m-Health System for the Self-management of Patients with Heart Failure

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Abstract: Increasingly, the use of technology is emerging as a tool to support health care. The new information and telecommunications technologies have triggered a new paradigm in health: in access, availability and management of information. Telemonitoring interventions in patients with heart failure have been shown to be cost effective in reducing the rate of hospitalisations and mortality. The development of m-Health applications focused on the centralization of care in patients, considering the perspectives of different stakeholders, promises results not only in clinical (mortality and morbidity) but also in patient outcome reports (quality of life and self-care). This work presents an integrated information system for telemonitoring and self-management of patients with heart failure.

1 Introduction

The sustainability of the national health system is one of the biggest challenges for policy makers in the health sector. With the increase in life expectancy, the aging of the population and advances in medicine, the prevalence of chronic diseases has increased exponentially throughout the world, leading to an increase in the consumption of health resources. Digital health emerges as a support tool to respond to the increased demand for healthcare, particularly in chronic diseases, increasing efficiency and access to healthcare and reducing healthcare costs.
Heart failure (HF) is a syndrome with high incidence and prevalence, affecting approximately 1-2% of the adult population in developed countries, with a prevalence of more than 10% in individuals over 70 years of age (McDonagh et al., 2021).
Training for self-management of patients with heart failure is essential for managing the disease and allows for improved adherence to pharmacological and non- pharmacological treatments, thereby reducing mortality, reducing hospitalizations and improving quality of life.
Technological development has brought new tools to support the care process for chronically ill patients, namely telemonitoring using mHealth systems. mHealth systems can be defined as the use of portable communication devices (such as cell phones or smartphones, wireless devices, and monitoring devices) that provide health services and information to support clinical and public health practice (Nouri et al., 2018).
Although there are a large number of mHealth systems, their use, even after being downloaded

many times, is low. Furthermore, many of the applications are of low quality, developed without taking into account scientific evidence or the needs and expectations of their users (Nouri et al., 2018). Software development is characterized by the sequencing of activities necessary to specify, design and test the results of the software under development, which must comply with the requirements defined for its development and with the national and international standards defined for the area (Silva and Videira, 2008). Requirements gathering is the most important step in software development, dictating its success or not. To identify the requirements, it is essential to know the needs and expectations of all its users, so that its use can be an added value for their daily lives (Hussain et al., 2016).

Given this paradigm, the present work consists of identifying the requirements for an mHealth system in the self-management of patients with heart failure, taking into account the perspectives of the various stakeholders in order to respond to their objectives, expectations and priorities.

2   Methods

To define the requirements for the development of an mHealth system for the self-management of patients with HF, the problem was contextualized in the follow-up of patients with HF. Subsequently, a systematic review of the literature was carried out on current mHealth systems and the benefits of their application. The work stages are systematized in the (Figure 2)
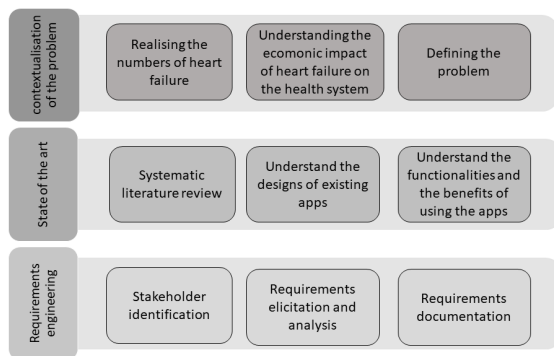

Figure 1: Study development phases

For requirements engineering, a qualitative methodological approach was chosen, which allowed exploring the perspectives of various stakeholders. The target population of the study were stakeholders involved in a care process for patients with heart failure in Portugal. The type of sampling was intentional – non-probability sampling, with the sample consisting of 25 elements. To this end, 4 focus groups were conducted:
- Group 1: Health professionals: 6 Cardiologists.
- Group 2: Health professionals: 5 Nurses.
- Group 3: 7 Patients.
- Group 4: 5 Informal Caregivers.
Interviews were also carried out with a health unit manager and a computer engineer.

3 Results

The systematic review of the literature allows to verify that the use of non-invasive telemonitoring using a smartphone is a useful tool in supporting the follow-up of patients with HF, demonstrating evidence of its effectiveness in improving the patient's self-care and quality of life, and in reduction in hospitalizations.

After analyzing the results from the perspectives of different stakeholders, the functional requirements of the VIVERcomIC app were divided into five main sections: Monitoring (daily surveillance); Alerts and feedbacks; Medication; Educational toturials and communication channels.

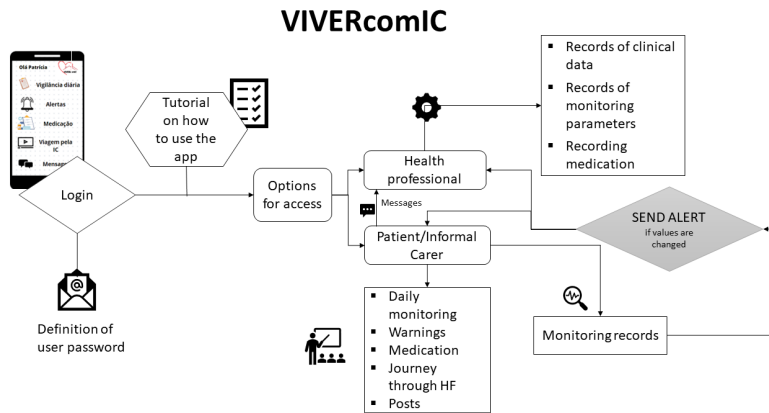The application architecture is systematized in the 2)

Figure 2: VIVERcomIC application architecture

The VIVERcomIC application aims to contribute to a strategy for recording the monitoring of signs and symptoms of the disease, allowing the patient access to feedback on their health status, and with this, more assertively resorting to healthcare.

In addition to monitoring, it provides educational tutorials on heart failure, enabling patients and informal caregivers to access information about their disease at their own pace and needs, and not just in specific moments of contact with healthcare professionals. Communication channels aim not only to facilitate contact with healthcare professionals, but also to provide feedback and alerts on health status, resulting in greater safety.

4 Conclusion

The emergence of new technologies has brought new models of care provision. The development of mHealth systems has proven to be an important tool in supporting patient training for self-management of heart failure. Reliability, accuracy of information and application interventions are the most discussed issues regarding the use of mHealth systems.

The functional requirements defined by stakeholders were divided into five main areas: Monitoring of signs and symptoms, alerts and feedbacks, recording of pharmacological therapy, educational tools and communication channels.

Therefore, the introduction of mHealth systems, more specifically VIVERcomIC, has the potential to positively promote changes in the health and well-being of patients, either by promoting health literacy, changing lifestyles, improving the self-management capacity of disease, namely by monitoring signs and symptoms of decompensation and early identification of warn-

ing signs, and by improving accessibility and communication between patients/informal care-
givers and healthcare professionals.

Acknowledgments

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