



REVIEW ARTICLE

Telemonitoring in heart failure: A state-of-the-art review



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KEYWORDS

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Abstract Heart failure is associated with high costs which are mainly the result of recurrent hospital admissions. New strategies to detect early decompensation and prevent heart failure-related hospitalizations and reduce total health care costs are needed.

Telemonitoring is a novel tool based on the use of recent communication technologies to monitor simple clinical variables, in order to enable early detection of heart failure decompensation, providing an opportunity to prevent hospitalization.

From conventional telemonitoring to more recent strategies using implantable cardiac devices or implantable hemodynamic monitors, the subject is under active investigation. Despite the beneficial effects reported by meta-analyses of small non-controlled studies, major randomized controlled trials have failed to demonstrate a positive impact of this strategy. Additionally, evidence regarding the value of newer monitoring devices is somewhat contradictory, as some studies show benefits in prognosis which are not confirmed by others.

This paper provides an overview of the existing evidence on telemonitoring in heart failure and a comprehensive state-of-the-art discussion on this topic.

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PALAVRAS-CHAVE

Monitorização remota;
Telemonitorização;
Insuficiência cardíaca

Telemonitorização na insuficiência cardíaca – estado da arte

Resumo A insuficiência cardíaca acarreta elevados custos, maioritariamente associados a internamentos recorrentes. Urge encontrar estratégias que possibilitem a deteção precoce dos episódios de descompensação da insuficiência cardíaca, de forma a prevenir as hospitalizações e, assim, reduzir o custo sanitário inerente à doença.

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A telemonitorização é uma ferramenta inovadora, baseada na utilização de tecnologias de comunicação recentes capazes de monitorizar variáveis clínicas simples que possibilitem a identificação precoce da descompensação da insuficiência cardíaca, proporcionando a oportunidade de evitar a hospitalização.

Desde a telemonitorização convencional até estratégias mais recentes utilizando dispositivos cardíacos ou monitores hemodinâmicos implantáveis, esta é uma temática sob investigação ativa. Apesar de metanálises prévias de pequenos estudos não controlados terem documentado o potencial benefício da telemonitorização, os principais ensaios clínicos aleatorizados não conseguiram demonstrar o impacto positivo dessa estratégia. Adicionalmente, os dados relativos ao valor dos dispositivos de monitorização mais recentes são contraditórios, na medida em que alguns estudos documentam potencial benefício prognóstico enquanto outros não o conseguem confirmar.

Este artigo fornece uma revisão da evidência científica referente à telemonitorização na insuficiência cardíaca, bem como uma discussão compreensiva acerca do tema.

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Introduction

Heart failure (HF) is associated with high mortality and morbidity, readmission rates and costs.¹ Costs related to HF account for 1–2% of all healthcare expenditure, mainly the result of recurrent hospital admissions.^{2–4} Despite recent advances in medical and device therapy, patients with HF still suffer from repeated hospitalizations due to the combination of progression of the disease, poor adherence to diet and medical therapy, occurrence of comorbidities and limited support.^{5,6} Thus, this clinical entity remains a major medical and epidemiological problem which carries a heavy economic burden.⁶ New strategies to detect early decompensation and prevent HF-related hospitalizations and hence reduce health care costs are needed.

Multidisciplinary HF management programs and HF clinics, considered 'usual care' in several European countries, have been successful in reducing all-cause hospitalization rates.^{7,8} However, because of geographic barriers, socio-economic constraints and other obstacles, only a relatively small proportion of HF patients have access to such programs. Interventions have therefore evolved to better monitor HF patients at home.⁹

Telemonitoring is a novel tool to improve patient care and adherence which encompasses the use of recent communication technologies to monitor simple clinical variables which are transmitted to the health care provider. Its goal is to detect early signs of heart failure decompensation, providing an opportunity for intervention before the patient requires hospitalization (Figure 1).^{10–12}

Several non-invasive telemonitoring strategies have been proposed, using regularly scheduled structured telephone interviews or more sophisticated systems, such as electronic transfer of physiological data with remote access control via external, wearable or implantable devices. They have been assessed in retrospective and prospective clinical studies, with conflicting results. This paper sets out to provide a critical review of the current evidence on telemonitoring in HF.

Published meta-analyses

Various observational studies on HF telemonitoring have called attention to its potential benefit. Two major meta-analyses aimed to assess the overall effect of HF telemonitoring on prognosis.

In 2009, Klersy et al.¹³ reviewed 96 articles, comparing multidisciplinary HF approaches by either usual care or remote patient monitoring. The cumulative incidence of events in the usual care approach (in-person visit) and in remote monitoring strategies (telephone or technology-assisted monitoring approaches) was compared. A total of 6258 patients were included in randomized controlled trials (RCTs) and 2354 patients in cohort studies, with a median follow-up of 6 and 12 months, respectively. In RCTs telemonitoring was associated with a significant reduction in mortality compared to usual care (relative risk [RR]: 0.83, $p=0.006$), total hospitalizations (RR: 0.93, $p=0.030$) and hospitalizations for HF (RR: 0.71, $p=0.001$). The combined endpoint of death or first hospitalization showed similar results (RR: 0.86, $p=0.001$). In cohort studies, telemonitoring was also associated with a significantly lower number of deaths (random-effects RR: 0.53, $p=0.001$) and hospitalizations (random-effects RR: 0.52, $p=0.001$). Hence, according to this meta-analysis, remote monitoring significantly reduced the risk of death and hospitalization for any cause in both RCTs and even more markedly in cohort studies.

In 2011, Inglis et al.,¹⁴ updating a study by Clark in 2007,¹⁵ published an extensive meta-analysis of RCTs on structured telephone support or telemonitoring compared to standard practice for patients with HF. They included five abstracts and 25 studies, of which 16 evaluated structured telephone support (5613 participants), 11 assessed telemonitoring (2710 participants) and two tested both interventions. Telemonitoring reduced all-cause mortality (RR: 0.66, $p<0.0001$) with structured telephone support demonstrating a non-significant positive effect (RR: 0.88,

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