

## Telemedicine: An Underused Weapon in the Therapeutic Arsenal of Chronic Heart Failure

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### Editorial

In France, nearly one million people are affected by heart failure (HF), with 120,000 new cases emerging each year [1]. HF is characterized by high mortality (30% of deaths within 5 years of first symptoms in more recent studies) and major disability in daily life (shortness of breath, fatigue, etc.), in addition to prolonged and recurrent hospitalizations [2]. Chronic HF diminishes patients' quality of life and has a major economic impact. This is primarily accounted for by healthcare costs resulting from re-hospitalization, especially for people aged over 65 years, due to the recurrent episodes of cardiac decompensation [1]. Current patient care aims to improve patients' quality of life by alleviating symptoms (shortness of breath, fatigue, etc.) and allow them to perform everyday activities, and by preventing cardiac decompensation episodes. As a result, hospital stays are likely reduced, as well as disease progression and mortality rates.

The management of chronic HF is currently based on two components: 1) a non-pharmacological treatment based on the prescription of dietary practices and regular physical activity. This diet and hygiene education has proven key to the therapeutic patient management; 2) a well-established and efficient pharmacological treatment (i.e., drugs) against HF [2]. Pharmacologic therapies include the use of: angiotensin-converting enzyme (ACE) inhibitors, angiotensin II receptor blockers, beta blockers, diuretics, aldosterone antagonists, inotropic agents, anticoagulants, digoxin, ivabradine and lastly the association sacubitril and valsartan. It is to note that all these drugs have demonstrated their interests in HF with reduced ejection fraction. In some cases, doctors recommend surgery

to treat the underlying problem that led to HF. In addition, some treatments have studied and used in certain patients including: coronary bypass surgery, heart valve repair or replacement, implantable cardioverter-defibrillators (ICDs), cardiac resynchronization therapy (CRT) or biventricular pacing, and the terminal situation ventricular assist devices (VADs) [2]. Heart transplants can improve the survival and quality of life of some people with severe heart failure. However, candidates for transplantation often have to wait a long time before a suitable donor heart is found.

Managing HF is a complex, lengthy, often difficult task, with great cost to our society, both in terms of healthcare and treatment time as well as from a financial standpoint [2]. Patients with chronic HF, frequently present for emergency hospitalization and re-hospitalization, which impairs the quality of their life. Some of these hospitalizations could be avoided if patients took greater responsibility for their disease and were followed up better. To improve chronic HF care, the most relevant means include preventing cardiac decompensation by anticipating patients' symptoms via regular monitoring of vital parameters, while promoting adherence to lifestyle changes and therapy [2,3]. Telemedicine may be of aid in this setting.

Since the beginning of the 2000's, numerous telemedicine projects have been conceived and developed in the area of chronic HF [4]. Practically all of them have investigated telemonitoring. The results of those telemedicine projects differed from study to study and were fairly inconclusive regarding any potential clinical benefit in terms of, for instance, re-hospitalization or a decrease in morbidity and mortality. Nevertheless, several reviews and meta-analyses

seem to have shown an undeniable utility for telemedicine. Moreover, aside from the medical considerations, it is worth noting that all the studies seem to agree that using telemedicine solutions in the management in case of HF was at least economically beneficial. It is worth bearing in mind that those projects, particularly the earlier ones, more closely resembled telephone follow-up with care providers (such as a nurse) traveling to the patient's home, rather than telemedicine as we think of it nowadays with nonintrusive, automated, smart telemonitoring using remote sensors via modern communication technology or even artificial intelligence [5]. Hence in our opinion those studies represent the first generation of telemedicine projects: "telemedicine 1.0".

Over the last 4 to 5 years, a second generation of projects has emerged in the chronic diseases area, e.g. in the HF area, particularly in developed countries as in France [5]. These projects are known as "telemedicine 2.0", because they utilize the new Information and Communication Technology (ICT) and the web. Most of these projects rely on the usual connected tools for monitoring chronic diseases, as such as blood pressure meters, weighing scales, and pulse oximeters in HF, or glucometers in diabetes mellitus., which relay the information collected via Bluetooth, 3G or 4G and incorporate tools for interaction between the patient and healthcare professionals like telephone support centers, tablets, and websites [5]. Some of them also provide tools for motivation and education, and occasionally, questionnaires about symptoms, such as dyspnea, palpitation and edema as experienced by the patient. We have developed in Strasbourg such of "telemedicine 2.0" project, centered on the patient's nurse and Family Doctor. This project is entitled: E-care.

The E-care project has been developed to optimize the home-monitoring of chronic HF patients. It detects situations in which there is a risk of cardiac decompensation and re-hospitalization, and it does this via a telemonitoring 2.0 platform [6,7]. The E-care platform automatically generates indicators of a worsening of the patient's health status. These "warning alerts" are generated for any HF decompensation that may lead to hospitalization if not treated. Between February 2014 and April 2015, the E-care platform was used in 175 patients with chronic HF, on a daily basis by patients and healthcare professionals according to a defined protocol of use specific to each patient [8]. Analysis of these alerts showed that the E-care platform automatically detected cardiac decompensation with sensitivity, specificity, and positive and negative predictive values, respectively of 100%, 72%, 90% and 100%. In the present experience, "warning alerts" have preceded cardiac decompensation for up to 5 days. Both the healthcare professionals and all the patients, even the frailest, used the E-care system without difficulty until the end of the study. During the study of non-autonomous patients, the system was employed by a nurse in addition to other tasks like washing and administering medication, as well as by close ones and Family members. Hence, it has been our experience that age is not a limiting factor on grasping and using new technologies. Several recent studies have reached the same

conclusion, documenting the use of telemedicine solutions even among 80-year-olds [9].

As with E-care, the "telemedicine 2.0" projects are perfectly compatible with the care pathways being developed in chronic diseases by the developed countries health authorities [9,10]. In fact, the telemedicine platform is also capable of structuring the patients' care pathways, a major theme in medicine for our governments and authorities; it is also capable of providing a means for the various healthcare professionals to exchange with each other; and of facilitating access to medical resources. What's more, all these findings should be analyzed with regard to the benefit of these telemedicine solutions. In the field of chronic diseases, given the epidemiology and expected shortage of time careers can provide, what we need is better follow-up and better education, improved prevention and anticipation, but, above all, better selection of the patients whose use of the healthcare system will be indispensable.

Thus in view of the results of these projects, we must encourage the deployment of telemedicine in patients with chronic HF. To our opinion, telemedicine 2.0 is currently an underused weapon in the therapeutic arsenal of chronic HF!

## Conflicts of Interest

The authors state that they have no conflicts of interest to declare except Mr M. Hajjam, who is the science director of the company PREDIMED Technology.

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