# Chapter 30
# mHealth Environments for Chronic Disease Management

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## ABSTRACT

*The management of chronic diseases requires the continuous monitoring and control of an extensive set of medical and lifestyle parameters affecting the health status of patients. The purpose of this chapter is to present an overview of the state of the art in wearable medical systems and mobile self-management support interventions in the daily care of Chronic Obstructive Pulmonary Disease (COPD) and Type 1 and Type 2 diabetes. In both cases, research and commercial approaches to the integration of specialized sensors in a wearable smart module are presented and their ability to provide real-time estimations for crucial parameters is emphasized. Moreover, special emphasis is placed on mobile self-monitoring applications which are progressively enhanced with decision support, pattern recognition and predictive capabilities which can be used by the patient. The way in which mobile health technology can improve health outcomes is discussed and future research directions are described.*

## INTRODUCTION

Chronic conditions are those which are long-term (lasting more than 6 months) and can have a significant effect on a person's life. They are generally hereditary or the result of factors such as poor diet and living conditions, using tobacco or other harmful substances, or a sedentary lifestyle. Chronic diseases may get worse, lead to death, be cured, remain dormant or require continual monitoring. At the same time chronic illness has a profound effect on the physical, emotional and mental well-being of individuals, often making it difficult to carry on with daily routines and relationships (Nuovo, 2006). However, in

many cases, deterioration in health can be minimized by good care. This often depends upon individual choices made on a daily basis.

Management to reduce the severity of both the symptoms and the impact of a chronic disease is possible in many conditions. Chronic disease management is a systematic approach to improving healthcare for people with chronic disease. Management includes medication and/or lifestyle changes such as diet and exercise, and stress management. Healthcare can be delivered more effectively and efficiently if patients with chronic diseases take an active role in their own care and providers are supported with the necessary resources and expertise to better assist their patients in managing their illness.

Chronic disease management accounts for a large amount of the total healthcare budget. 70 to 80% of healthcare budgets, an estimated € 700 billion per year are spent on chronic diseases in the European Union (Economic, Affairs, & Group, 2012). These days, the supervision and the treatment of chronic patients is inefficient and suffers from several challenging conditions and interoperability weaknesses. Patient's medical data are missing, healthcare providers and clinicians are unable to monitor (in real-time or retrospectively) patient's health status and the patient himself is difficult to undertake the needed medical tasks resulting in increased risk situations for patient's health.

Several protocols and programs are carried out among medical and research departments focusing on the improvement of prevention and wellness strategies in the area of chronic diseases. In the majority of them, great expectations and promising outcomes are generated by the introduction of mobile health (mHealth) technologies in the whole healthcare system. The development of innovative and effective mHealth systems should be supported by the increased and widespread use of mobile connectivity which contributes to reachable and easily accessible healthcare services for a large part of population improving patient's quality of life. In such a way, the whole range of mHealth's stakeholders that are the patients, healthcare providers, clinicians, medical experts and health industries would benefit and more advanced and effective healthcare services could be provided to the chronic patients.

## BACKGROUND

Mobile devices, such as smartphones and tablets are becoming increasingly popular in the provision of services in various fields. In the last 10 years, they have become a central part in the provision of healthcare services as well thanks to a series of unique features, such as:

1.  Provision of significant computational capabilities and native applications (Andoid, iOS, Windows Phone) which provide Application Programming Interfaces (APIs)
2.  Incorporation of internet and other connectivity options (e.g. Bluetooth)
3.  Availability of inbuilt sensors (accelerometers, cameras, GPS, etc.) and associated data analysis algorithms (e.g. heart rate extraction)
4.  Availability of a great variety of apps as well as app-enabled peripheral devices (connected health and lifestyle gadgets)
5.  Tendency of people to carry and use mobile phones and smartphones everytime and everywhere

The mHeath technologies have been designed, developed and validated in order to build patient's environments that could achieve sustainable health status by monitoring, managing therapy or even changing behaviors regarding medication adherence. The majority of mHealth applications in chronic

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