

Exercit@rt: An Integrated Web and Mobile App for COPD Management



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INTRODUCTION

Chronic Obstructive Pulmonary Disease (COPD) is a highly prevalent disease worldwide (World Health Organization [WHO], 2008). As the disease progresses, patients become more susceptible to respiratory exacerbations which cause frequent hospital admissions and readmissions and, thus have a considerable impact on patients' quality of life and healthcare costs (Alison et al., 2009). Furthermore, the gradual disability often leads to higher dependence on family members, who become central to provide support (Caress, Luker, Chalmers, & Salmon, 2009). This poses COPD as a public health problem of increasing concern to healthcare systems (Nici et al., 2006) but also of increasing burden to families (Figueiredo, Gabriel, Jácome, Cruz, & Marques, 2014). This has also relevance as the number of patients with COPD being managed at home is increasing to reduce health-related costs while trying to improve patients' quality of life (Bolton, Waters, Peirce, & Elwyn, 2011). Pulmonary rehabilitation is part of the essential care to these patients (Spruit et al., 2013) however, most do not have access to these programs, the family member is not commonly included and the long-term maintenance is difficult to achieve. Moreover, it

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has been reported that patients, after completing pulmonary rehabilitation programs and finding themselves on their own, usually stop performing the physical exercises and end up losing track of previously acquired gains (Marshall, Medvedev, & Antonov, 2008).

Home telemonitoring interventions, namely telerehabilitation, are a relatively new field in COPD research. These interventions are very promising (Cruz, Brooks, & Marques, 2014b) as they enable direct interaction between all key players - patients with COPD, their family members and health professionals - in the disease management even at a distance, promoting a more integrated care model. e-Health solutions can help patients with COPD to gain autonomy, commitment and motivation, offering solutions that allow them to continue their rehabilitation programs outside the traditional health contexts, maintaining the online support from health professionals. Exercit@rt was created within this context.

In the first stage of the research project, a pulmonary rehabilitation program was adapted to an online desktop interaction paradigm, through a web platform - Exercit@rt. This platform offers to patients with COPD, their family caregivers and health professionals a complement to the pulmonary rehabilitation program, enabling these users to create their own home-based rehabilitation exercise plans, based on scheduled sessions. Each session is composed by a set of exercises, with progressions available for each exercise, presented by pictograms and textual descriptions. The platform also provides an opportunity for users to communicate, share their experiences and outpourings and monitor their health condition through online self-rated questionnaires.

At a second stage, a mobile app was prototyped, closely integrated with the web platform. This app enables real time biometric data monitoring/collection, i.e., peripheral oxygen saturation and heart rate, via an oximeter finger sensor that dynamically provides a feed of data samples. The app also includes a status dashboard, allowing patients and family caregivers to follow and evaluate their performance.

Besides presenting the web platform and mobile app features, rationale and development phases (specification, prototyping and development), this chapter will also: contextualize and present the underlying pulmonary rehabilitation program; analyze the importance of e-health and m-health solutions in COPD rehabilitation and monitoring; present the state of the art of web based and real-time biometric monitoring/collection data solutions used in COPD management; discuss the technical challenges derived from integrating third-party sensors with mobile devices and the web platform; and discuss the challenges related with the adaptation/migration of developed visual contents from the platform's web context to a new mobile context.

The main purpose of this chapter is, therefore, to present the Exercit@rt ongoing development and current achievements, highlighting the challenges of integrating web and mobile solutions, and to demonstrate the potential of these new tools on the rehabilitation of patients with COPD in an integrated care model.

BACKGROUND

Chronic Obstructive Pulmonary Disease (COPD) affects 210 million people worldwide (Mathers & Loncar, 2006; WHO, 2007a) and is one of the main leading causes of long-term disability (WHO, 2008). This chronic disease, despite being primarily characterized by progressive airflow limitation, is known by its systemic features, such as impaired mobility and muscle weakness, that contribute to high disability (The Global Initiative for Chronic Obstructive Lung Disease [GOLD], 2015). As the disease progresses,

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