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Original Research

D-WISE: Diabetes Web-Centric Information and Support Environment: Conceptual Specification and Proposed Evaluation



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ABSTRACT

Objective: To develop and evaluate Diabetes Web-Centric Information and Support Environment (D-WISE) that offers 1) a computerized decision-support system to assist physicians to A) use the Canadian Diabetes Association clinical practice guidelines (CDA CPGs) to recommend evidence-informed interventions; B) offer a computerized readiness assessment strategy to help physicians administer behaviour-change strategies to help patients adhere to disease self-management programs; and 2) a patient-specific diabetes self-management application, accessible through smart mobile devices, that offers behaviour-change interventions to engage patients in self-management.

Methods: The above-mentioned objectives were pursued through a knowledge management approach that involved 1) Translation of paper-based CDA CPGs and behaviour-change models as computerized decision-support tools that will assist physicians to offer evidence-informed and personalized diabetes management and behaviour-change strategies; 2) Engagement of patients in their diabetes care by generating a diabetes self-management program that takes into account their preferences, challenges and needs; 3) Empowering patients to self-manage their condition by providing them with personalized educational and motivational messages through a mobile self-management application. The theoretical foundation of our research is grounded in behaviour-change models and healthcare knowledge management.

We used 1) knowledge modelling to computerize the paper-based CDA CPGs and behaviour-change models, in particular, the behaviour-change strategy elements of A) readiness-to-change assessments; B) motivation-enhancement interventions categorized along the lines of patients' being ready, ambivalent or not ready; and C) self-efficacy enhancement. The CDA CPGs and the behaviour-change models are modelled and computerized in terms of A) a diabetes management ontology that serves as the knowledge resource for all the services offered by D-WISE; B) decision support services that use logic-based reasoning algorithms to utilize the knowledge encoded within the diabetes management ontology to assist physicians by recommending patient-specific diabetes-management interventions and behaviour-change strategies; C) a mobile diabetes self-management application to engage and educate diabetes patients to self-manage their condition in a home-based setting while working in concert with their family physicians.

Results: We have been successful in creating and conducting a usability assessment of the physician decision support tool. These results will be published once the patient self-management application has been evaluated.

Conclusions: D-WISE will be evaluated through pilot studies measuring 1) the usability of the e-Health interventions; and 2) the impact of the interventions on patients' behaviour changes and diabetes control.

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R É S U M É

Objectif : Développer et évaluer le D-WISE (Diabetes Web-Centric Information and Support Environment) de manière à offrir : 1) un système informatisé d'aide à la décision qui contribuera à ce que les médecins : A) utilisent les lignes directrices de pratique clinique de l'Association canadienne du diabète (LDPC-ACD) en vue de proposer des interventions fondées sur des données probantes, B) offrent une stratégie d'évaluation informatisée de la réceptivité au changement les aidant à gérer les stratégies de changement du comportement dans le but d'encourager les patients à s'inscrire aux programmes de prise en charge autonome de la maladie; 2) une application personnalisée pour la prise en charge autonome du diabète qui sera accessible à partir d'appareils mobiles intelligents et qui proposera des interventions visant à favoriser les changements du comportement dans le but d'encourager les patients à se prendre en charge de manière autonome.

Méthodes : Les objectifs mentionnés ci-dessus ont été assurés par une approche de prise en charge des connaissances qui faisait appel : 1) à la traduction des LDPC-ACD en format papier et aux modèles de changement du comportement comme les outils informatiques d'aide à la décision qui aideront les médecins à offrir une prise en charge du diabète personnalisée et fondée sur des données probantes, et des stratégies visant à favoriser les changements de comportement; 2) à la participation des patients à leurs soins de diabète en générant un programme de prise en charge autonome du diabète qui tient compte de leurs préférences, leurs difficultés et leurs besoins; 3) à l'habileté des patients à prendre en charge de manière autonome leur affection en leur offrant des messages personnalisés éducatifs et motivants à partir d'une application mobile sur la prise en charge autonome. Les fondements théoriques de notre recherche reposent sur les modèles de changement du comportement et de gestion des connaissances en matière de soins de santé.

Nous avons utilisé : 1) la modélisation des connaissances pour informatiser les LDPC-ACD et les modèles de changement du comportement, en particulier, les éléments de stratégie de changement du comportement : A) les évaluations de la réceptivité au changement; B) les interventions d'amélioration de la motivation catégorisées selon l'ambivalence ou la non réceptivité des patients au changement; C) l'amélioration de l'auto-efficacité. Les LDPC-ACD et les modèles de changement du comportement sont modélisés et informatisés quant : A) à l'ontologie pour la prise en charge du diabète qui sert de ressource d'information pour tous les services offerts par le D-WISE; B) aux services d'aide à la décision qui utilisent les algorithmes sur le raisonnement logique pour exploiter les connaissances encodées dans l'ontologie pour la prise en charge du diabète afin d'aider les médecins en proposant des interventions personnalisées sur la prise en charge du diabète et des stratégies de changement du comportement; C) à une application mobile sur la prise en charge autonome du diabète pour encourager et éduquer les patients diabétiques à prendre en charge de manière autonome la maladie dans le cadre de leur domicile tout en collaborant avec leur médecin de famille.

Résultats : Nous avons réussi à créer et la réalisation d'une évaluation de la convivialité de l'outil d'aide à la décision du médecin. Ces résultats seront publiés une fois l'application d'auto-gestion des patients a été évaluée.

Conclusions : Le D-WISE sera évalué par des études pilotes mesurant : 1) la convivialité des interventions en télésanté; 2) l'effet des interventions sur les changements de comportement des patients et la maîtrise de leur diabète.

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Introduction

The World Health Organization considers type 2 diabetes a global epidemic in which the prevalence in 2010 of 285 million people is expected to grow to 438 million by 2030 (1). More than 3 million Canadians live with diabetes and are at serious risk for morbidity, complications and mortality. According to the Canadian Diabetes Association (CDA), the personal costs of diabetes medications and supplies is \$1000 to \$15,000 per year, and diabetes-related healthcare costs are estimated to grow to almost \$17 billion by 2020 (2). Although the pathophysiology of diabetes is well understood and is supported by effective interventions, effective diabetes self-management rests largely on the behaviour of the individuals (3,4). Optimal diabetes control requires ongoing adherence to medication and medical care, self-monitoring of blood glucose, achieving a healthful weight, eating healthily, not smoking, drinking moderately, being physically active and managing stress. The goal of the diabetes self-management intervention is to support the individual in making all of the behavioural changes required to achieve optimal diabetes control. Behavioural science is now being integrated into diabetes self-management interventions (5–7) to better educate and engage individuals in self-management of the condition. It involves theory-driven, evidence-based approaches a) to increase motivation to change when such

motivation is low (e.g. stages of change (8,9), theory of planned behaviour (10), social cognitive theory (11,12)), and b) motivational interviewing (2,13) to support effective behaviour-change when motivation is present (14); and c) to address emotional and relational barriers to change when they arise (15,16). These approaches have been developed and applied to chronic-disease management in general and to diabetes control in particular. Our group, through the Behaviour Change Institute (BCI), has developed specialized behaviour-change training modules that both train and empower primary care providers, certified diabetes educators (CDEs) and patients living with diabetes to use behaviour-change methods to achieve clinical outcomes more effectively. Despite the availability of specialized behaviour-change interventions and evidence-based CDA clinical practice guidelines (CPGs) (17) on diabetes management, the challenge is to translate these knowledge resources at the point of care such that family physicians (FPs) and CDEs can use them to offer evidence-informed behaviour-change support and diabetes management to individuals with diabetes. Given that there are too few training opportunities and significant barriers to the uptake of intensive competency-based training programs, it is prudent to leverage technology-enabled mechanisms to deliver CDA CPGs-informed diabetes care and behaviour-change interventions to support FPs and CDEs in managing diabetes.

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