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Effectiveness of ICT interventions for Diabetes: A Systematic Overview (protocol)

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Background and Purpose: The use of Information and Communication Technologies (ICT) in fighting diabetes is particularly booming in recent years. Previous studies showed to varying degrees the impact that these technologies can have in the prevention and management of diabetes.
The main objective of this overview of systematic reviews is to systematically summarize the best evidence on ICT interventions that can significantly improve one or more indicators of diabetes
Methods: We will include all type of reviews that aim to evaluate the effect of ICTs on diabetes indicators. We will consider all types of ICT applications, including: mobile health, teleconsultations, tele-expertise, electronic health records, decision support systems, elearning etc. Key comparisons will be: ICT intervention for the management of diabetes versus no intervention; ICT intervention compared to the usual management of diabetes; ICT for the management of diabetes compared to other non-ICT interventions; ICT intervention versus another ICT intervention for the management of diabetes. We will include systematic reviews published in English and French during the past 25 years, i.e. between January 1991 and March 2015. Reviews will be limited to those on human subject only. Two reviewers will screen independently the title and abstract of the papers in order to assess their eligibility, and extract relevant information based on a predetermined grid.
Any disagreements will be resolved first by discussion and consensus between the two reviewers, or will imply a third author as arbitrator.
Results: Outcomes of interest will be clinical indicators of diabetes that could be influenced by ICT interventions. These will be the main non-exhaustive and objectively measurable indicators related to the monitoring and the management of diabetes and which are generally accepted by diabetes experts
Conclusion: Based on concrete interventions that have demonstrated scientific evidence, this overview could help identify the most effective ICT interventions for improving diabetes indicators.

Keywords: Diabetes, ICT, E-health interventions, diabetes indicators

1 Introduction

Despite the availability of wide range of therapeutic and preventive means, the prevalence of diabetes in the world continues to increase year after year. According to the World Health Organization, in 2014 the prevalence of diabetes was estimated to 9% for people aged 18 years and older [1]. Furthermore diabetes was the direct cause of 1.5 million deaths worldwide in 2012, 80% of which were in low-income countries [2]. The WHO predicts that diabetes will be the 7th leading cause of death worldwide by 2030 [3]. Its complications are many, causing increased morbidity and mortality. This results in increased social, human and financial burden related to this disease.

In this context, the use of Information and Communication Technologies (ICT) in fighting diabetes is particularly booming in recent years. Multiple tools have been used such as mobile technology, remote training, teleconsultation/ telemonitoring, and electronic patient records. Previous studies showed to varying degrees the impact of these technologies on the prevention and management diabetes [4,5,6,7,8].

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It becomes important to summarize this evidence to help guide practitioners and patients to the most effective ehealth interventions in solving problems related to diabetes, and ultimately improving care and the use of scarce resources.

1.1 Objectives

Given the existence of numerous studies showing the effects of ICT interventions on diabetes, it is necessary to have a global overview based on a review of systematic reviews in order to achieve the following objectives: 1) To explore and summarize specific ehealth interventions and their characteristics that have demonstrated an impact on the management of diabetes; 2) To highlight in a systematic way the indicators for the monitoring and the management of diabetes on which ICT interventions can have influence.

1.2 Why it is important to do this overview

There exists a wide and rich range of studies about ICT interventions for the management of diabetes. A preliminary Pubmed search on diabetes and ehealth in human subjects published in the last 25 years retrieved more than 400 reviews, including systematic reviews.

Moreover, it is known that systematic reviews about the same topic can vary depending on several factors: the methodology, the quality, the number of publications, the publication medium etc [9].

Similar to systematic review, an overview of systematic reviews is a systematic technique to synthesize evidence to inform not only practitioners but also political authorities, hopefully for better decision making. [10]

Moreover given the considerable development of ICT interventions in general [11] and in the field of diabetes, in particular, with some studies directly targeting specific indicators [12,13,14,15,16,17] and other more general [18,19,20,21], it becomes imperative to highlight the real impact of these interventions on indicators used in monitoring this particular disease. This comparative analysis of different ICTinterventions would certainly help accurately answer the questions: Which intervention? For what impact? On what indicator of diabetes management?

2 Methods

2.1 Criteria for considering reviews for inclusion

Types of reviews.
Will be included in this overview all the systematic reviews that meet the following main criteria:
Those assessing and describing the effects of ICT on the indicators of management of diabetes, regardless of the type of diabetes and type of interventions

Those published in English or French during the last 25 years (1991 -2015)

Those clearly describing the method used to select studies

Those that used systematic search strategies to identify selected studies

Those that have a systematic presentation and provide a summary of the results and main characteristics of the included studies [22]

Types of participants.
All individuals suffering of type 1 or type 2 diabetes, gestational diabetes or with risk factors of having diabetes.

Types of interventions.
All types of interventions using Information and Communication Technologies (ICT) that have an effect on one or more indicators for the management of diabetes will be considered, regardless of the technologies used.

Possible interventions might be teleconsultation, remote monitoring, mHealth, electronic patient record, etc.

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The classification done by Mair et al. will be used. This classification suggests a division of ehealth interventions in four areas [23]:

- Management systems: in this case it might be computerized medical record. For example an electronic medical record for a better monitoring of a diabetic patient.
- Communication systems: synchronous or asynchronous telemedicine activities such as teleconsultation, telemonitoring, tele-expertise.
- Computerized decision support systems. This area includes all computerized or automated systems based on patients' data and/or rules that serve to support health professionals in the decision-making process. Interventions in this category will be part of our study only if they have had a direct impact on the diabetic patient.
- Information systems: This area includes all Internet resources or ehealth portal users can access.

In any case, any intervention that will not have a direct effect on at least one indicator for the management of diabetes will be excluded. It could be intervention in the management or administration of human resources for which direct impact is difficult to measure in the management of diabetes.

Types of comparison.

Key comparisons will be: Using ICT for the management of diabetes versus no intervention; ICT intervention for the management of diabetes compared to usual management of diabetes; ICT intervention for the management of diabetes compared to other non-ICT interventions; ICT intervention in diabetes versus other ICT intervention for the management of diabetes.

2.2 Main expected outcomes measures

Three broad types of effects will be outlined: effects on behavior, effects on physiological indicators; and effects on knowledge and ability of the diabetic patients to take care of themselves [24].

Our analysis will focus on clinical indicators of diabetes that could be influenced by ehealth interventions. These will be the main non-exhaustive and objectively measurable indicators related to the monitoring and the management of diabetes and which are generally accepted by diabetes experts including:

- HbA1C or glycated hemoglobin
- Lipids: Total Cholesterol -HDL-LDL Triglycerides
- Albumin / creatinine
- Micro-albuminuria
- Pallesthesia of lower limbs
- Retinal screenings and microangiopathic complications
- Clinical android obesity factors (BMI, waist circumference, waist-height ratio)
- Fundus oculi
- ECG
- Screening of the foot
- Education about risk factors (BMI, possible complications, Hypertension)
- Adherence to treatment
- Neurological, ophthalmologic and skin complications

2.3 Search methods for identification of reviews

We will conduct standardized Literature searches using the following databases

- EMBASE,
- PubMed,
- CINAHL,
- Web of Science (Web of Knowledge)

Sources of information specialized in systematic reviews and other synthetic materials will be searched too. This includes: Cochrane Database of Systematic Reviews, Database of Abstracts and Reviews (DARE), the Health Technology Assessment (HTA) database and Epistemonikos. Will be included systematic reviews in English and French published during the past 25 years, i.e. between January 1991 and March 2015. Reviews will be limited to those on human subject only.

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Search strategies using controlled vocabularies will be developed and used to retrieve relevant publications. For example, MeSH descriptors will used with Pubmed while EMTREE will be used for EMBASE. The equivalents of these descriptors will be found in the vocabulary used by each database.

In addition to searches with controlled vocabulary, free keywords searching will be performed in the title and abstract fields.

A sample search strategy with Pubmed for our study is presented in Appendix 1.

We will conduct manual searches in the following journals specialized in medical informatics, telemedicine and diabetes: *BMC Medical Informatics and Decisions Making; International Journal of Medical Informatics; Studies in Health Technology and Informatics; Journal of Telemedicine and* Telecare; *Journal of Medical Internet Research; Journal of American Medical Informatics Associations, Telemedicine Journal and e-health; Journal of Diabetes and Its Complications.*

3 Results: Data collection and analysis

3.1 Selection of reviews

First of all, duplicates will be removed. Two independent reviewers will review the titles and abstracts of all articles to assess their eligibility according to the inclusion criteria. The full text copies of the papers meeting the predetermined inclusion criteria will be acquired.

Reviewers will compare their results and discuss any differences. A third reviewer will assess all cases on which the reviewers had different opinions.

Based on Smith's study [25], for each systematic review the following information will be retrieved: author name, year of publication, objectives of the review, research methodology, number of included studies, number of participants and method of analysis.

3.2 Data extraction and management

Two reviewers will independently synthesize all reviews that meet the inclusion criteria following the method proposed by the "Cochrane Handbook of Systematics Reviews of Interventions"[26] in the table "characteristics of the included journals".

The following information will be extracted: Description of the ehealth intervention (context, process, synchronous / asynchronous application), type of intervention (mHealth, telemonitoring, teleconsultation), comparison, description of the results (information on diabetes indicators that the intervention had an effect on) and any limits on the reviews.

The data or results will be summarized in tables and charts for readability. All contradictions and differences of opinions will be discussed in order to find a consensus between the two reviewers. In the case the two reviewers do not agree the opinion of a third reviewer will be required.

When there is missing or incomplete information the authors of the review will be contacted. In the case it is impossible to have this information the following footnote will be explicitly stated at the bottom of the review: "included without data" or "incomplete data".

3.3 Quality assessment

The quality of the methodologies used in the reviews included will be evaluated by two independent reviewers based on AMSTAR tool [27, 28]. This method provides a checklist of 11 items that allow reviewers to give one point for each item met in a review. All reviews with a score of more than 3 points will be included [29]. However, an exclusion of any review will be amply justified by clear and precise explanations.

3.4 Data Synthesis

A meta-analysis will be conducted for the synthesis and consolidation of data. If necessary a statistical analysis based on the types of variables will be performed [30]. For dichotomous data the risk ratios, their 95% confidence intervals and corresponding P values will be reported, and standardized mean differences will be presented for continuous data.

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3.5 Sensitivity analysis

For all primary outcomes a qualitative synthesis of the evidence will be done. To do this end, the GRADE approach will be applied [31, 32].

3.6 Sub-group analysis

The reviews will be classified in different sub groups according to the types of intervention and their main goal (which must prove an impact of ICT on one or more indicators of the management of diabetes); the study population (type I diabetes, type II; people with risk factors) and positive effects on indicators of diabetes management, as mentioned in the inclusion criteria.

4 Discussion

The results of this overview could help to accurately establish the effectiveness of various ICT interventions on specific diabetes indicators. Based on concrete interventions that have demonstrated scientific evidence, the practitioner and the diabetic patient will be able to choose between interventions depending on the problem to solve. This will avoid exposing blindly the patient to many interventions some of which are often unnecessary and costly.

An overview of the contribution of ICT for diabetic care is a necessity to ensure the quality and safety of the healthcare system [11, 33]. In this sense, we believe that this study will guide health services to the interventions that have shown a proven efficacy on targeted indicators related to diabetic care. Furthermore, we also know that diabetic patients often are reluctant to accept the situation of chronic disease and thus to adhere to interventions [34], hence there is a need to target useful and effective interventions.

Finally, we think that a better understanding of the effects of ehealth interventions on indicators for monitoring diabetes through a synthesis of scientific evidence will facilitate the establishment of the most appropriate deployment strategies for better care. Indeed, these interventions can easily influence the doctor / patient relationship [35]. Therefore, a better understanding of these interventions and their effects is an important prerequisite to maintain this relationship [36].

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Statement on conflicts of interest

The authors declare that they have no competing interests.

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