Remote Patient Monitoring Technologies

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INTRODUCTION

Over the last decades we experienced a paradigm shift from acute to chronic diseases, mainly due to the aging of population. However, the training of doctors, and other health professionals, kept the traditional educational models that focused in diagnosis and treatment of acute pathologies. In the second half of the 20th century, since the 1960's, new information and communication technologies began to develop and they have emerged in the health context, with positive and negative effects. It is therefore important to develop new approaches, technologies, skills and knowledge to address this new reality. (Ruiz et al. (2006); Strandberg et al. (2007); Wholihan et al. (2012)).

Despite the fact that acute conditions require specific medical attention at the current conjuncture we cannot continue to control chronic diseases in the same way we do for acute diseases. It is essential to develop an educational model that turns to the chronicity and long-term care, to the disease prevention and to palliative care (Celler et al. (2003)).

In this context doctor-patient communication develops a new and a highest reputation and, also, has evolved throughout the last decades from paternalism to individualism. The fundamental objective of any doctor-patient communication is to improve the patient's health and medical care. (Bertakis (1977); Nilsson (2010)) Current model of information exchange shared decision making and patient-centered communication is currently considered to be the best model (Cline et al. (2001); Herndon et al. (2002); Sawyer et al. (2003)). The main objective is learning to negotiate therapeutic and care plans, to support patients in self-management, to use information systems and to work as members of multidisciplinary teams. Increasing patient involvement in supervision and documentation process of their own health may lead to a greater involvement and accountability from the patient. This is certainly a new way to look at the doctor-patient relationship (Reis et al. (2013); Albernethy et al. (2010)).

Also, with the same purpose, efficient and reliable measurement technology and sensor technology in physiology will gain a lot of importance for the assessment of human functional state. The registration of physiological signals or biosignals is important not only for timeless classical applications concerning medical diagnosis and subsequent therapy, but also for future applications such as daily monitoring (Kaniusas (2012)).

Bearing in mind the importance and current of this theme, in this chapter, a definition of biosignals will be given as well as possible classifications of commonly used biosignals in order to perceive a nearly unlimited diversity of biosignals, their usefulness for remote monitoring patients, followed by future trends in biosignal monitoring.

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BIOSIGNALS DEFINITION AND MONITORING

The use of human biosignals, or physiological signals, in medicine had a great evolution over the centuries determined by patient and physician needs as well as by other problems that were encountered, namely those related with changes in disease pattern associated with population aging.

A biosignal can be defined as a description of a physiological phenomenon that can be used in both diagnosis and therapy. The first were historically evaluated by *inspection* (through which patient is carefully observed, with necked eye, for example as regards skin colour, nutritional state), *palpation* (to feel and to determine body size, shape, location of organs, and so on, with hands applying a small of pressure), *percussion* (involves striking the body directly or indirectly with short and sharp knocks of a finger. The produced sounds indicate the presence of a solid mass or an air-containing structures, and are also helpful in determining the size and position of various internal organs) and *auscultation* (in which the physician listens to internal body sounds to detect pathologies). With technological progress these procedures were improved with the support of instruments used by the physician on the patient (e.g. stethoscope, otoscope, ophthalmoscope) spreading to the spectrum of functions to evaluate. However, these acquisition methods of biosignals are not objective, and in this way an objective evaluation essential for a good diagnosis is not possible. Likewise, reproducibility, analysis, comparison and circulating biosignals information is not possible due to the subjective and variability of physicians and it's instantaneous impression, as well as due to the lack of storage for future applications (Kaniusas (2012); Loewe et al. (2013)).

Considering that a biosignal is any signal in living beings that can be continually measured and monitored, problems related with the objectivity of their evaluation were recognized, and efforts to avoid them were made in order to be objective and any assessment can be reproducible, recorded, compared with other assessments and communicated on a large scale for global assessment. (Shalevet et al. (2011)

In a simple way we have in extreme poles verbal and individualized description of a signal, which is inaccurate and subject to interferences by the experience and sensibility of who makes the evaluation. On the other hand we have technology assessment with precise, quantitative measurements where hardly occurs interference of the observer.

The question is how and what to monitor? Nowadays, the surveillance of chronic diseases is a problem for the organization of health systems because of their high costs.

With the progressive aging of the population, associated with errors held in lifestyle (sedentary lifestyle, improper diet, smoking habit, among others), the need to care for patients with chronic and progressively disabling weaknesses increased. In this context hospitalization and costs associated with the recovery, rehabilitation and control of diseases and their complications also increased. Thus the idea of permanently monitoring health status of patients emerged,. With this we intend to identify and detect any change as early as possible and to intervene early and prevent further deterioration in the health status of the patient.

Currently more and more biosignals monitoring tended to depend on the use of new mobile communication technologies that allow continuous transmission of information on the health status of the patient to health professionals, generating responses for individual control of each patient and timely policy planning of global health. The first step of this process depends on the definition of what should be monitored and how such monitoring can be made. (Bull et al. (2010))

It is important to reaffirm that the use of means of monitoring physiological functions to evaluate the state of health is not new. The use of regular analytical controls, the determination of capillary blood glucose, regular measurement of weight or blood pressure is widely known.