distribution of RPM services to more vulnerable populations (*interviewee 3*); Sensitization to ensure uptake by different social groups (*interviewee 1*)

5 ACTIONABLE STRATEGIES TO OVERCOME EXISTING BARRIERS TO THE ADOPTION OF RPM

To define impactful and context-specific strategies, this chapter presents actionable recommendations to overcome the main barriers to adopting RPM in Portugal. These recommendations were developed by synthesizing knowledge from a literature review and interviews with experts. The resulting framework serves as a practical guide for policymakers, healthcare institutions, and other stakeholders seeking to implement RPM in a structured, equitable, and sustainable manner.

5.1 RECOMMENDATIONS

The adoption of RPM faces significant technological, financial, social, organizational, and equity barriers. Based on the literature review and interviews with healthcare professionals, this chapter presents a set of actionable strategies to facilitate the implementation of RPM in the Portuguese healthcare system.

The recommendation framework presented below (Figure 3) provides a visual synthesis of the key strategies proposed to support the successful implementation of RPM in the Portuguese healthcare system. At the center of the model is RPM, surrounded by the four main strategic areas identified through literature and expert interviews:

1) AI to improve RPM
2) Health policy reforms
3) Education/training programs
4) Optimization of clinical workflows

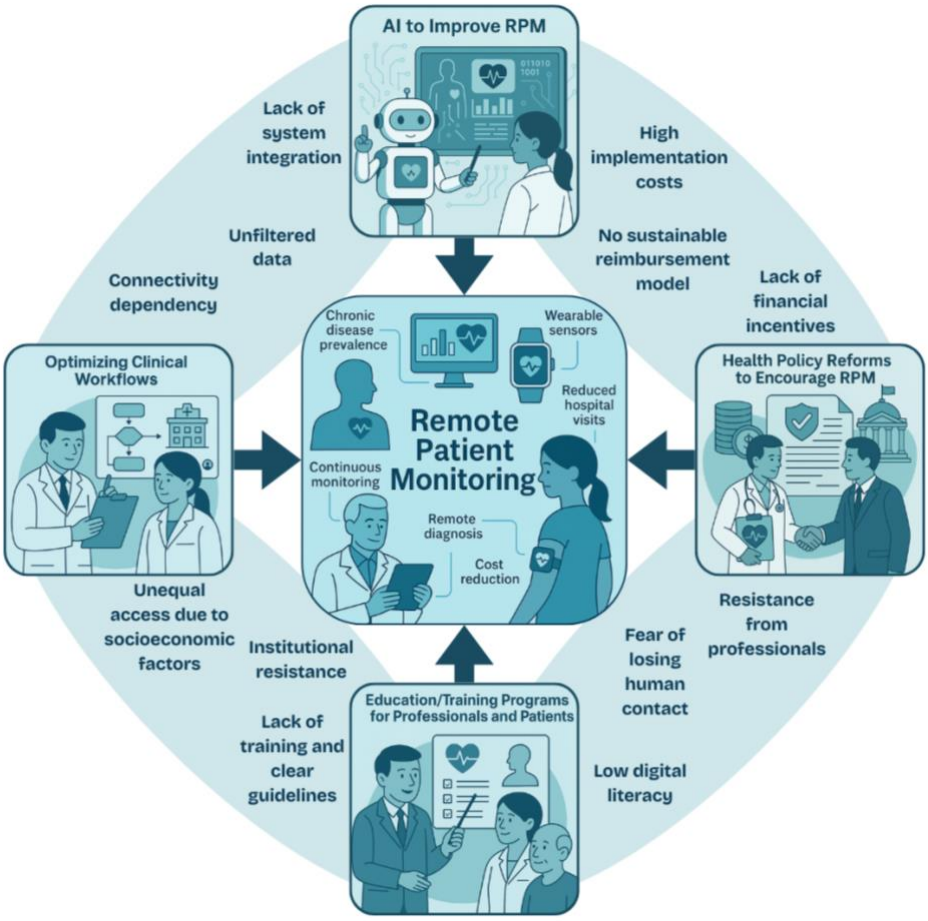

Figure 3 – Recommendation Framework

Each quadrant highlights one of these focus areas and is linked to specific barriers that hinder the adoption of RPM. These challenges are grouped into five overarching categories: technological and infrastructure, financial and economic, human, and social, organizational and systemic, and equity and accessibility:

- ➔ AI to improve RPM addresses technical issues such as lack of system integration, unfiltered data, and connectivity dependency.
- ➔ Health policy reforms address economic barriers, including high implementation costs, lack of financial incentives, and unsustainable reimbursement models.
- ➔ Education/training programs address people-related challenges such as professional resistance, low digital literacy, and fear of losing human contact.
- ➔ Optimizing Clinical Workflows focuses on systemic and equity issues, including institutional resistance, lack of training, and inequitable access due to socioeconomic disparities.

The framework also focuses on the core benefits of RPM, such as continuous monitoring, remote diagnosis, cost reduction, and improved chronic disease management. By mapping each strategic recommendation to its associated barriers, this framework provides a

structured and actionable guide for decision-makers seeking to advance RPM adoption sustainably and equitably.

5.1.1 Using Artificial Intelligence to Improve RPM

The amount of data generated by RPM devices is one of the biggest challenges for healthcare professionals, as it can lead to information overload and hinder clinical decision-making. To overcome this obstacle, it is essential to invest in artificial intelligence as a means of filtering, prioritizing, and interpreting the data collected to ensure that only the most relevant information reaches doctors and nurses.

Implementing predictive models based on machine learning would allow patient data to be analyzed in real-time, identifying clinical patterns, and reducing the number of unnecessary alerts. This would allow healthcare professionals to focus on only those cases that require intervention. In addition, the integration of AI into remote screening and monitoring can be complemented by virtual assistants and chatbots to help patients use devices, clarify common doubts, and provide technical support, reducing the need for direct interactions with healthcare services.

Another key strategy is to develop intelligent dashboards that allow healthcare professionals to view RPM data in an organized and intuitive way. These platforms should present predictive analytics and simplified reports to ensure that medical decisions can be made based on clear and useful information. However, for these innovations to be effective, they must be accompanied by clear security and privacy standards that ensure compliance with the General Data Protection Regulation (GDPR) and increase the confidence of professionals and patients in the use of AI in the context of RPM.

5.1.2 Health Policy Reforms to Encourage RPM

The lack of a regulatory framework and structured financing models is one of the main barriers to the uptake of RPM in Portugal. To ensure the sustainable growth of this technology in the NHS, policy reforms must be implemented to incentivize its use and ensure its long-term economic viability.

One of the first measures to be considered is the inclusion of RPM in NHS program contracts, with specific targets and adequate funding for its implementation. Creating financial incentives for hospitals and health units to adopt RPM can speed up the transition to this monitoring model and reduce institutional resistance. To ensure sustainable funding, it is also necessary to develop reimbursement models adapted to RPM that allow hospitals and clinics to be properly compensated for services provided remotely.

In addition to financial incentives, it is essential to update the National Strategic Plan for Telehealth, including specific guidelines for RPM and establishing a regulatory body responsible for monitoring the implementation of this technology. At the same time, it is

essential to define national interoperability standards, ensuring that remote monitoring systems can be effectively integrated with EHRs and other hospital systems.

The involvement of the private sector can also play an important role in the dissemination of RPM. The development of public-private partnerships and the inclusion of EHRs in health insurers' plans can increase patient access to these services, relieving pressure on the NHS and ensuring that EHRs are an accessible solution for a greater number of patients.

5.1.3 Education and Training Programs for Professionals and Patients

Resistance from healthcare professionals and lack of digital literacy among patients are significant barriers to the adoption of RPM. Therefore, the creation of targeted training programs for healthcare professionals and awareness-raising initiatives for patients are essential to increase acceptance and facilitate the use of remote monitoring technologies.

In the case of healthcare professionals, the introduction of mandatory courses on RPM can contribute to greater familiarity with the technology. These courses should be integrated into the continuing education promoted by professional bodies and medical associations to ensure that doctors and nurses acquire the necessary skills to prescribe and use RPM effectively. It is also recommended that RPM be included in the curricula of medical and nursing schools to prepare new generations of healthcare professionals for this digital transformation.

For patients, awareness campaigns about the benefits of RPM can be an effective strategy to increase adherence. Creating accessible educational materials, such as explanatory videos, interactive guides, and online support platforms, can help patients better understand how RPM works and feel more confident using the devices. Digital literacy can be promoted through specific community programs for more vulnerable groups, such as the elderly and low-income populations, to ensure that no one is excluded from access to this technology.

Finally, creating a program of 'RPM ambassadors', made up of doctors and nurses who are already using the technology, can be an effective way of spreading good practice and encouraging other professionals to adopt it. Sharing experiences among colleagues and institutional recognition for those who promote RPM in their health units can greatly accelerate the uptake of this technology.

5.1.4 Optimizing Clinical Workflows

The introduction of RPM requires changes to hospital workflows to ensure that the technology is integrated efficiently and sustainably. Redefining clinical protocols is an essential step to ensure that RPM is used in a structured way without overburdening healthcare professionals.

One of the key recommendations is to create standardized protocols for prescribing and monitoring patients with RPM so that all healthcare professionals have clear guidelines on when and how to use this technology. To facilitate this transition, it may be useful to designate

dedicated RPM teams within hospitals, responsible for monitoring data and communicating with patients.

In addition, allocating specific human resources to RPM can contribute to more effective implementation. Introducing the role of RPM coordinators within healthcare facilities would allow for better follow-up of remotely monitored patients and ensure that clinical alerts are analyzed efficiently.

Finally, before rolling out RPM nationwide, it would be prudent to conduct pilot projects in different hospitals and health centers, allowing the technology to be tested in a real-world environment and workflows to be adapted before widespread implementation.

5.2 Reflection on the Practical Usefulness of the Recommendations

This section reflects the strategies proposed to overcome the barriers to the adoption of RPM technologies in the Portuguese healthcare system. The recommendations enumerated in the preceding section are evaluated based on several criteria, including their relevance, feasibility, alignment with stakeholder input, anticipated impact, and identified limitations.

The strategies presented are strongly aligned with the five main categories of barriers identified in the study. For instance, the implementation of AI-based filtering tools addresses the problem of unfiltered data overload, as emphasized by *interviewee 4*. The call for national interoperability standards responds to the persistent lack of integration between RPM platforms and electronic health records (EHRs), as discussed by *interviewees 3 and 4*.

Despite the robust foundation of the proposed strategies in empirical evidence, their feasibility exhibits variability across different domains. The implementation of training programs for healthcare professionals and the execution of patient awareness campaigns are both cost-effective measures that align with existing continuing education structures, suggesting a high level of feasibility. A similar approach can be adopted for workflow optimization through pilot programs and the introduction of RPM coordinators, which can be implemented in high-capacity hospitals on a gradual basis.

However, the implementation of more complex strategies, such as the introduction of novel reimbursement models or the incorporation of RPM within national health contracts, necessitates political action, financial investment, and a robust political commitment. The absence of an updated national framework following the expiration of the *Plano Estratégico Nacional para a Telessaúde* (PENTS) in 2023 signifies a lacuna in the delineation of institutional priorities, which may impede the immediate viability of these initiatives.

If implemented effectively, the proposed strategies could significantly increase the adoption and effectiveness of RPM in Portugal. The expected results are as follows:

- The enhancement of access to healthcare, particularly for patients residing in rural or underserved regions.

- Reduce clinical workload through automation, AI-supported decision-making, and more efficient workflows.
- Improve patient adherence through digital literacy initiatives and personalized education tools.
- Reduce healthcare expenditures by decreasing the frequency of non-essential hospital visits and by promoting early intervention for chronic diseases.
- The promotion of greater equity is best achieved through inclusive design and targeted outreach programs.

The long-term systemic integration of RPM has the potential to strengthen preventive care, optimize resource allocation, and support the sustainability of the Portuguese National Health Service (SNS).

6 CONCLUSIONS AND FUTURE RESEARCH

The digital transformation of healthcare has accelerated in recent years, with remote patient monitoring (RPM) technologies emerging as a key tool to improve the quality of care, reduce system overload, and promote patient autonomy. However, despite the clear benefits and growing global adoption, the effective integration of RPM in the Portuguese healthcare system remains limited. This dissertation set out to investigate the reasons for this gap, with the aim of identifying the main barriers to RPM implementation and formulating actionable strategies to overcome them.

To achieve these aims, the research combined an in-depth literature review with qualitative interviews conducted with experts from different fields - health policy, digital health, hospital administration, and academia. This dual approach allowed for a comprehensive understanding of both the theoretical framework and the real challenges of RPM implementation in Portugal.

The research questions were answered effectively, and the objectives were fully met. The study identified key barriers, including technological gaps, financial constraints, organizational challenges, and equity-related issues, and developed targeted, evidence-based strategies to address them. These strategies include health policy reforms, investments in training and education, artificial intelligence integration, and clinical workflow optimization. Together, these proposals offer a practical roadmap for advancing the sustainable adoption of RPM in the Portuguese context.

The findings reveal a diverse landscape of barriers, grouped into five main categories:

- **Technological and Infrastructure barriers**, such as lack of interoperability with electronic health records (EHRs), data overload, and limited connectivity in rural areas.
- **Financial and Economic barriers**, including high initial investment costs, unclear reimbursement models, and limited awareness of available funding.
- **Human and Social barriers**, characterized by resistance from healthcare professionals, low digital literacy among patients, and fear of reduced human interaction.
- **Organizational and Systemic barriers**, including a lack of strategic prioritization by healthcare institutions, inadequate training, and a lack of standardized clinical protocols for RPM.
- **Equity and Accessibility barriers**, reflecting disparities in access to devices, internet connectivity, and support for vulnerable or marginalized populations.

These findings led to the development of a structured set of recommendations organized around four key strategic axes:

1. **Leverage Artificial Intelligence:** AI can make RPM much more effective by filtering, analyzing, and prioritizing large volumes of clinical data, preventing information

overload, and enabling more timely interventions. AI-powered dashboards, virtual assistants, and predictive models have been proposed as tools to streamline monitoring and empower both professionals and patients.

2. **Policy Reform:** essential to create an enabling environment for RPM. This includes integrating RPM into national telehealth strategies, defining clear and sustainable reimbursement models, establishing interoperability standards, and encouraging public-private partnerships to foster innovation and scalability.
3. **Investing in Education and Training**: capacity building is critical for both healthcare providers and patients. The study recommends integrating RPM and digital health topics into medical and nursing curricula, providing continuing education for existing professionals, and developing targeted digital literacy programs for patients - especially the elderly, socioeconomically disadvantaged, and those living in remote areas.
4. **Optimizing Clinical Workflows**: Effective RPM implementation requires a rethinking of existing processes and roles within healthcare institutions. The creation of RPM coordinators, dedicated monitoring teams, and pilot programs in selected hospitals can support smoother integration. Standardized clinical guidelines for the use of RPM should also be developed to ensure consistency and quality of care.

Taken together, these strategies form a comprehensive roadmap to promote the sustainable and inclusive implementation of RPM in Portugal. The contribution of this dissertation is not only to diagnose the barriers but also to translate them into concrete and context-sensitive recommendations that can guide policymakers, healthcare managers, and technology developers.

Theoretically, this research contributes to the academic literature on digital health adoption by integrating perspectives from different disciplines and applying them to a specific national context. Practically, it provides decision-makers with a clear set of priorities and interventions to accelerate RPM adoption.

Despite its contributions, the study opens avenues for future research. First, more quantitative studies are needed to evaluate the effectiveness of real-world RPM strategies in terms of cost, patient satisfaction, and clinical outcomes. Second, longitudinal studies could examine how RPM usage evolves among different demographic groups. Third, comparative studies between countries or regions with different healthcare systems could help identify best practices and transferable lessons. Finally, as these technologies continue to evolve and integrate into clinical practice, further research into the ethical and legal dimensions of RPM — particularly about privacy, informed consent, and AI transparency — will be crucial.

Additionally, this research was limited by the inability to obtain feedback from private technology companies involved in developing or implementing RPM in Portugal. Consequently, the proposed strategies could not be validated from an industry perspective. Future work should incorporate these stakeholders to refine the recommendations' feasibility

and applicability. Another limitation was the limited availability of academic literature specifically focused on the Portuguese context, which restricted the depth of country-specific comparisons and required a greater reliance on international studies. This highlights the need for further national-level research to inform locally adapted solutions.

In conclusion, this dissertation reinforces the potential of RPM as a powerful driver of healthcare transformation. However, unlocking this potential will require coordinated efforts across technology, policy, education, and organizational domains. By addressing the existing barriers with bold and collaborative strategies, RPM can move from pilot projects to becoming a fundamental pillar of patient-centered, accessible, and sustainable healthcare in Portugal.

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APPENDIX A

Thank you for filling in the Research Ethics Checklist. After reviewing your request, you can proceed with the study as we do not foresee any major ethical concerns with the project.

Project No.: **OTHER2024-11-242922**

Project Title: **Overcoming Barriers to the Adoption of Remote Patient Monitoring**

Principal Researcher: **Joana Oliveira**

according to the regulations of the Ethics Committee of NOVA IMS and MagIC Research Center this project was considered to meet the requirements of the NOVA IMS Internal Review Board, being considered **APPROVED** on 29/11/2024.

APPENDIX B

The interviews included in appendices B-E are presented in their original language, Portuguese, to preserve the accuracy, nuance, and integrity of the participants' responses. This approach ensures that no meaning is lost in translation and that the content remains faithful to the participants' original expressions and insights.

Interview 1 Transcript, Interview Date: November 11, 2024

Q A1: What is your opinion on the role of remote patient monitoring in the Portuguese healthcare system? Do you think this technology is gaining traction, or is it still at an early stage?

A: Tendo em conta a idade da população portuguesa e outros fatores, a monitorização remota seria um mecanismo importante para garantir um melhor acompanhamento das pessoas que necessitam de cuidados. Portanto, acho que desempenha um papel relevante, mas não sei até que ponto está realmente a ser implementada.

Q A2: What do you perceive as the main barriers to the adoption of RPM in Portugal?

A: Parece-me que alguns obstáculos vêm da falta de familiaridade da classe médica e dos serviços de saúde com as tecnologias existentes e as suas facilidades. Pode também haver alguma resistência por parte dos pacientes, embora me pareça que a sugestão para a adoção desta tecnologia deva partir dos médicos e dos serviços de saúde. Normalmente, são pessoas mais idosas que necessitam deste acompanhamento, pelo que não deveriam ser elas a sugerir este tipo de solução, mas sim os hospitais e os profissionais de saúde.

Q A3: From a policy and regulatory perspective, how do you assess the impact of existing public policies and reimbursement structures on the implementation of RPM?

A: Pessoalmente, não conheço os regulamentos aplicáveis a esta área. O GDPR, por exemplo, pode levantar algumas questões, uma vez que a monitorização remota envolve a manipulação de dados que exigem autorização explícita. Quanto aos regulamentos de inteligência artificial e outros, talvez não representem um grande problema neste contexto, já que, em princípio, regulamentam a atuação de empresas que desenvolvem essas tecnologias. Neste caso, a decisão caberia ao próprio utilizador, que teria de dar o seu consentimento. Por isso, não me parece que a regulamentação da IA imponha grandes restrições. Já o GDPR pode ser mais problemático, pois envolve dados sensíveis que seriam analisados e manipulados, tornando o cumprimento das regras mais exigente.

Q B1: How do interoperability issues with electronic health records (EHRs) and infrastructure disparities (e.g., internet access, connectivity) impact the adoption of RPM in Portugal?

A: A interoperabilidade e a infraestrutura podem representar desafios para a adoção da monitorização remota, sobretudo porque os serviços de saúde e os profissionais ainda não estão totalmente familiarizados com estas tecnologias. Além disso, a implementação de novos sistemas exige ajustes na organização dos serviços, algo que pode dificultar a integração com os registos eletrónicos existentes.

Q B2: To what extent do financial costs (e.g., upfront investments, maintenance) and reimbursement policies deter healthcare providers from adopting RPM?

A: Não creio que o custo seja o principal obstáculo, uma vez que existem mecanismos de financiamento específicos para a telemonitorização. No entanto, pode haver uma falta de conhecimento por parte dos serviços de saúde sobre os instrumentos de reembolso disponíveis, o que pode levar a uma menor adoção da tecnologia.

Q B3: How do these barriers affect the performance of healthcare professionals in their daily work?

A: Acredito que o impacto não seria tão negativo. De facto, o tempo dos médicos seria utilizado para tarefas que, de outra forma, não seriam alocadas a essa componente. No entanto, a monitorização em tempo real não é necessariamente obrigatória, pois sistemas de inteligência artificial poderiam realizar esse acompanhamento. Os médicos, por sua vez, precisariam apenas fazer uma análise rápida, talvez uma vez por dia ou de forma regular. Nesse contexto, a carga de trabalho poderia ser mais equilibrada, permitindo que um médico, no tempo que gastaria para atender dois ou três pacientes, pudesse também analisar os dados de monitoramento remoto de 20 pacientes. Isso tornaria o processo razoavelmente eficiente, desde que o tempo necessário fosse devidamente alocado para essa tarefa.

Q B4: What factors do you think contribute most to the potential resistance or non-adherence of patients to remote monitoring?

A: Muitos pacientes podem sentir que a monitorização remota é invasiva, principalmente se envolver o acompanhamento de dados vitais e até de movimentos. A ideia de ter um dispositivo constantemente monitorando esses aspetos pode gerar desconforto, especialmente para aqueles que valorizam sua liberdade. Este fator pode representar uma grande barreira, particularmente entre os idosos, que podem não estar dispostos a usar permanentemente dispositivos como pulseiras que transmitem dados. No entanto, essa resistência precisaria ser estudada mais a fundo. Seria importante perguntar diretamente às pessoas se estariam dispostas a adotar essas tecnologias. Caso a alternativa fosse estar em um hospital ou em um ambiente restrito, talvez aceitassem a monitorização, mas essa questão precisa ser analisada diretamente com os pacientes que apresentariam essas condições.

Q B5: What challenges arise when integrating RPM into existing clinical workflows, and how could standardized guidelines help facilitate adoption?

A: A ausência de normas e diretrizes atualizadas para a implementação da telemonitorização é um dos principais desafios. Embora existam algumas orientações antigas, não há um enquadramento padronizado que ajude os serviços de saúde a integrar esta tecnologia de forma eficiente. A criação de guidelines específicas poderia facilitar essa adoção, tornando o processo mais estruturado e acessível.

Q B6: How accessible is RPM for underserved populations, and what role do socioeconomic factors like income and education play in patient engagement?

A: A adesão dos pacientes pode ser afetada por fatores como a falta de literacia digital e a perceção de que a tecnologia pode ser invasiva. Além disso, a acessibilidade pode ser desigual, já que algumas pessoas podem não ter os recursos necessários, como acesso à Internet ou apoio familiar, para beneficiar da telemonitorização.

Q C1: What would be the priority measures to overcome the barriers identified?

A: Em relação ao GDPR, seria necessário analisar a legislação e, eventualmente, criar exceções ou um enquadramento específico para esta questão, evitando, por exemplo, a necessidade de um parecer da Comissão de Proteção de Dados ou das Comissões de Ética dos hospitais para cada caso individual, o que tornaria o processo demasiado burocrático. Uma legislação mais abrangente poderia permitir a aplicação da monitorização remota sem autorizações específicas caso a caso.

Do lado dos pacientes, campanhas de sensibilização seriam fundamentais para demonstrar que esta tecnologia pode salvar vidas, permitindo alertar rapidamente um médico ou chamar socorro. Vídeos, documentos ou outro tipo de material educativo poderiam explicar as vantagens da monitorização remota. Muitas pessoas que poderiam beneficiar desta tecnologia nem sequer estão a ser monitorizadas, por isso, uma campanha de consciencialização poderia aumentar a aceitação e até levar alguns pacientes a sugerirem esta solução aos seus médicos.

Q C2: How could artificial intelligence and other emerging technologies help address the challenges associated with RPM adoption?

A: A inteligência artificial pode ser aplicada à monitorização de sinais vitais de forma pouco invasiva, por exemplo, através de pulseiras, que permitem detetar situações em que uma pessoa possa precisar de apoio ou de uma avaliação médica. Há também a possibilidade de utilizar análise de imagem ou vídeo, embora essa abordagem seja mais invasiva, pois transmite mais informações sobre a pessoa.

Num futuro mais distante, a análise de imagem poderia ser realizada exclusivamente por sistemas de IA, sem que os vídeos fossem disponibilizados a pessoas, o que ajudaria a

contornar questões de privacidade. No entanto, não sei até que ponto as pessoas estariam abertas a essa solução. No geral, a aplicação mais relevante da IA neste contexto continua a ser a monitorização de sinais vitais e a emissão de alertas sempre que os valores se afastem dos parâmetros normais.

Q C3: How can we encourage both healthcare professionals and patients to trust and adopt these technologies more quickly?

A: Do ponto de vista legislativo, é essencial avaliar se existe um enquadramento legal adequado. Do lado dos pacientes, é importante sensibilizá-los para os benefícios da monitorização remota. Já no que diz respeito aos profissionais de saúde, a formação é fundamental para aumentar a sua familiaridade com estas tecnologias e incentivar a sua utilização.

Q C4: What role should technology companies, governments, and healthcare institutions play in creating a viable and sustainable environment for RPM?

A: As empresas tecnológicas já desenvolvem sensores e softwares de análise e devem continuar a desempenhar esse papel. O governo deve focar-se na criação de uma legislação enquadradora que facilite a adoção desta tecnologia. Os sistemas de saúde, por sua vez, devem sensibilizar e formar os médicos, além de criar condições internas para a implementação da monitorização remota. Isso inclui disponibilizar sensores, software e uma infraestrutura que permita aos médicos recomendar facilmente esta abordagem, sem que tenham de assumir toda a responsabilidade pelo processo.

APPENDIX C

Interview 2 Transcript, Interview Date: December 13, 2024

Q A1: What is your opinion on the role of remote patient monitoring in the Portuguese healthcare system? Do you think this technology is gaining traction, or is it still at an early stage?

A: A monitorização remota de pacientes está, sem dúvida, a ganhar tração. O investimento feito nos últimos anos na hospitalização domiciliária foi um passo importante nesse sentido, e a população, sobretudo com o envelhecimento demográfico, está cada vez mais consciente das vantagens destas abordagens. A evolução tecnológica e a maior acessibilidade também têm contribuído para essa mudança. Antes da pandemia, havia bastante resistência à adoção dessas soluções, mas a necessidade imposta pela crise sanitária ajudou a alterar mentalidades. De forma geral, estamos a assistir a uma evolução positiva.

Q A2: What do you perceive as the main barriers to the adoption of RPM in Portugal?

A: As principais barreiras passam, em primeiro lugar, por limitações financeiras, já que o acesso a estas tecnologias depende, muitas vezes, do Serviço Nacional de Saúde (SNS). Além disso, as seguradoras ainda não aderiram totalmente a este tipo de abordagem. Outra dificuldade prende-se com a falta de conhecimento por parte de alguns profissionais de saúde, que, não estando familiarizados com estas soluções, acabam por não as recomendar aos seus doentes. Por fim, a própria população ainda tem uma visão muito centrada nos cuidados institucionais, o que torna essencial um trabalho contínuo de literacia em saúde.

Q A3: From a policy and regulatory perspective, how do you assess the impact of existing public policies and reimbursement structures on the implementation of RPM?

A: A legislação sobre hospitalização domiciliária já representou um avanço importante, permitindo que hospitais e clínicas façam mais sem necessidade de um novo enquadramento. No entanto, desconheço se existem outras iniciativas relevantes nesta área.

Q B1: How do interoperability issues with electronic health records (EHRs) and infrastructure disparities (e.g., internet access, connectivity) impact the adoption of RPM in Portugal?

A: A monitorização remota de pacientes tem vindo a ganhar tração, impulsionada pelo investimento na hospitalização domiciliária e pelo avanço tecnológico. No entanto, a implementação generalizada destas soluções depende da infraestrutura disponível e da integração eficaz com os sistemas de registos de saúde eletrónicos. A resistência pré-pandemia à adoção destas tecnologias demonstra que ainda há desafios organizacionais e técnicos que precisam de ser ultrapassados.

Q B2: To what extent do financial costs (e.g., upfront investments, maintenance) and reimbursement policies deter healthcare providers from adopting RPM?

A: As limitações financeiras continuam a ser um dos principais obstáculos à adoção da monitorização remota. O acesso a estas tecnologias depende, em grande medida, do financiamento do SNS, e as seguradoras ainda não aderiram completamente a este modelo. Além disso, a falta de um sistema de incentivos estruturado faz com que muitos hospitais e clínicas não vejam um benefício direto na implementação da RPM. A criação de programas de financiamento baseados nos resultados em saúde poderia incentivar a adoção destas tecnologias.

Q B3: How do these barriers affect the performance of healthcare professionals in their daily work?

A: Os profissionais de saúde já enfrentam uma sobrecarga considerável, e essa situação pode ser ainda mais agravada pelas barreiras atuais. No entanto, a monitorização remota poderia ser uma solução para aliviar essa carga de trabalho, permitindo que os profissionais se tornassem mais eficientes e, consequentemente, oferecessem cuidados de saúde de maior qualidade. Além disso, ao implementar essa abordagem, seria possível atender um maior número de pacientes, o que representa uma grande oportunidade que ainda não está sendo totalmente aproveitada devido às barreiras existentes.

Q B4: What factors do you think contribute most to the potential resistance or non-adherence of patients to remote monitoring?

A: A resistência dos pacientes à monitorização remota pode ser atribuída a vários fatores. Em primeiro lugar, a falta de literacia digital é um obstáculo importante, pois muitos pacientes nem sequer sabem que essa possibilidade existe. Além disso, a perceção de barreiras financeiras pode desmotivar a adesão a essas tecnologias. Por fim, a ausência de recomendações diretas por parte dos profissionais de saúde também contribui para a não adesão. Muitos pacientes ainda dependem da orientação dos médicos para adotar novas tecnologias, o que destaca a importância do papel do profissional na promoção da monitorização remota.

Q B5: What challenges arise when integrating RPM into existing clinical workflows, and how could standardized guidelines help facilitate adoption?

A: Um dos principais desafios na integração da monitorização remota nos fluxos clínicos é a falta de conhecimento por parte dos profissionais de saúde, o que leva a uma menor recomendação destas soluções aos doentes. Além disso, a abordagem tradicional dos cuidados institucionais ainda está profundamente enraizada, tornando necessária uma mudança de mentalidade e uma maior literacia em saúde. Diretrizes padronizadas poderiam ajudar a clarificar processos e incentivar a adoção destas tecnologias de forma mais consistente em todo o sistema de saúde.

Q B6: How accessible is RPM for underserved populations, and what role do socioeconomic factors like income and education play in patient engagement?

A: A acessibilidade à monitorização remota ainda é desigual. A falta de literacia digital é um fator importante, pois muitos doentes desconhecem estas soluções ou não sabem como utilizá-las. Além disso, a perceção de barreiras financeiras pode limitar a adesão, especialmente em populações mais vulneráveis que dependem do financiamento do SNS. Para garantir um acesso mais equitativo, seria necessário reforçar a literacia em saúde e envolver tanto o setor público como o privado na disponibilização destas tecnologias.

Q C1: What would be the priority measures to overcome the barriers identified?

A: Seria essencial criar programas de financiamento baseados nos resultados em saúde para incentivar a adoção destas abordagens. Também é fundamental garantir que os profissionais de saúde tenham maior conhecimento sobre estas tecnologias, eventualmente através de incentivos que promovam a sua utilização. Do lado dos doentes, a literacia sobre as possibilidades existentes deve ser reforçada. Além disso, seria importante envolver o setor privado para que a monitorização remota não seja uma iniciativa exclusiva do SNS, mas sim uma solução integrada em todo o sistema de saúde.

Q C2: How could artificial intelligence and other emerging technologies help address the challenges associated with RPM adoption?

A: Já existem várias soluções tecnológicas implementadas em diferentes países, desde assistentes virtuais à monitorização remota. A inteligência artificial pode ajudar a ultrapassar algumas barreiras, permitindo, por exemplo, integrar uma componente assistencial empática, que pode ser crucial para aumentar a aceitação destes cuidados. No geral, a IA tem potencial para facilitar e expandir a utilização da monitorização remota.

Q C3: How can we encourage both healthcare professionals and patients to trust and adopt these technologies more quickly?

A: O sistema de saúde está a evoluir no sentido de valorizar cada vez mais os ganhos em saúde. Em muitos contextos, sabemos que os resultados para os doentes seriam melhores com a monitorização e o acompanhamento remoto do que com a abordagem clássica ainda dominante. Se o modelo de financiamento privilegiasse os ganhos em saúde, isso criaria um sistema de incentivos que estimularia a adoção destas tecnologias tanto por profissionais como por gestores e doentes.

Q C4: What role should technology companies, governments, and healthcare institutions play in creating a viable and sustainable environment for RPM?

A: O Governo deve criar um modelo de governança e regulamentação que gere confiança em relação a estas tecnologias, tal como já acontece com os medicamentos e dispositivos médicos. Tal como hoje a regulamentação de medicamentos e dispositivos médicos é uma

prática essencial para garantir que os profissionais de saúde possam prescrever esses produtos com total confiança, ainda não existe uma abordagem estruturada para a regulamentação de ferramentas de monitorização e inteligência artificial, e esse vazio dificulta a sua adoção. Além disso, o Governo pode incentivar o uso destas tecnologias através de modelos de financiamento baseados em resultados e promovendo a literacia dos profissionais de saúde.

As empresas tecnológicas, por sua vez, têm a responsabilidade de garantir uma utilização responsável destas soluções. Mais do que focarem-se apenas na comercialização dos seus produtos, devem demonstrar como as suas tecnologias contribuem para ganhos reais em saúde e como podem ser integradas de forma sustentável no sistema de saúde. Para os doentes, é fundamental dar visibilidade a casos concretos que mostrem o impacto positivo destas tecnologias na qualidade de vida, incentivando assim a sua aceitação e adesão.

Final Considerations

A: A verdadeira transformação passa por mudar o modelo atual, que ainda se baseia no financiamento de processos, para um modelo orientado pelos resultados em saúde. Mais do que tentar encaixar estas tecnologias nos moldes tradicionais, devemos aproveitá-las para repensar como queremos cuidar da saúde no futuro. É imperativo que utilizemos estas tecnologias para otimizar a produção de cuidados de saúde de maior qualidade, prevenir mais doenças, reduzir a carga da doença, controlar as doenças crónicas de forma mais eficaz e garantir mais qualidade de vida e bem-estar ao longo de todo o ciclo de vida.

É necessário olhar para estas ferramentas com uma mentalidade aberta, sem dogmas. Muitas vezes, ficamos presos a um sistema que já se mostrou insuficiente para reduzir a carga da doença, e isso gera um ciclo vicioso de custos cada vez maiores. As tecnologias podem ajudar a quebrar esse ciclo, mas será preciso coragem, criatividade e liderança para implementar as mudanças necessárias e construir consensos ao longo dos anos.

APPENDIX D

Interview 3 Transcript, Interview Date: December 27, 2024

Q A1: What is your opinion on the role of remote patient monitoring in the Portuguese healthcare system? Do you think this technology is gaining traction, or is it still at an early stage?

A: A monitorização remota tem vindo a crescer, mas não tanto quanto esperado. Apesar de existir há anos, com financiamento específico desde 2013-2014 para doentes com Doença Pulmonar Obstrutiva Crónica (DPOC) e insuficiência cardíaca, a sua adoção não tem aumentado de forma exponencial nem se expandido para novas instituições de saúde. Os dados disponíveis sobre a sua utilização são limitados e pouco claros, especialmente no setor público, enquanto no setor privado o crescimento parece ser ainda mais modesto. No geral, estima-se que apenas 10 a 15% dos doentes que poderiam beneficiar da monitorização remota estejam, de facto, a utilizá-la.

Q A2: What do you perceive as the main barriers to the adoption of RPM in Portugal?

A: As barreiras tecnológicas não são o principal entrave, embora existam algumas dificuldades, como o acesso limitado à internet em certas regiões, especialmente no interior do país, e a literacia digital reduzida entre alguns doentes. No entanto, muitas soluções de monitorização remota já são projetadas para serem intuitivas e fáceis de usar, mesmo para aqueles com pouca experiência tecnológica.

O verdadeiro desafio está no nível organizacional. A adoção da monitorização remota implica uma mudança na estrutura dos serviços de saúde, pois exige que os hospitais passem a atuar de forma mais preventiva e menos reativa. Em teoria, essa abordagem reduz a sobrecarga nas urgências ao permitir que os doentes sejam acompanhados antes que sua condição se agrave. No entanto, para que isso aconteça, é necessário realocar recursos, o que pode ser complexo a curto prazo. O investimento inicial em equipas e infraestruturas de monitorização remota pode levar meses para gerar benefícios visíveis, tornando mais difícil a sua priorização por parte das administrações hospitalares.

Além disso, o contexto atual da reorganização administrativa das Unidades Locais de Saúde (ULS) também influencia esse processo. Com tantas mudanças estruturais acontecendo simultaneamente, a implementação de novos programas de monitorização remota pode acabar relegada a segundo plano. Apesar de a nova estrutura das ULS ter potencial para favorecer a integração dos cuidados e impulsionar a telemonitorização, a prioridade das instituições em 2024 tem sido adaptar-se à nova organização, o que atrasa decisões sobre novos projetos.

Por fim, há uma questão cultural e de mentalidade dentro das instituições de saúde. A monitorização remota não é vista como uma necessidade imediata, mas sim como um complemento. Essa visão impede uma adoção mais rápida e ampla da tecnologia, mesmo quando existem evidências claras dos seus benefícios.

Q A3: From a policy and regulatory perspective, how do you assess the impact of existing public policies and reimbursement structures on the implementation of RPM?

A: Há pouco enfâse político e regulatório na monitorização remota. A última norma da Direção-Geral da Saúde sobre telesaúde data de 2015, e o Plano Estratégico Nacional para a Telesaúde (PENTS) expirou em 2023 sem uma revisão formal ou um novo plano definido. Isso reflete a falta de uma estratégia nacional estruturada, deixando a implementação a cargo das iniciativas individuais das instituições de saúde e dos prestadores privados.

Q B1: How do interoperability issues with electronic health records (EHRs) and infrastructure disparities (e.g., internet access, connectivity) impact the adoption of RPM in Portugal?

As barreiras tecnológicas podem dividir-se em duas áreas: a infraestrutura e a falta de standards de integração.

A maioria das soluções de telemonitorização não foi concebida para integrar diretamente com os registos eletrónicos dos hospitais e, ainda menos, com os sistemas dos cuidados de saúde primários. Estas soluções foram desenvolvidas, sobretudo, para recolher dados registados pelos próprios doentes ou por dispositivos como oxímetros e balanças, disponibilizando-os a uma equipa clínica—geralmente composta por enfermeiros e, em alguns casos, médicos—num centro de telemonitorização.

O primeiro grande desafio decorre do facto de estes centros de telemonitorização, muitas vezes geridos por empresas privadas, acompanharem doentes que podem estar a ser seguidos em diferentes hospitais ou unidades de saúde. Como os dados são centralizados nesses centros, torna-se difícil integrá-los nos sistemas hospitalares ou nos cuidados de saúde primários, que operam numa infraestrutura distinta.

O segundo desafio prende-se com a infraestrutura tecnológica. Os hospitais e centros de saúde públicos estão ligados através da Rede Informática da Saúde (RIS), uma rede privada de telecomunicações exclusiva para o setor público. Já as empresas que gerem telemonitorização utilizam redes próprias, muitas vezes em edifícios privados, criando mais um obstáculo à partilha de informação.

Mesmo que estes sistemas fossem instalados diretamente nos servidores dos hospitais, a interoperabilidade continuaria a ser um problema, pois não existem standards definidos para a integração entre soluções de telemonitorização e os registos clínicos eletrónicos. Esta discussão está ainda numa fase inicial. Por exemplo, tenho um aluno de doutoramento que

está a trabalhar esta questão, analisando standards internacionais existentes e propondo soluções para facilitar essa integração.

Para contextualizar, no setor dos laboratórios clínicos, este problema já está resolvido. Os dados recolhidos pelos equipamentos laboratoriais são processados por um software específico (LIS - Laboratory Information System), onde são validados por médicos e técnicos. Posteriormente, esses dados são integrados automaticamente no registo clínico eletrónico dos hospitais, seguindo standards internacionais bem estabelecidos. As empresas que desenvolvem estes softwares sabem exatamente como programar os seus sistemas para garantir essa comunicação fluida. No entanto, na telemonitorização, esse nível de padronização ainda não existe, dificultando a adoção desta tecnologia no setor público de saúde.

Q B2: To what extent do financial costs (e.g., upfront investments, maintenance) and reimbursement policies deter healthcare providers from adopting RPM?

A: Essa ideia não corresponde à realidade. Em Portugal, existem diversos incentivos para a inscrição de doentes em programas de telemonitorização. Há financiamento próprio para este tipo de serviços, e os hospitais não precisam de fazer investimentos avultados à partida.

A maioria dos hospitais públicos pode recorrer a empresas especializadas em telemonitorização, pagando por doente acompanhado, sem necessidade de criar infraestruturas próprias. O modelo funciona de forma escalável: os hospitais pagam consoante o número de doentes incluídos no programa e recebem um valor por doente que, apesar de não ser muito superior ao custo do serviço, cobre essa despesa.

Portanto, não há barreira financeira significativa à adoção da monitorização remota. O verdadeiro obstáculo pode estar na falta de conhecimento sobre os mecanismos de reembolso disponíveis. Se os hospitais não aproveitam estas oportunidades, isso deve-se, em grande parte, à incompetência da gestão hospitalar, nomeadamente das Unidades Locais de Saúde (ULS).

Q B3: How do these barriers affect the performance of healthcare professionals in their daily work?

A: Quando uma iniciativa não é considerada prioridade pela gestão, ela acaba por não ser uma prioridade para os profissionais de saúde. Para que a telemonitorização seja incorporada nos cuidados, é necessário repensar o processo e estabelecer protocolos claros. Esses protocolos podem até ser inspirados por outras instituições, mas devem ser adaptados à realidade de cada instituição e ao perfil dos seus pacientes. Isso exige uma mudança significativa na rotina dos profissionais. Durante uma consulta, o médico precisaria interromper o atendimento para avaliar se o paciente se qualifica para a telemonitorização, comunicar com a enfermeira e a família, verificar os critérios de elegibilidade, disponibilizar os equipamentos necessários e iniciar o processo. Esse tipo de mudança exige uma grande reorganização no fluxo de trabalho,

e vencer essa inércia organizacional pode ser um grande desafio. Para isso, é fundamental que alguém dentro da instituição tenha a visão e a autoridade para promover essa transformação, destacando a necessidade de um novo paradigma. Em vez de seguir o modelo tradicional de consultas periódicas e visitas à emergência, o foco deveria ser a monitorização contínua dos pacientes, com intervenção antes que o paciente precise retornar fisicamente à instituição. Essa mudança de paradigma exige tempo e dedicação, que muitas vezes estão ausentes nas instituições de saúde, o que dificulta a inovação.

Q B4: What factors do you think contribute most to the potential resistance or non-adherence of patients to remote monitoring?

A: A resistência à monitorização remota pode ser atribuída a vários fatores, sendo a falta de educação e literacia digital um dos principais. Se os pacientes não têm acesso à internet ou não sabem como utilizar a tecnologia, isso limita a sua adesão. Outro fator importante é o sentimento de acompanhamento por parte dos profissionais de saúde. Se o paciente sentir que a monitorização remota é uma adição ao acompanhamento que já recebe, ele ficará mais recetivo a essa tecnologia. A evidência e as conversas com os pacientes mostram que, quando percebem que a tecnologia complementa o atendimento e oferece mais informações aos profissionais, eles se sentem mais seguros e confortáveis.

Porém, se o paciente sentir que a telemonitorização é uma substituição do acompanhamento físico, com a possibilidade de perder o contato direto com o médico ou enfermeiro, a resistência é maior. Nesse caso, ele pode ver a tecnologia como uma ameaça ao acesso pessoal que tinha anteriormente. A chave é garantir que os pacientes compreendam que a monitorização remota não significa a eliminação do contato humano, mas sim uma forma de oferecer um atendimento mais eficiente e contínuo, com mais informações disponíveis para o profissional. Se a telemonitorização for vista como um passo para reduzir o contacto direto, a reação negativa dos pacientes será mais forte.

Q B5: What challenges arise when integrating RPM into existing clinical workflows, and how could standardized guidelines help facilitate adoption?

A: Há alguns anos foram criadas diretrizes sobre telesaúde, incluindo normas de orientação clínica na área da telemonitorização. No entanto, estas normas datam de 2013 ou 2014 e estão desatualizadas, não refletindo a realidade atual nem as necessidades dos serviços de saúde.

Atualmente, não existe uma norma específica que estabeleça um modelo padronizado para a organização dos serviços de telemonitorização. Esta ausência representa uma grande barreira: quando a vontade de inovar já é reduzida, a falta de diretrizes concretas torna ainda mais fácil a inação.

Outro desafio crítico prende-se com a antecipação do impacto da telemonitorização nos serviços. Imagine um serviço de pneumologia com recursos escassos – médicos e enfermeiros

sobrecarregados, como é habitual no setor público. Durante meses, estes profissionais acompanham doentes internados e que recorrem frequentemente à urgência. A telemonitorização permitiria uma abordagem preventiva, iniciando o acompanhamento remoto desses doentes ainda numa fase precoce, para que, meses depois, estejam mais estáveis e necessitem de menos internamentos ou idas à urgência.

O problema? No imediato, exige um esforço adicional: as equipas já sobrecarregadas têm de alocar tempo para monitorizar e interagir com os doentes de forma regular, o que significa mais trabalho a curto prazo. Essa necessidade de reorganização dos fluxos de trabalho é uma barreira difícil de ultrapassar, sobretudo quando não há mais recursos humanos disponíveis.

No entanto, há exemplos bem-sucedidos, como o Hospital de Viana do Castelo, que conseguiu mobilizar enfermeiros dos cuidados intensivos para apoiar a implementação do programa. Começaram com 10 doentes, depois 20, depois 50 – e, ao fim de um ano, o impacto foi visível. No inverno seguinte, enfrentaram uma carga de trabalho diferente: menos doentes internados e um maior acompanhamento à distância, com telefonemas e monitorização contínua, reduzindo assim a necessidade de intervenções mais agressivas.

A definição de diretrizes padronizadas ajudaria a ultrapassar estes desafios, criando um modelo claro para a implementação da RPM e permitindo que os serviços de saúde beneficiassem de uma estrutura organizada e previsível, em vez de dependerem do entusiasmo pontual de alguns profissionais.

Q B6: How accessible is RPM for underserved populations, and what role do socioeconomic factors like income and education play in patient engagement?

A: Atualmente, a acessibilidade à telemonitorização é extremamente desigual. Não existe qualquer garantia de equidade no acesso. O que se verifica, na prática, é que a RPM depende do entusiasmo individual de alguns profissionais e da abertura da administração hospitalar a adotar estas soluções.

Se existir um cardiologista ou pneumologista conhecedor e motivado, que consiga convencer a gestão do hospital, então um pequeno grupo de doentes pode beneficiar do serviço. Mas isso significa que a inclusão num programa de telemonitorização não depende das reais necessidades clínicas ou da prevalência da doença na região – depende apenas de haver um profissional ou uma administração hospitalar interessada.

Além disso, os critérios de inclusão tendem a favorecer doentes com melhor suporte familiar e condições socioeconómicas mais favoráveis. Para que a telemonitorização funcione, é muitas vezes necessário que o doente tenha internet em casa, saiba utilizar os dispositivos ou tenha familiares que possam ajudar. Como consequência, as populações mais vulneráveis – aquelas que teoricamente mais poderiam beneficiar da telemonitorização – acabam por ser as mais excluídas.

Embora existam normas e mecanismos de financiamento nacionais para a telemonitorização, na prática, o acesso continua a ser extremamente desigual. O modelo atual não garante que os doentes mais necessitados sejam os que recebem acompanhamento remoto, criando um cenário em que a telemonitorização é, essencialmente, um privilégio das classes média e alta em certas regiões do país.

Q C1: What would be the priority measures to overcome the barriers identified?

A: Primeiro, é essencial formar os profissionais de saúde, especialmente em especialidades como pneumologia e cardiologia, onde a monitorização remota já demonstrou um custo-benefício bom. Além disso, os gestores hospitalares precisam ser capacitados para integrar e dinamizar serviços híbridos que combinem consultas presenciais e telemonitorização. Quanto aos doentes, a sensibilização deve ser feita no momento da adesão, através de uma consulta inicial onde o funcionamento do sistema é explicado. O objetivo deve ser massificar o processo e integrá-lo no dia a dia dos serviços, evitando que permaneça apenas como um projeto piloto restrito a poucos doentes.

Q C2: How could artificial intelligence and other emerging technologies help address the challenges associated with RPM adoption?

A: A inteligência artificial pode contribuir em três áreas principais:

> **Melhoria na análise de dados:** Reduzindo alertas irrelevantes e tornando as notificações mais pertinentes, ao integrar variáveis como diagnóstico e medicação do doente.
>
> **Apoio ao utilizador:** Chatbots podem responder a dúvidas comuns, auxiliando doentes e familiares na resolução de pequenos problemas técnicos, como falhas nos dispositivos.
>
> **Otimização de estudos clínicos:** IA pode facilitar a análise de grandes volumes de dados recolhidos, acelerando a produção de conhecimento e melhorando a tomada de decisão clínica.

Q C3: How can we encourage both healthcare professionals and patients to trust and adopt these technologies more quickly?

A: A adoção só avançará rapidamente se for uma meta contratualizada. O Governo deve estabelecer objetivos concretos para a inclusão da monitorização remota no SNS, com percentagens mínimas de doentes abrangidos. Se a tecnologia já demonstrou eficácia e economia para o sistema de saúde, a sua implementação não pode depender apenas da vontade das administrações hospitalares ou dos profissionais de saúde. É necessário um compromisso político claro e uma política ativa para garantir sua integração efetiva.

Q C4: What role should technology companies, governments, and healthcare institutions play in creating a viable and sustainable environment for RPM?

A: O Governo deve definir uma estratégia nacional clara, atualizar o plano estratégico para a telesaúde e estabelecer metas concretas de inclusão da monitorização remota nos cuidados de saúde. As instituições de saúde, públicas e privadas, precisam implementar essas soluções de forma sistemática, maximizando o seu impacto na qualidade dos cuidados e na redução de custos. Já as empresas tecnológicas devem garantir soluções seguras, robustas e adaptáveis às necessidades dos utilizadores, priorizando não apenas a venda de produtos, mas também a sua real integração no sistema de saúde.

APPENDIX E

Interview 4 Transcript, Interview Date: January 6, 2025

Q A1: What is your opinion on the role of remote patient monitoring in the Portuguese healthcare system? Do you think this technology is gaining traction, or is it still at an early stage?

A: Penso que a adoção da monitorização remota está a crescer, mas de forma bastante lenta. Isso deve-se a vários fatores, sendo um dos principais o custo associado à aquisição das plataformas e dos equipamentos necessários. Apesar dos avanços tecnológicos, o investimento inicial continua a ser significativo, o que representa uma barreira para muitas instituições.

Além disso, existe um fator cultural dentro dos hospitais, relacionado com protocolos e hábitos já estabelecidos. Embora seja evidente que muitas situações clínicas poderiam beneficiar deste tipo de abordagem, reduzindo deslocações desnecessárias ao hospital e garantindo maior segurança tanto para os doentes como para os profissionais de saúde, a verdade é que a sua implementação ainda é limitada. Muitas vezes, isto acontece não apenas por falta de equipamento, mas também porque não há uma visão clara da sua utilidade e do seu potencial impacto nos cuidados de saúde.

Em resumo, apesar de se verificarem progressos, o crescimento da monitorização remota está muito aquém do seu verdadeiro potencial, principalmente devido a dificuldades económicas, organizacionais e culturais.

Q A2: What do you perceive as the main barriers to the adoption of RPM in Portugal?

A: Do ponto de vista tecnológico, os avanços dos últimos anos tornaram a monitorização remota cada vez mais viável, permitindo a recolha de uma grande quantidade de dados úteis para a vigilância e monitorização de doentes. No entanto, apesar desta evolução, continuam a existir desafios relacionados com a utilização de wearables, a gestão eficaz desses dados e a integração de algoritmos capazes de interpretar a informação recolhida. Como estes dispositivos geram um grande volume de dados, é essencial que existam sistemas que filtrem e priorizem a informação mais relevante, para evitar sobrecarga nos profissionais de saúde.

No entanto, o maior entrave à adoção da monitorização remota não é tecnológico, mas sim cultural e organizacional. Ainda não existe, dentro dos serviços de saúde, uma visão consolidada sobre o verdadeiro potencial desta tecnologia. Os profissionais de saúde precisam de reconhecer a monitorização remota como uma ferramenta eficaz para um conjunto específico de doentes, permitindo ganhos de eficiência e qualidade nos cuidados prestados.

Além disso, a integração da monitorização remota no funcionamento do SNS continua a ser um desafio. Para que esta abordagem seja utilizada de forma rotineira, é necessário tempo, protocolos bem definidos e uma reorganização dos serviços. Neste momento, a monitorização remota ainda não está enraizada na estrutura do SNS como uma solução padrão, o que limita significativamente o seu crescimento. Embora existam barreiras tecnológicas e económicas, a maior limitação é a dificuldade na integração deste modelo nos processos clínicos de forma natural e estruturada.

Q A3: From a policy and regulatory perspective, how do you assess the impact of existing public policies and reimbursement structures on the implementation of RPM?

A: Para que a monitorização remota se torne uma realidade mais disseminada, é fundamental que haja um reconhecimento claro, ao nível central, do impacto positivo desta tecnologia. O Ministério da Saúde pode desempenhar um papel determinante ao incluir objetivos concretos nos contratos-programa e nos modelos de financiamento das instituições, incentivando-as a adotar esta abordagem.

A experiência mostra que, quando existem mecanismos de financiamento específicos para este tipo de inovação, as instituições tendem a aderir mais rapidamente. Se houver uma política clara de incentivo, através de financiamento direcionado e recompensas para as ULS e hospitais que adotem a monitorização remota, isso poderá acelerar a sua implementação e aceitação.

Dessa forma, torna-se essencial que o Governo e o Ministério da Saúde desenvolvam políticas ativas e estratégias de financiamento que estimulem esta área, promovendo a sua expansão e garantindo a sua sustentabilidade a longo prazo.

Q B1: How do interoperability issues with electronic health records (EHRs) and infrastructure disparities (e.g., internet access, connectivity) impact the adoption of RPM in Portugal?

A: Estas questões colocam obstáculos significativos, dificultando a adoção generalizada e a expansão mais rápida desta tecnologia.

Q B2: To what extent do financial costs (e.g., upfront investments, maintenance) and reimbursement policies deter healthcare providers from adopting RPM?

A: O facto de os sistemas ainda não estarem devidamente adaptados a estas modalidades cria constrangimentos na faturação, o que impede uma adoção mais alargada e sistemática. Adicionalmente, há questões económicas relacionadas com a aquisição de wearables e centrais de monitorização, bem como com o desenvolvimento de software e algoritmos para interpretar os dados. Também se colocam desafios ao nível dos sistemas de informação, que exigem investimento para garantir uma integração eficaz da RPM nos sistemas de saúde existentes.

Q B3: How do these barriers affect the performance of healthcare professionals in their daily work?

A: Se os serviços não disponibilizarem tempo para este fim, será necessário que, desde logo, haja uma priorização por parte das administrações hospitalares e centros de saúde. Isto implica alocar recursos humanos, disponibilizar condições para a implementação de projetos, reformular procedimentos, dialogar com os doentes e garantir tempo para essas mudanças. Além disso, o maior entrave inicial é a necessidade de uma gestão eficiente dos recursos humanos, garantindo que a RPM seja integrada como uma prioridade nos serviços de saúde.

Q B4: What factors do you think contribute most to the potential resistance or non-adherence of patients to remote monitoring?

A: A adesão dos doentes depende muito da sua compreensão sobre os benefícios da RPM. É fundamental que os profissionais de saúde dediquem tempo a informar e esclarecer os pacientes sobre as vantagens da tecnologia, como a redução de deslocações e o aumento da segurança no acompanhamento da sua condição. Quando essa explicação é feita de forma adequada, há uma grande abertura por parte dos doentes para aderirem a este tipo de monitorização.

Q B5: What challenges arise when integrating RPM into existing clinical workflows, and how could standardized guidelines help facilitate adoption?

A: A introdução da RPM exige uma reorganização do sistema de trabalho. Seria fundamental um plano nacional que estabeleça diretrizes claras, bem como uma adaptação das regras da administração pública para permitir uma implementação eficaz e sustentada. Além disso, há desafios logísticos, como a instalação e recolha dos dispositivos na casa dos doentes, bem como preocupações sobre a responsabilidade em caso de danos nos equipamentos. Estes aspetos devem ser simplificados para garantir uma implementação eficiente e sem entraves administrativos.

Q B6: How accessible is RPM for underserved populations, and what role do socioeconomic factors like income and education play in patient engagement?

A: Esta questão é crítica, pois, em vez de promover a inclusão, a RPM pode acabar por acentuar desigualdades no acesso aos cuidados de saúde. É essencial garantir que esta abordagem beneficie todas as camadas da população, independentemente da sua condição socioeconómica.

Q C1: What would be the priority measures to overcome the barriers identified?

A: Em primeiro lugar, deveria existir uma linha específica de financiamento nos contratos-programa para incentivar a implementação da monitorização remota. Atualmente, já existem linhas de financiamento para algumas áreas específicas, como DPOC, o enfarte do miocárdio e a insuficiência cardíaca. No entanto, este modelo deveria ser ampliado e estruturado de

forma mais abrangente, dado que a monitorização remota pode trazer benefícios para diversas patologias.

Além disso, seria fundamental a criação de um mecanismo centralizado para a aquisição de equipamentos. A compra em volume poderia reduzir significativamente os custos para o SNS, facilitando o acesso a estas tecnologias. Também é essencial investir na integração dos sistemas de informação, garantindo uma recolha, interpretação e utilização eficiente dos dados clínicos.

A nível clínico, seria útil desenvolver protocolos nacionais para orientar a utilização da monitorização remota em diferentes patologias. Em vez de cada hospital criar os seus próprios procedimentos, uma abordagem colaborativa entre a Direção-Geral da Saúde (DGS), a Ordem dos Médicos e a Ordem dos Enfermeiros poderia definir diretrizes claras sobre quais dados recolher, como interpretá-los e quais as melhores práticas a seguir.

Por fim, o incentivo à investigação nesta área também pode desempenhar um papel importante. Projetos de investigação que avaliem o impacto da monitorização remota em diferentes patologias e demonstrem os seus benefícios podem ajudar a impulsionar a sua adoção a nível nacional.

Q C2: How could artificial intelligence and other emerging technologies help address the challenges associated with RPM adoption?

A: Um dos principais desafios da monitorização remota é a enorme quantidade de dados gerados pelos dispositivos utilizados pelos doentes. Sem um sistema eficiente de análise, os profissionais de saúde correm o risco de serem sobrecarregados com informação irrelevante.

A inteligência artificial pode desempenhar um papel crucial ao processar esses dados, identificando padrões e destacando apenas os eventos clínicos realmente relevantes. Já existem exemplos na prática clínica, como a análise automática de eletrocardiogramas de longa duração, onde apenas as secções com possíveis anomalias são revistas por um especialista.

O desenvolvimento de algoritmos mais avançados permitirá expandir esta lógica para outras patologias, garantindo que os doentes possam ser monitorizados de forma contínua sem exigir a atenção constante de um profissional de saúde. Isto aumentaria a eficiência do sistema, reduzindo a necessidade de recursos humanos dedicados exclusivamente à monitorização de dados.

Q C3: How can we encourage both healthcare professionals and patients to trust and adopt these technologies more quickly?

A: A adoção da monitorização remota pode ser impulsionada por diferentes estratégias. No caso dos doentes, campanhas de sensibilização poderiam ser eficazes para demonstrar os

benefícios deste modelo, como a redução do número de deslocações ao hospital e a maior segurança no acompanhamento da sua condição.

Para os profissionais de saúde, é essencial que as instituições criem condições para a experimentação e implementação gradual da monitorização remota. Isso pode ser feito através de incentivos, reconhecimento de boas práticas e até financiamento de projetos piloto dentro dos hospitais. Além disso, mecanismos de reconhecimento e mérito para equipas que desenvolvam e implementem soluções inovadoras nesta área podem ajudar a gerar uma maior adesão e motivação entre os profissionais.

Q C4: What role should technology companies, governments, and healthcare institutions play in creating a viable and sustainable environment for RPM?

A: O sucesso da monitorização remota depende da existência de um ecossistema robusto e bem estruturado. Em primeiro lugar, é fundamental garantir a confiança nos sistemas tecnológicos, assegurando a sua segurança e fiabilidade.

O processo de aquisição de tecnologia deve ser simplificado para permitir uma integração mais fácil e menos burocrática nos serviços de saúde. À medida que a monitorização remota se expande, é importante que a sua implementação seja ágil e flexível, evitando entraves administrativos que possam desencorajar doentes e profissionais de aderirem a esta abordagem.

Final Considerations

A: A monitorização remota é seguramente o futuro, que já deveria ser o presente. Há doentes que poderiam beneficiar muito mais sendo acompanhados à distância do que permanecendo internados no hospital. O desafio agora não é tecnológico, mas sim organizacional e administrativo. Precisamos de criar condições que permitam que esta abordagem se torne uma realidade no dia-a-dia dos hospitais e das ULS.

ANNEX

Plano Estratégico Nacional para a Telessaúde (PENTS 2019–2022)

Source: Shared by Interviewee 3. Original publication: SPMS – Serviços Partilhados do Ministério da Saúde, 2019. Available online at: https://www.spms.min-saude.pt/wp-content/uploads/2019/11/PENTS_portugu%C3%AAs.pdf

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