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Review

# Remote telemonitoring of cardiovascular patients: Benefits, barriers, new suggestions



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**Abstract** Remote telemonitoring systems have been designed as a response to the new needs of home care for patients with chronic diseases. It also has the potential to ensure appropriate monitoring and treatment of patients as well as reducing the healthcare costs. Telemonitoring has been shown to be able to significantly improve the treatment outcomes of many chronic diseases, including pulmonary disorders, diabetes, hypertension, and cardiovascular diseases (CVD). Despite the promising results of telemonitoring systems regarding patient management and healthcare costs reduction, usage of this innovative technology is not as widespread as we would expect. The major barriers responsible for this are: unawareness and non-compliance of health care providers and patients, insufficient reimbursement of telemonitoring system expenses by National Health Service (NHS) and health insurance companies, unclear business models and also high costs of making necessary adjustments to change from more conventional systems to the new ones for the healthcare providers. These concerns should be addressed when designing and producing new telemonitoring systems. The focus has to be on making systems that are more user friendly, cost effective, durable with better safety standards. There should be a lot of effort to gain the support of the NHS and health insurance companies as well as to train and educate patients and health care providers in order to make them more compliant. Moreover, specific considerations must be made for special needs groups such as the elderly, those with impaired mental health or the ones that do not have access to computers easily.

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## Introduction

In recent decades the average human life expectancy has grown around the world, mainly due to the improvements in social and environmental conditions as well as the scientific and technological advancements which has helped the healthcare providers to provide better clinical and para clinical services. As a result, the world population is aging in an unprecedented, pervasive and enduring way. The aging has been extraordinary and unparalleled through human history and it is going to be even more rapid in the 21th century. The aging process which is a universal phenomenon affecting almost all the countries around the world. It is also enduring meaning that the world population never returns to its younger state again.<sup>1</sup> The aging phenomena is going to have profound effects on many aspects of human life including health related issues.

The major health related consequence is the fact that the incidence and prevalence of chronic diseases, also known as non-communicable diseases (NCDs), is on the rise. According to the CDC reports (Center for Disease Control), as of 2017, almost 50% of adult Americans were dealing with one or more chronic conditions and 25 percent had two or more chronic health conditions at the same time.<sup>2</sup> The number of deaths due to the chronic diseases is also growing in most countries, despite the progress in reducing age-standardized death rates.<sup>3</sup> In fact, about 40 million people die due to the chronic diseases on a yearly basis which equals to 70% of annual death rate. The four major NCDs are cardiovascular diseases (CVD), cancers, chronic pulmonary disorders and diabetes. For instance heart diseases and cancer together accounted for nearly 46 percent of all deaths,<sup>2</sup> they are followed by respiratory diseases and diabetes which cost around 3.9 and 1.6 million yearly death, respectively.<sup>4</sup>

In addition to the growing prevalence and the high rate of mortality and morbidity, NCDs are costly as well. Dealing with different aspects of chronic diseases management consumes the largest portion of a nation's health budget<sup>2</sup> and poses a significant and long standing challenge for virtually all healthcare systems.<sup>5</sup> In United States total costs of diagnosed diabetes and CVDs together, were more than 550 billion of dollars, in 2012.<sup>2</sup> Among the prevalent NCDs, the growing burden of CVDs on national healthcare

systems is well recognized amongst healthcare professionals internationally.<sup>6</sup> In fact, CVDs alone are not only capable of placing a burden on almost any healthcare budget, but also on the entire economy of a country. This is even more concerning when considering the middle or low income countries in which the high Costs of CVDs, can be responsible for macroeconomic losses equivalent to, up to 6.77% of their GDP.<sup>7</sup> In view of the fact that the chronic diseases affect people in low and middle income countries disproportionately, the growing economic burden of such diseases is able to push those countries through poverty and drain their household resources.<sup>4</sup>

What adds to the challenges above is the fact that the number of healthcare service providers is declining in the face of the increasing demand. According to WHO the world is going to face a 12.9 million healthcare provider shortage by 2035, as the current rate of training new health professionals do not meet the present and upcoming needs. Internal or international migration of providers has also exacerbated the problem by shaping an unfair distribution of providers between different areas. The report showed that 83 countries have failed to reach the basic expected threshold of healthcare professionals to the population ratio.<sup>8</sup> The most recent report of annual physician workforce projections predicted that by 2030, demand for physicians will exceed supply by a range of 40.800 to 104.900.<sup>9</sup> The imbalance between demand and supply for nursing professionals is also well recognized according to many global and national reports.<sup>10</sup> Furthermore, physicians and nurses are aging as the general population. In 10 years more than one third of current physicians will be older than 65, meaning that many of them will not be among the active health providers in near future.<sup>11</sup> Focusing on the trends of nurse shortage and the increasing average age of nurses, also indicates that the nurse workforce will decline below projected requirements in coming years.<sup>12</sup>

The enormous economic burden of chronic diseases along with the growing imbalance between the number of patients and number of healthcare providers is challenging our health care systems. In order to address this challenge, we have to seek for new solutions which would enable us to utilize our limited resources more efficiently. Our

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