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Using telecare for diabetic patients: A mixed systematic review

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Abstract

Objective: *Numerous telecare interventions and technologies are used in the management of* type 2 diabetes mellitus. This systematic review examines the different telecare interventions implemented, the technologies used, as well as the outcomes. Such a synthesis serves to optimize telecare use for diabetic patients and inform decision makers on technology selection and the impacts that can be expected with telecare use.

Materials and methods: *Following a* systematic, comprehensive search of databases, 2139 qualitative and quantitative studies were initially selected; after careful review and screening, 50 studies were coded and analyzed.

Results: *A typology is proposed that* identifies the nature of telecare interventions and technologies used as well as the outcomes associated with their use. *Overall,* telecare produces positive results with a variety of outcomes, such as improved health status, increased quality of care, decreased health service use or cost, increased satisfaction and increased patient knowledge.

Discussion: *While telecare is seen to have overall positive outcomes, some caveats have been identified.* There is no "one size fits all" solution. Inexperience with technology combined with a mediocre user interface can create many problems that inhibit appropriate adoption of the technology. There is a growing presence of mobile technologies, which provide immediate feedback and can be integrated with social media.

Conclusion: The results of this review can be used by healthcare professionals, organizations and patient support groups to tailor their policies with regard to the choice, planning, diffusion and monitoring of telecare interventions and the technologies implemented to care for patients with diabetes.

Background and significance

Health information technology has an unparalleled potential to improve the access, quality, safety, and efficiency of patient care [1]. In particular, the use of telecare

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technologies (TT) seems to hold promise for chronic care management since it "produces accurate and reliable data, empowers patients, influences their attitudes and behaviors, and potentially improves their medical conditions." [2]. However, there is still a lack of evidence on its clinical effects, cost effectiveness, and impacts on service utilization [2].

The large prevalence of type 2 diabetes mellitus (T2DM) in the patient population and the impetus for quality of care —including monitoring, self-care and close follow-up—are creating a need for the development and use of TT. The prevalence of T2DM is emerging as one of the greatest global public health challenges in the 21st century [3]. This epidemic is growing at an alarming rate, and patients suffering from T2DM incur significant health and financial costs. T2DM places individuals at risk for several types of complications, including cardiovascular diseases, kidney diseases, amputations, and diabetic retinopathies. Although several effective medications are available, overuse of these medications can lead to greater resistance and eventually provoke a worse state of the illness. It is thus essential to carefully manage the care of patients with T2DM.

In the past decade, there has been a growing interest in interventions aimed at improving diabetes management, patient centered-care and personalized medicine. It has been shown that interventions targeting healthcare professionals, such as clinical and organizational interventions that facilitate structured and regular reviews of patients, are effective in improving the process of care [4]. Also, interventions targeting the patients themselves, such as educational and behavioral interventions, produce better diabetes self-management and patient outcomes [5]. More recently, there has been a major resurgence in the development of novel TT to help both healthcare professionals and patients manage, monitor and control diabetes. Indeed, telecare represents a promising avenue for helping empower patients to control their blood sugar levels and, ultimately, prevent and/or delay chronic illness. Telecare also represents a way to improve healthcare professionals' competencies and clinical practices in order to better adapt/customize the care provided to each specific patient and ultimately to improve the quality of care offered to diabetic patients.

However, given the large variety of TT currently available and the diversity of interventions, ranging from condition monitoring to instant health diagnoses, it is difficult to fully grasp the actual impacts of telecare. There have been numerous reports of interventions designed to improve the care of patients with diabetes, but the effectiveness of telecare interventions is unclear. Given the advent of a multitude of new technologies and society's growing familiarity with technology, it is now an appropriate time to assess the overall effectiveness and efficacy of telecare in the care of patients with T2DM and to verify whether all TT are beneficial. There is also a need to assess the impact of telecare on adherence to guidelines, enhanced monitoring, fewer treatment errors, and a reduction of overall health care system costs for patients with T2DM. Considering the great variety of telecare interventions and technologies and the fact that each outcome is poorly understood, it is essential to clarify the nature of the different telecare interventions implemented, the technologies used per se, and the associated outcomes. Also, given the growing number of telecare interventions and technologies used in diabetic care, the time is right for a synthesis of research on telecare use in diabetes. Such a synthesis will serve to identify the characteristics and impacts of telecare, optimize telecare use, and inform decision makers on telecare interventions and technology selection and the impacts they can expect from telecare use.

This paper therefore presents a mixed systematic review of telecare interventions and the technologies used in diabetic care. The specific objectives of this review are (1) to provide a typology of the different telecare interventions and technologies used and (2) to determine the outcomes, both positive and negative, of telecare used in the context of T2DM.

Methods

Design

A mixed-method systematic review was used to integrate results from both qualitative and quantitative studies [6]. Through a review of evidence from both qualitative and quantitative studies, disparate data were synthesized in order to better understand complex phenomena such as the adoption of innovations [6-9]. Evidence extracted from different sources was integrated to identify patterns and directions in the findings. This method, recognized by the Cochrane Collaboration for systematic reviews of interventions [10], is used to determine the impacts of interventions [11] and the choice of appropriate types of interventions [12], as it can determine the effectiveness and efficacy, or lack thereof, of different interventions [9-12]. This method also serves as a decision-making guide in service management and health policy development [6,7,10]. This mixed review followed recognized standards for systematic reviews [10,13] and is presented according to PRISMA criteria [14]: (1) eligibility criteria; (2) information source and search strategy; (3) study selection; (4) data collection process and synthesis of results; and (5) critical appraisal.

Eligibility criteria

The studies that met the inclusion criteria were evaluation studies using a quantitative, qualitative or mixed-method study design. We did not *a priori* exclude specific study designs, but quantitative and/or qualitative results had to be available. The review considered all types of telecare interventions, including telemonitoring, telediagnosis, teleconsultation and all types of technologies, including Internet and smart phone use. Articles were excluded if they focused solely on describing a telecare intervention or a technology. See detailed eligibility criteria in Appendix A9. We excluded studies on patients with gestational diabetes as the management of this population is usually not on a long term basis.