



Review

Maximizing the healthcare environment: A systematic review exploring the potential of computer technology to promote self-management of chronic illness in healthcare settings

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ARTICLE INFO

Article history:

Received 4 December 2012

Received in revised form 15 February 2013

Accepted 27 February 2013

Keywords:

Computer-based education

Chronic disease

Systematic review

ABSTRACT

Objective: The aim of this systematic review is to investigate the effectiveness of using computers to deliver patient self-management programs (PSMPs) to patients with chronic illness in health supported settings.

Methods: We included randomized controlled trials (RCTs), where the experimental intervention was compared either with an equivalent 'standard' PSMP delivered by staff, usual care or no intervention and reported data either on clinical or behavioral outcomes. We conducted a narrative synthesis, incorporating a small quantitative analysis to enable comparisons across studies.

Results: A total of 11 studies met the inclusion criteria. There was insufficient evidence to determine whether computer-based PSMPs were superior to standard programs. However, it appeared that these interventions were effective when compared to no intervention. Interventions incorporating behavior change techniques beyond the provision of information appeared more effective than those that did not.

Conclusion: Evidence from the current review, whilst limited, suggests that computer-based PSMPs, delivered in health-supported settings, show potential for changing health behaviors and improving clinical outcomes in patients with chronic illness.

Practice Implications: Although the approach shows promise, it is premature to recommend the integration of these interventions into clinical practice. However, more well designed trials are warranted to test their efficacy and cost-benefit.

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1. Introduction

The prevalence of chronic illness is increasing globally, and these conditions are now the primary cause of death and disability in all parts of the world except Africa [1]. In the UK, it is thought that as many as 18 million adults have a chronic illness [2] with the prevalence increasing with age [3]. Similarly, in the USA, almost half of all adults are now living with chronic illness [4], increasing to 92% of those aged over 65 years [5]. This means that healthcare systems are under increasing pressure to maintain health and promote self-management of conditions, particularly in older people, who are already heavy users of the health service. This pressure is expected to increase in future with reduced national

budgets and increased pressure to reduce staffing costs coupled with a growing healthcare workforce crisis [6].

Chronic illnesses, such as diabetes, chronic obstructive pulmonary disorder and coronary heart disease, are caused, maintained or exacerbated by modifiable lifestyle factors, such as, insufficient physical activity, poor nutrition, tobacco use, and excessive alcohol consumption [7]. The health outcomes of these illnesses are also strongly associated with behavior and depend upon good patient self-management. Typically, this involves adherence to treatment (e.g. medication or monitoring regimes) and lifestyle (e.g. diet and exercise) recommendations. For example, people with diabetes need to maintain glycaemic control through diet, exercise and weight control, as well as adherence to therapeutic regimes such as self-monitoring of blood glucose concentrations, foot care, and oral medication or insulin injections [8]. Therefore an important part of patient care is the enhancement of these self-management behaviors [9].

The primary mode of facilitating self-management is via patient self-management programs (PSMPs, such as patient education), typically provided by healthcare professionals. Two types of PSMP

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have been identified: educational interventions which aim to improve self-management by increasing knowledge; and psychological interventions which target emotional, cognitive, and behavioral functioning [8]. However, in the current financial climate, despite the importance of these interventions, healthcare providers are facing increasing resource constraints which restrict the number of staff and amount of time available to deliver these interventions [10]. The use of computers to promote self-management in patients with chronic illness is one potential solution to this challenge [11].

Information and communication technology (ICT) is changing the way that patients interact with the healthcare system, particularly with the development of mobile and web-based interventions [12,13], but this technology also offers numerous opportunities to maximize the efficiency of the healthcare environment. Patients, particularly those with chronic illness, have to attend for regular medical appointments. However, only 24% of patients in England are currently seen at their scheduled appointment time [14]. Appropriate integration of computer-based PSMPs into waiting time could minimize the impact of the indirect patient costs (such as work days lost, traveling and waiting time) of appointments, which can in some cases exceed direct costs such as inpatient care, doctor visits and medicines [15], whilst taking advantage of 'teachable moments' around healthcare contacts when patients are primed to receive information on health behaviors [16]. Providing public access computers to deliver PSMPs could also contribute toward bridging the 'digital divide', in particular with older adults who are less likely to own computers or use the internet [17,18]. Most importantly, from the point of view of the healthcare provider, this technology allows patients access to effective self-management interventions whilst saving healthcare staff time.

A number of other reviews have investigated the use of computers to deliver PSMPs. None, however, have focused on their effectiveness within health-supported settings. Most [10,19–22] have focused on the effectiveness of all forms of computer-based patient education across settings, with others focusing on their use with specific illnesses [23,24]. One review investigated the effects of interactive health communication applications for people with chronic illness, but also included online programs, and interventions with a focus beyond patient self-management, including peer and decision support [12]. Similarly, whilst Wofford et al's [25] review was concerned with exploring the potential of using computer-based patient education in the office (clinical) setting, and it also included web- and home-based interventions. The current review, therefore, aims to investigate the effectiveness of using computers to deliver PSMPs to patients with chronic illness in health supported settings.

2. Methods

We followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA (<http://www.prisma-statement.org/>) [26]) guidelines throughout the design, conduct and reporting of this systematic review.

2.1. Selection criteria

The PICOS (population, intervention, comparison, outcome, study design) approach was used to formulate the research question [27]. We included randomized controlled trials (RCTs), published in English, where the experimental intervention involved delivering a PSMP using a computer (e.g. standalone desktop computer, laptop, computer 'kiosk') in a health-supported setting (i.e. a professional health care setting mediated by health care professionals (e.g. hospital outpatients' department, GPs'

surgery, pharmacy), to adults (aged 18 years +) with a chronic illness for which there is a recommended treatment pathway (e.g. diabetes, heart disease, pulmonary disease, arthritis). A PSMP was defined as any intervention that aims to enable a patient to self-manage their own condition, either through the provision of information or by targeting emotional, cognitive, and behavioral functioning. Although sometimes such programs may also involve family members or other formal or informal caregivers, we were interested in programs targeted solely at the patient. Interventions had to be compared either with usual care (with no self-management element specified), an equivalent 'standard' (i.e. not computer-based) PSMP or no intervention and report the effect of the intervention either on clinical (e.g. HbA1c, mortality etc. . .) or behavioral (e.g. medication adherence, diet etc. . .) outcomes.

2.2. Study identification

We searched CENTRAL (The Cochrane Library, Issue 6), EMBASE (via Ovid, 1980–2012), INSPEC (ISI Web of Knowledge, 1969–2012) and MEDLINE (OVID SP, 1950–2012) between May and June 2012. The electronic search strategy was developed by the first author (MSMD), who is experienced in conducting systematic reviews, in consultation with an information specialist. A broad strategy, incorporating keywords sourced from relevant articles together with appropriate subject headings was used to search for studies. The strategy was first developed in MEDLINE before being adapted for use in other databases. Further details can be seen in the review protocol (see [additional materials](#)). We also scanned the reference lists of nine systematic reviews covering similar content identified via scoping searches in Google Scholar (using the terms "systematic review", "literature review", "computerized", "patient education" and "health information") [10,12,19–25]. We also searched reference lists of included studies. We did not hand search journals.

The first review author (MSMD) pre-screened all titles and abstracts for possible inclusion. The accuracy of the screening process was then checked independently by the second author (AEW) based on a sub-set of included and excluded articles. Those selected were then subject to full-text assessment. Both authors independently assessed the selected articles for inclusion. The first author then extracted data and assessed the quality of each study, the accuracy of which was again checked independently by the second. Any discrepancies were resolved by consensus.

2.3. Data extraction

Details of the intervention and control group populations (e.g. number, demographics and condition), the interventions that they received (intervention content and duration, behavior change techniques used, hardware etc. . .), and outcomes (measures used, length of follow-up and results) were extracted. The interventions described in the selected studies were complex; covering not only a diverse range of conditions (e.g. diabetes, chronic heart disease etc. . .), but also a large number of discrete self-management behaviors (e.g. adherence to medication regimen, smoking cessation, healthy eating etc. . .). In an attempt to manage the complexity of these interventions and inform practice, we sought to determine the 'active ingredients' of each by coding intervention descriptions for behavior-change techniques (BCTs). A BCT is defined as 'any explicit description of intervention content that can alter a participants. . . behavior, e.g. not including mode or style of delivery' [28] (p316). Taxonomies of BCTs have been created for interventions designed to boost physical activity and healthy eating [29] and for individual interventions for smoking cessation [28] but not, to our knowledge, for computer-based PSMPs. Where possible, we used the BCT terminology described in the above

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