Doctoral Thesis

The Dissemination of Clinical Practice Guidelines to Arthritis Health Professionals Using Innovative Strategies

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List of Abbreviations

AAP	asthma action plan
AGREE	Appraisal of Guidelines Research and Evaluation
ANOVA	analysis of variance
CCT	comparative controlled trial
CPGs	clinical practice guidelines
EBP	evidence-based practice
ICTs	information and communication technologies
KT	knowledge translation
KTA	Knowledge-to-Action framework
OA	osteoarthritis
PGrip	People Getting a Grip on Arthritis
PICOS	population, intervention, comparison, outcome, and study design
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta Analysis
RCT	randomized controlled trial
RA	rheumatoid arthritis
SUS	System Usability Scale
TAM2	Technology Acceptance Model (second edition)
TAS	The Arthritis Society
TDF	Theoretical Domains Framework

Abstract

Problem: With an increasing aging Canadian population with chronic diseases such as arthritis, there is an urgent need for health professionals to promote evidence-based arthritis self-management support to their patients.

Objective: The overall objective of this thesis was to determine the feasibility of using Facebook as a dissemination strategy for an online evidence-based arthritis self-management program, People Getting a Grip on Arthritis (PGrip), by arthritis health professionals with their patients.

Methods: To identify the current evidence and knowledge gaps in regards to the use of innovative dissemination strategies for clinical practice guidelines (CPGs) and social media use for chronic disease self-management among health professionals, two systematic reviews of the literature were conducted. The first systematic review identified research on health professionals' perceived usability and practice behaviour change of information and communication technologies (ICTs) for the dissemination of CPGs. The second identified research on the perceived usability of social media by health professionals to facilitate chronic disease self-management with their patients. To engage potential knowledge users in the research process, an advisory committee consisting of six arthritis health professional users (two registered nurses, two physiotherapists, and two occupational therapists) was convened to identify barriers and facilitators of using and accessing Facebook as a dissemination strategy for PGrip. The advisory committee was also convened to identify how the PGrip Facebook group page could be tailored to improve usability among arthritis health professionals. A feasibility study of 78 arthritis health professionals was then conducted to determine the feasibility of using Facebook as a dissemination strategy for PGrip among arthritis health professionals to their patients. To guide future research, a protocol for a pilot randomized controlled trial (RCT) was developed that will compare Facebook with an educational website and email to determine which strategy will demonstrate greater perceived usefulness among arthritis health professionals to disseminate the PGrip program with their patients.

Results: The findings of the first systematic review revealed that health professionals' perceived usability and practice behaviour change varies by type of ICT and the heterogeneity and paucity of properly conducted studies did not allow for a clear comparison between studies. The second systematic review revealed that health professionals perceived discussion forums and collaborative projects to be useful social media platforms to facilitate chronic disease self-management with patients. The feasibility study suggested that a Facebook group page can be used as a dissemination strategy for the PGrip program by arthritis health professionals. The Facebook group page was perceived to be usable with patients after two weeks and three months in regards its ease of use and high output quality.

Conclusion: The overall research of this thesis provides advanced knowledge on how a Facebook group page as a dissemination strategy for an evidence-based self-management program for patients is perceived by arthritis health professionals. Facebook may provide arthritis health professionals with an additional option of how to best share evidence-based information to allow their patients to successfully self-manage their arthritis. A future pilot RCT is needed to determine whether Facebook is superior to other ICT intervention in regards its perceived usefulness among arthritis health professionals to disseminate the PGrip program with their patients.

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Format of thesis

The following thesis is written in article format and conforms to the guidelines provided by the PhD in Rehabilitation Sciences program. The first section of the thesis consists of a preface and an overview of the research processes that were used (Chapter 1), and an introduction on the thesis topic and rationale for research (Chapter 2). The second section presents the methodology and findings of the research conducted in this thesis entailing four manuscripts: two systematic reviews of the literature (Chapters 3 and 4), methodology and findings of an advisory committee and a feasibility study (Chapter 5), and a protocol for a future RCT (Chapter 6). The third section provides a discussion of the syntheses and implications of the research findings (Chapter 7). The fourth section outlines the contribution of collaborators of the manuscripts described above. Lastly, the fifth section presents the appendices for each chapter of this thesis.

Given that chapters 3 to 6 have been published or have been submitted for publication as separate manuscripts, there may be duplication among these chapters in regards to their introduction, and background sections, as well as some discussion points. The formatting in these chapters has not been modified from the original publications, and the published versions of these manuscripts can be found in the appendices (Appendix 1.1 Publication #1, Appendix 1.2: Publication #2, and Appendix 1.3 Publication #3). Permission to reproduce and include the published manuscripts can be found in Appendix 1.6 Permissions.

Ethics Approval and Questionnaires

Ethics approval was sought for the research conducted for the advisory committee (H12-14-07) and the feasibility study (H11-12-10). Approval was provided by the University of Ottawa Research Ethics Board (REB). The REB approval letter and ethics documents (e.g., consent form) can be found in Appendix 1.4 Ethics documents. Questionnaires used in the advisory committee and the feasibility study can be found in Appendix 1.5.1 Advisory Committee Interview Topic Guide and Questions, Appendix 1.5.2 Advisory Committee Questionnaire and Appendix 1.5.4 Feasibility Study Online Questionnaire

Part I: Introduction

Chapter 1: Preface

This chapter presents an overview of the research milestones of this thesis, and how each were guided by the Knowledge-to-Action (KTA) framework

Overview of Milestones

The research of this thesis can be summarized into five milestones that were conducted to address the overall objective (see Objective and Hypothesis). Table 1 summarizes these milestones.

Table 1: Overview of Milestones

Milestone	Research
1	Conducting a systematic review of the literature to summarize the current evidence pertaining to the perceived usability of ICTs (e.g., social media sites, e-mail) as a guideline dissemination strategy for health professionals. The outcome of practice behaviour change was also assessed in this systematic review
2	Convening of an advisory committee to determine arthritis health professionals' barriers and facilitators of using Facebook as a guideline dissemination strategy with their patients for the PGrip program and how the PGrip Facebook social media site can be tailored to improve perceived usability
3	Conducting a systematic review of the literature to summarize the current evidence pertaining to the perceived usability of social media by health professionals to facilitate chronic disease self-management with their patients.
4	Conducting a feasibility study to determine arthritis health professionals' perceived usability of Facebook as dissemination strategy with their patients for PGrip and to determine whether Facebook, used as a dissemination strategy for PGrip, could improve practice behaviour change (i.e., sharing/discussing the PGrip program with their patients) among arthritis health professionals.
5	Development of a proposal for a pilot RCT that will aim to examine whether Facebook as a dissemination strategy for PGrip has a greater perceived usability among arthritis health professionals than other ICT comparators (i.e., educational website or email) (primary outcome) and other exploratory outcomes (e.g., practice behaviour change, barriers, actual use).

Milestone 1: The research of this thesis began by conducting a systematic review on the topic of information and communication technologies (ICTs) and their perceived usability and practice behaviour change as a guideline dissemination strategy for health professionals (Milestone 1 detailed in Chapter 3: Systematic review of ICTs as a guideline dissemination strategy for health professionals). Dissemination in this systematic review referred to both the dissemination of evidence to health professionals, as well as the dissemination by health professionals to their patients.

Milestone 2: Following the completion of this systematic review, an advisory committee consisting of a group of six arthritis health professionals (physiotherapists, nurses and occupational therapists) was

convened to provide insight and guidance on the proposed feasibility study of this thesis (Milestone 2, detailed in Chapter 5: Advisory Committee and Feasibility Study). After initial discussions with the advisory committee, it was deemed that for the research of this thesis, dissemination should solely be investigated in the context of the dissemination of evidence by health professionals to their patients. The main reasoning was specifically related to the intervention of interest of the feasibility study (i.e., a Facebook group page containing an arthritis self-management educational program for patients) and the type of included participants of this study (i.e., arthritis health professionals spending a minimum 50% of the time in direct patient care). There was a consensus among the advisory committee that arthritis health professionals would not use social media as a dissemination strategy to access evidence, as they felt that health professionals should already have the knowledge of the material presented in the educational program. Thus, for consistency with the feasibility study, the concept of dissemination was thereafter referred to as the dissemination of evidence by health professionals to their patients.

Milestone 3: Based on the findings of the initial systematic review and revised concept of dissemination, it was evident that a major knowledge gap still existed: determining the current evidence pertaining to the perceived usability of social media by health professionals to facilitate chronic disease self-management with their patients. Thus a second systematic review, with a more focused scope was conducted to address this question (Milestone 3 detailed in Chapter 4). The scope of latter review indicated no evidence regarding the perceived usability of social media, a specific social media platform, by health professionals to facilitate chronic disease self-management with their patients.

Milestone 4: The findings further strengthened the rationale for conducting a feasibility study to address this knowledge gap. After reviewing the literature on ICT use by health professionals as a guidelines dissemination strategy, and more specifically, the current evidence pertaining to the perceived usability of social media by health professionals to facilitate chronic disease self-management with their patients, the feasibility study was conducted to determine arthritis health professionals' perceived usability of Facebook as dissemination strategy with their patients for PGrip and to determine whether Facebook, used as a dissemination strategy for PGrip, could improve practice behaviour change (i.e., sharing/discussing the PGrip program with their patients) among arthritis health professionals (Milestone

4, Chapter 5: Advisory Committee and Feasibility Study).

Milestone 5: Positive findings from the feasibility indicated that further research comparing Facebook with other ICTs is warranted, thus a proposal for a pilot RCT was developed (Milestone 5 Chapter 6: Protocol for a Future Pilot Randomized Controlled Trial).

This thesis was guided by the main phases of the Knowledge-to-Action (KTA) framework.

Table 2 presents an overview of how each milestone of this thesis was guided by the KTA framework (1). A description of the KTA framework is provided in Chapter 2: Background and further discussion on how the KTA framework guided each of the processes of this thesis is described in Chapter 7: Synthesis and Implications.

Table 2: Summary of KTA Action phases related to the conducted research

KTA Action Phases	Methods	Chapter
1. Identify knowledge-to-action gap **(Knowledge = PGrip program)**	To address the knowledge gap on the use of ICTs as a guideline dissemination strategy (Milestone 1), and more specifically the use of social media to facilitate chronic disease self-management with their patients (Milestone 2), separate systematic reviews were conducted for each.	Chapter 3 and 4
2. Adapt Knowledge to Local Context **(Knowledge = PGrip program)**	The PGrip program was adapted to the local context prior to the research conducted in this thesis. The PGrip program used in the Facebook dissemination strategy is based on evidence from the Ottawa Panel CPGs. The Ottawa Panel CPGs have been summarized in lay terms using video presentations posted on a Facebook group website (See Chapter 2 for further details on the Ottawa Panel CPGs).	Chapter 5
3. Assess Barriers/Facilitators to Knowledge Use **(Knowledge = Facebook dissemination strategy)**	An advisory committee consisting of arthritis health profession users was convened to assess barriers and facilitators of using Facebook as a guideline dissemination strategy with their patients for PGrip. (Milestone 3)	Chapter 5

4. Select, Tailor, Implement Interventions	The PGrip program was disseminated using a Facebook group page. Based on feedback from the advisory committee, the Facebook group website was tailored to address barriers and facilitators and improve usability for arthritis health professionals. (Milestones 3 and 4)	Chapter 5
1. Monitor Knowledge Use **(Knowledge = Facebook dissemination strategy)**	Actual use of the knowledge (ICT intervention [i.e., Facebook, email or an educational website]) to share information from the PGrip program with their patients will be assessed in the proposed pilot RCT proposal (Milestone 5).	Chapter 6

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Chapter 2: Background

The following chapter provides an introduction to the topic of using ICTs to improve the dissemination of evidence-based CPGs to arthritis health professionals, highlighting knowledge gaps and challenges that are currently faced. Social media, specifically the social networking site Facebook, warrants further investigation on whether it can be a successful dissemination strategy for an evidence-based arthritis self-management program for patients. The objective and hypothesis of the research of this thesis are presented. The conceptual frameworks used to guide the research are described.

Problem

With the aging population and the increased number of individuals with chronic diseases such as arthritis, there is an urgent need to reduce the knowledge to practice gap, allowing health professionals to improve evidence-based practice (EBP) to promote arthritis self-management interventions to their patients. Unfortunately, success in regularly transferring research knowledge into clinical practice has been limited (1) and evidence-based clinical practice guidelines (CPGs) are often not applied effectively, resulting in the failure to achieve optimal health outcomes for patients (2). There is relative agreement on arthritis management CPGs; however, uptake among arthritis health professionals has been suboptimal, suggesting difficulties with implementation rather than a lack of quality of evidence (3). For example, the results of the study conducted by Harrold et al. concluded that a significant number of arthritis patients do not receive care that is consistent with current arthritis recommendations (4). McGlynn et al. revealed that approximately only 55% of osteoarthritis patients in the United States received recommended care (5). Thus, efforts to reduce the knowledge-to-action gap remain a constant challenge among researchers and arthritis health professionals. The process for identifying why these gaps exist can be complex. MacDermid & Graham identify that knowledge-to-action gaps may exist due to a lack of awareness of how to apply EBP, or as a result of barriers to practicing what the evidence indicates (6).

Dissemination has been defined as:

> *"The intentional, active process of identifying target audiences and tailoring communication strategies to increase awareness* and understanding of evidence, and to motivate its use in policy, practice, and individual choices" (7).

Knowledge translation (KT), the process of implementing knowledge into action, can provide methods for closing the knowledge-to-action gap (8). A specific KT strategy is the distribution of printed recommendations for clinical care, including CPGs and electronic publications (9). Guideline dissemination strategies can have a modest impact on the processes and outcomes of care (10–13), though evidence regarding the likely effectiveness of different strategies to overcome specific barriers to KT remains incomplete (9). Furthermore, a systematic review by Menon et al. concluded that although KT

interventions enhance knowledge and practice behaviours, there remains a lack of clarity of which KT strategies can effectively change the attitudes of EBP among physiotherapists (14). Consequently, there remains a need for developing guideline dissemination strategies and developing methods to operationalize existing CPGs to improve uptake in target populations across professions in arthritis care (3). A systematic review by Lineker and Husted concluded that there is limited evidence on educational programs for the implementation of arthritis CPGs in the primary care environment and that further research is needed (15).

Information and communication technologies

Information and communication technologies (ICTs) are defined as “technologies that provide access to information through telecommunications focusing primarily on communication technologies including the Internet and wireless networks, cell phones, and other communication mediums” (16). The online nature of ICTs can allow consumers and clinicians with a convenient method to both access and disseminate CPGs (17). A systematic review by Grimshaw et al. revealed that there is incomplete evidence to guide the choice of dissemination strategies targeting health professionals (9). The evidence on practice behaviour change targeting health care professionals of traditional dissemination strategies such as printed educational materials (18), educational meetings (19), audit and feedback (20), local opinion leaders (21), and educational outreach (22) has been summarized. Yet, there remains a gap in the knowledge of the perceived usability and practice behaviour of health professionals for more innovative ICT dissemination strategies.

One ICT dissemination strategy is social media. Social media has been defined as “a group of online applications that allow for the creation and exchange of content generated by users” (p.1376) (23). There are various platforms of social media which have been categorized into the following groups: collaborative projects, content communities, blogs or microblogs, social networking sites, virtual gaming or social worlds (24), and online discussion forums (23). Social networking sites are “applications that enable users to connect by creating personal information profiles, inviting friends and colleagues to have access to those profiles, and sending e-mails and instant messages between each other” (p. 63) (24). One of the

most popular social networking sites is Facebook, with over a billion active users worldwide (25). Facebook allows for a new form of interaction between patients and their health professionals (26) allowing for opinion and information sharing through links, texts, and pictures (27). A scoping review of the literature by Hamm et al. on social media use by health care professionals and trainees revealed that only 16 of the included 96 studies (17%) comprised a social networking site, of which only 2 studies measured usability (23). The findings of the scoping review confirmed a need for further research to measure the perceived usability of Facebook as a dissemination strategy among arthritis health professionals (23).

Evidence-based Arthritis Self-Management Program

Graham et al. illustrates the process of knowledge creation as a funnel and "as knowledge moves through the funnel (28). The funnel is refined and, ideally becomes more useful to end-users of the knowledge which include researchers, health care professionals, policy makers, and the public" (p. 27). The knowledge of the research for this thesis that was disseminated to arthritis health professionals (health professionals working in the field of arthritis such as physiotherapists, occupational therapists and nurses) via Facebook was People Getting a Grip on Arthritis (PGrip), a bilingual evidence-based online self-management educational program for patients with osteoarthritis (OA) and rheumatoid arthritis (RA) (www.arthritis.ca/peoplegettingagrip). The PGrip program is based on the results of high-quality comparative controlled trials which have investigated the efficacy of various self-management interventions for arthritis and the findings were synthesized and graded by the Ottawa Panel (29–39). Through knowledge synthesis, systematic reviews were performed and rigorous methods were used to develop the Ottawa Panel CPGs for the self-management of arthritis. The self-management interventions presented in PGrip were those that achieved positive recommendations (Grades A, B and C+) in the Ottawa Panel CPGs (29–39). The Ottawa Panel CPGs for OA and RA are recognized as rigorous CPGs according to several systematic reviews using the Appraisal of Guidelines Research and Evaluation (AGREE I & II) criteria (www.agreetrust.org) (3,40–42). Knowledge from the Ottawa Panel CPGs have been translated into lay terms and tailored into a set of didactic videos for the PGrip program. For each self-management intervention identified in the Ottawa Panel CPGs, two video presentations were

created: 1) a narrated PowerPoint presentation of simplified instructions on how to perform/apply the self-management intervention with case scenarios illustrating the appropriateness and relevance of each; and 2) practical sessions with an arthritis health professional providing step by step instructions while performing/applying the self-management intervention with a patient with arthritis.

Conceptual Frameworks

Three frameworks were used in this thesis. The Knowledge-to-Action framework (8) was used to guide and develop the Facebook dissemination strategy, while the Technology Acceptance Model (TAM2) (43) and the Theoretical Domains Framework (TDF) (2) were used to guide and define the outcome measures.

Knowledge-to-Action framework

As described in Chapter 1: Preface , this thesis was guided by the main phases of the Knowledge-to-Action (KTA) framework (8). The KTA framework was chosen to guide the research of this thesis as it provides an approach that combines commonalities of various planned-action theories, which include activities to facilitate behavioral change (8). This framework used to guide the development of KT strategies, illustrating the dynamic process of knowledge creation and application (28). The process of ‘'**knowledge creation"** consists of three phases: knowledge inquiry, knowledge synthesis, and knowledge tools/products. The KTA framework presents the concept of knowledge creation, which demonstrates how knowledge is refined, moving through a funnel of inquiry and synthesis, providing useful information, tools, and products for end users. The “**action cycle**” of the framework consists of seven phases that occur either sequentially or simultaneously. The phases of the action cycle include: 1) Identify the knowledge-to-action gaps, 2) Adapt knowledge to local context, 3) Assess barriers and facilitators to knowledge use, 4) Select, Tailor, Implement Interventions, 5) Monitor knowledge use, 6) Evaluate outcomes, and 7) Sustain Knowledge Use.

The Technology Acceptance Model (TAM2)

The primary objective of the feasibility study was to determine arthritis health professionals' perceived usability of Facebook as a CPG dissemination strategy for PGrip with their patients. The measure of perceived usability was guided by the second edition of The Technology Acceptance Model (TAM2) (43). The TAM2 was chosen to guide the outcome of perceived usability as it was originally designed to predict ICT acceptance and usage in the workplace, and has been widely used for diverse set of ICT and users (44). According to the TAM2, the behaviour intention to use a system is determined by perceived usefulness defined as "the extent to which a person believes that using the system will enhance his/her job performance, and perceived ease of use, defined as the extent to which a person believes that using the system will be free of effort" ((43) p. 187). In addition to the theoretical constructs of perceived usefulness and perceived ease of use, the TAM2 also incorporates constructs of social influence processes (subjective norm, voluntariness, and image) and cognitive instrumental processes (job relevance, output quality, and result demonstrability) (Appendix 2.1 Definitions of TAM2 Domains).

Theoretical Domains Framework (TDF)

The measurement of practice behaviour change and assessment of barriers in the feasibility study was guided by the TDF (2) (Appendix 2.2 Definitions of TDF Domains). The TDF was chosen to guide the outcome of practice behaviour change as it simplifies and integrates a plethora of behaviour change theories including social cognitive theory, learning theory, and diffusion theory (2). The TDF is an integrative framework used for studying the implementation of EBP. The TDF identifies numerous behaviour constructs and consists of 12 domains: 1) knowledge, 2) skills, 3) social/ professional role and identity, 4) beliefs about capabilities, 5) beliefs about consequences, 6) motivation and goals, 7) memory, attention and decision processes, 8) environmental context and resources, 9) social influences, 10) emotion regulation, 11) behavioural regulation, and 12) nature of the behaviour (Appendix 2.2 Definitions of TDF Domains).

Objective and Hypothesis

The overall objective of this thesis was to determine the feasibility of using Facebook as a CPG dissemination strategy using an evidence-based online self-management educational program by arthritis health professionals with their patients. The hypothesis of the feasibility study was that arthritis health professionals would demonstrate improvements in the perceived usability of Facebook to share information from the PGrip program with patients after two weeks and three months.

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Part II: Presentation of Methodology and Findings

Chapter 3: Systematic review of ICTs as a guideline dissemination strategy for health professionals

Chapter 2 presented an introduction to the topic of using ICTs to improve the dissemination of evidence-based CPGs to arthritis health professionals and described why the social networking site Facebook, warrants further investigation to determine whether it can be a successful dissemination strategy for an evidence-based online self-management educational program for patients.

This chapter is the first of the milestones (Milestone 1) and presents a manuscript of a systematic review of ICTs as a guideline dissemination strategy for health professionals. The published version of this manuscript can be found in Appendix 1.1 Publication #1. The objective of this systematic review was to identify research on health professionals' perceived usability and practice behaviour change of ICTs for the dissemination of clinical practice guidelines.

Information and communication technologies for the dissemination of clinical practice guidelines to health professionals: A systematic review

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Abstract

Background: The transfer of research knowledge into clinical practice can be a continuous challenge for researchers. Information and communication technologies, such as websites and electronic mail, have emerged as popular tools for the dissemination of evidence to health professionals.

Objective: The objective of this systematic review was to identify research on health professionals' perceived usability and practice behaviour change of information and communication technologies for the dissemination of clinical practice guidelines.

Methods: A systematic approach was used to retrieve and extract relevant studies data. A total of 2,248 citations were identified, of which 21 studies met criteria for inclusion; 20 studies were randomized controlled trials, and one was a controlled clinical trial. The following information and communication technologies were evaluated: websites (5 studies), computer software (3 studies), online workshops (2 studies), computer decision support systems (2 studies), online educational game (1 study), email (2 studies), and multifaceted interventions that consisted of at least one information and communication technology component (6 studies).

Results: Website studies demonstrated significant improvements in perceived usefulness and perceived ease of use, but not for knowledge, reducing barriers and intention to use clinical practice guidelines. Computer software studies demonstrated significant improvements in perceived usefulness, but not for knowledge and skills. Online workshop and email studies demonstrated significant improvements in

knowledge, perceived usefulness, and skills. An online educational game intervention demonstrated a significant improvement from baseline in knowledge after 12 and 24 weeks. Computer decision support system studies demonstrated variable findings for improvement in skills. Multifaceted interventions demonstrated significant improvements in beliefs about capabilities, perceived usefulness, and intention to use clinical practice guidelines, but variable findings for improvements in skills. Most multifaceted studies demonstrated significant improvements in knowledge.

Conclusions: The findings suggest that health professionals' perceived usability and practice behaviour change vary by type of information and communication technology. Heterogeneity and the paucity of properly conducted studies did not allow for a clear comparison between studies and conclusion on the effectiveness of information and communication technologies as a knowledge translation strategy for the dissemination of clinical practice guidelines.

Introduction

Success in regularly transferring research knowledge into clinical practice has been limited (1) and evidence-based clinical practice guidelines (CPGs) are often not implemented effectively, resulting in the failure to achieve optimal health outcomes for patients (2). Thus, efforts to reduce the knowledge-to-action gap remain a constant challenge among researchers and health professionals.

Knowledge translation (KT), the process of implementing knowledge into action, can provide methods for closing the knowledge-to-action gap (3). With the emerging appeal of online KT resources that allow for potential widespread reach through self-paced, self-directed learning, the Internet has become an important platform for KT initiatives such as CPG dissemination (4). Information and communication technologies (ICTs) are defined as “technologies that provide access to information through telecommunications focusing primarily on communication technologies including the Internet and wireless networks, cell phones, and other communication mediums” (5). ICTs have the potential to improve accessibility to CPGs. For example, digital CPGs can be continuously reviewed and updated with new evidence, while having the potential to be widely disseminated (6). Furthermore, these online tools provide both clinicians and consumers with a convenient method to access evidence-based CPGs (6).

Teaching modalities for medical education including CPG dissemination have evolved (7). The development and implementation of novel teaching and dissemination strategies was prompted by research findings showing that traditional didactic seminars do not always modify behavior and learning competency (7). Grimshaw et al. (8) concluded that the evidence to guide choice of KT strategies targeting health professionals is incomplete. While the evidence of traditional KT strategies such as printed educational materials (9), educational meetings (10), educational outreach (11), local opinion leaders (12), and audit and feedback (13) focusing on practice behaviour change targeting health care professionals has been summarized (8), we have limited knowledge of the perceived usability and practice behaviour among health professionals when using novel KT strategies such as ICTs for the dissemination of CPGs.

The objective of this systematic review is to summarize the evidence pertaining to the use of ICTs for the dissemination of CPGs to health professionals. Specifically, this review will provide new knowledge on health professionals' perceived usability and change in practice behaviour when using ICTs to disseminate CPGs.

Methods

This systematic review was conducted using the Preferred Reporting Items for Systematic Reviews and Meta Analysis (PRISMA) guidelines (14). To summarize the evidence, we used a systematic approach to retrieve relevant papers from the literature. Articles were selected for this review using the following pre-defined selection criteria guided by the PICOS (population, intervention, comparison, outcome, and study design).

Table 3: Selection Criteria

Population: Health professionals (e.g., physicians including medical residents, nurses, and physiotherapists)
Intervention: ICTs compared to each other or control (e.g. no intervention)
Comparator: ICTs compared to each other or control (e.g. no intervention)
Outcomes: Usability (e.g. perceived usefulness and perceived ease of use) Practice Behaviour (e.g. barriers, knowledge, skills, social/professional role and identity, optimism, beliefs about capabilities, beliefs about consequences, intentions, memory/attention /decision, environmental context and resources, social influences, and emotion)
Study Design: RCTs Non-randomized CCTs

CCTs = comparative controlled trials; CPGs = clinical practice guidelines; ICT= information and communication technologies; RCTs= randomized controlled trials.

Studies were excluded if they did not meet the selection criteria (Table 3). Duplicate publications, narrative reviews, case series, case reports, data presented in abstract form only, conference proceedings, study protocols, and publication not written in English were also excluded.

The literature search was performed by an information specialist. Published literature was identified by searching the following bibliographic databases up to the end of December 2015: Medline, Cochrane Central Register of Controlled Trials, Embase, CINAHL, ERIC, and PsycINFO. The search was performed using terms to identify peer-reviewed research in which ICTs and CPG dissemination were important features (Appendix 3.1). Grey literature (literature that is not commercially published) was conducted by searching Google and other Internet search engines to search for additional web-based publications. In addition, the searches were supplemented by hand searching the bibliographies of key papers. To ensure all ICTs would be captured in the literature search, including those that are older and established (e.g., email), we did not place any date limits.

Two reviewers independently screened the titles and abstracts of all citations retrieved from the literature search using Covidence, an online systematic review software. An independent review of the full-text articles was then performed based on the selection criteria. Disagreements were resolved through discussion until consensus was reached. The study selection process is presented in a PRISMA flow diagram (Figure 1).

Both descriptive data and results were extracted by one reviewer from each eligible article. The extraction was subsequently verified by a second reviewer. Data extraction forms were designed a priori to document and tabulate relevant study and patient characteristics, study findings, and author's conclusions. Data from figures were not used if they were not explicit. Studies were categorized by the type of ICT intervention used (Table 4).

One reviewer independently assessed the quality of each study using the Cochrane risk of bias tool (15), which was subsequently checked for accuracy by a second reviewer. Disagreements were resolved through consensus. Risk of bias was assessed at the study level.

Given the broad inclusion criteria and heterogeneity of the interventions and methodological characteristics of included studies (PICOS), a meta-analysis was deemed inappropriate, and a narrative synthesis and summary of study findings was therefore conducted. The outcomes of interest included the usability of the ICT intervention and practice behaviour change.

Usability

The usability outcomes were guided by the Technology Acceptance Model (TAM2) (16) which illustrates that behaviour intention to use a system is determined by perceived usefulness and perceived ease of use. Perceived usefulness is defined by Venkatesh & Davis (16) as “the extent to which a person believes that using the system will enhance his/her job performance” (p. 187), and perceived ease of use is defined as “the extent to which a person believes that using the system will be free of effort” (p. 187).

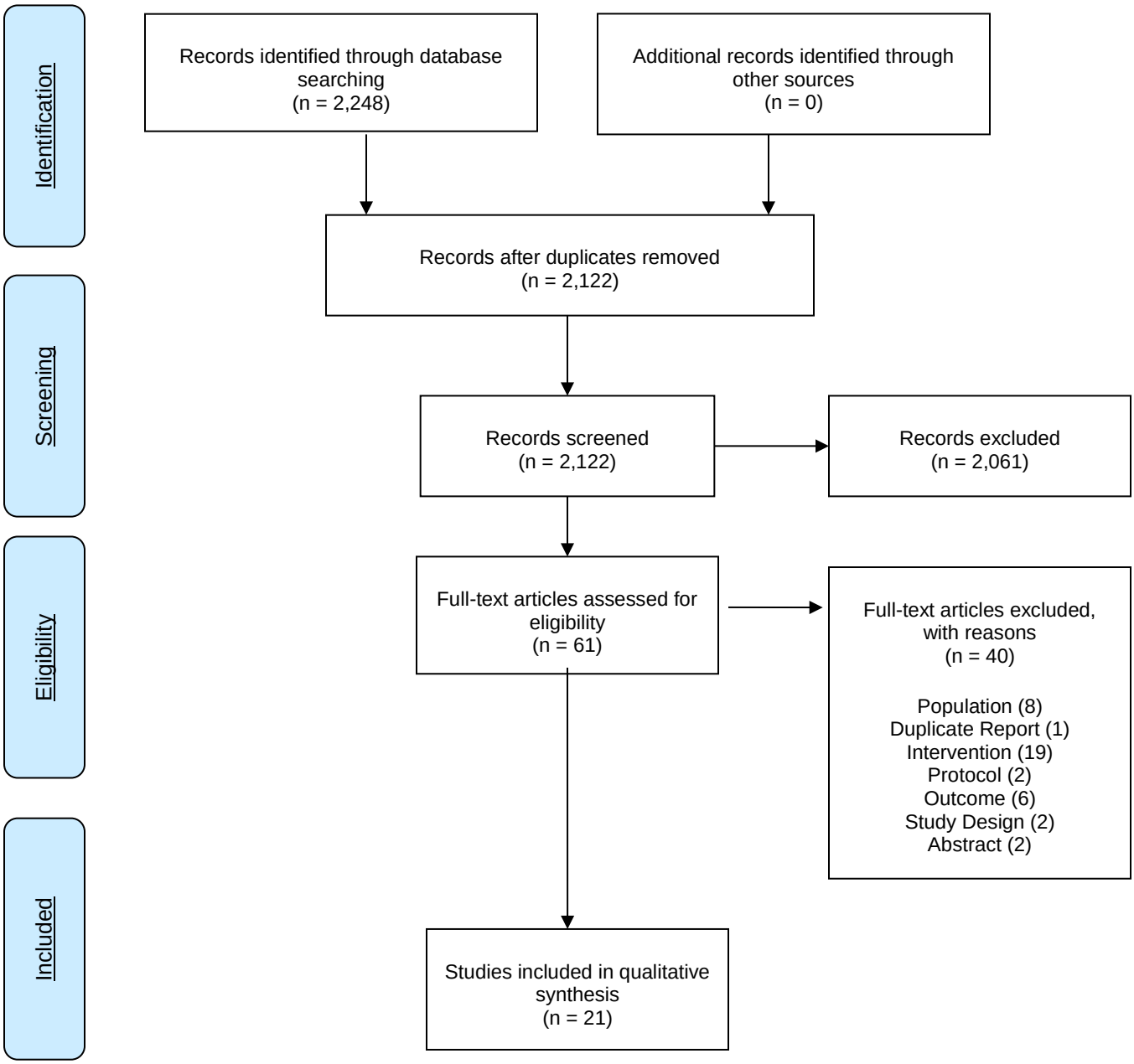
Practice Behaviour

The Theoretical Domains Framework (TDF) guided the practice behavior change outcomes (2). The TDF identifies numerous behaviour constructs and consists of 12 domains: 1) knowledge, 2) skills, 3) social/ professional role and identity, 4) beliefs about capabilities, 5) beliefs about consequences, 6) motivation and goals, 7) memory, attention and decision processes, 8) environmental context and resources, 9) social influences, 10) emotion regulation, 11) behavioural regulation, and 12) nature of the behavior. Practice behavior outcomes were categorized by the domains listed above.

Results

A total of 2,248 citations were identified through the initial search. After removing duplicates, 2,122 publication abstracts and titles were screened. The full-texts of 61 articles were assessed, of these, 40 were excluded for the following reasons: irrelevant population (8 studies), duplicate report (1 study), irrelevant intervention (19 studies), study protocol (2 studies), irrelevant outcome (6 studies), inappropriate study design (2 studies), and presented as abstract only (2 studies). The excluded studies are listed in Appendix 3.2. The PRISMA flow diagram is shown in (Figure 1).

Figure 1: PRISMA Flow diagram of included studies



Of the 21 studies that were included in our systematic review, 20 were RCTs (95%), and one was a CCT (5%). There were seven primary ICT interventions that were used to disseminate CPGs: websites (17, 22-25), computer software (26-28), online workshops (20,29), computer decision support systems

(30,31), online educational game (21), email (19,32), and multifaceted interventions that consisted of at least one ICT component (18, 33- 37) (Table 4).

Table 4: Type of ICT used in each included study

ICT Intervention (number of studies)	Study
Website (5)	Balamuth et al. (22); Bell et al. (23); Schroter et al. (17); Sassen et al. (24); Wolpin et al. (25)
Computer software (3)	Bullard et al. (26); Butzlaff et al. (27); Jousimaa et al. (28);
Online workshops (2)	Epstein et al. (20); Fordis et al. (29)
Computer decision support system (2)	Gill et al. (30); Peremans et al. (31)
Online educational game (1)	Kerfoot et al. (21)
Email (2)	Lobach et al. (19); Stewart et al. (32)
Multifaceted[a] (6)	Bernhardsson et al. (33); Chan et al. (34); Desimone et al. (35); McDonald et al. (36); Fretheim et al. (18); Shenoy (37)

[a] multifacted that consisted of at least one ICT component
ICT = information and communication techonology

Study characteristics are presented in Appendix 3.3. Eleven (52%) of the included studies involved only physicians (20-24, 27-30, 32, 37), three studies (14%) involved only medicine residents/fellows (family or internal)(23, 25, 35), three studies (14%) involved only nurses (31, 34, 36), and one study (5%) involved physiotherapists (33). Two studies (10%) assessed both nurses and physicians (17, 18) and another study (5%) assessed the combination of physicians, nurses, and medical residents (19).

Eight studies were compared with no intervention (19, 27, 30, 31, 33, 34), usual care [36], or usual education [35]. Two studies were compared with a waiting list (24, 32). Ten studies were compared with active interventions (17, 18, 21-23, 25, 26, 28, 29, 37), and one study was a pre-post design where assessments were conducted before and after the ICT intervention (20). Ten studies were conducted in the US (19, 20, 22, 23, 25, 29, 30, 35-37), three in Canada (26, 34, 32), seven in Europe (17,18, 24, 27, 28, 31, 33), and one was an international study conducted in 63 countries (21). Study durations and follow-up ranged from immediate post-test to one year post-intervention.

Websites

Five studies (17, 22-25) assessed the use of a website for the dissemination of CPGs to health professionals (Table 3). Balamuth et al. (22) compared an online one-page summary sheet of guidelines

(n=128) with a web link to guidelines (n=109) among physicians after six weeks. Schroter et al. (17) compared an interactive web-based tool combined with online didactic material (n=527) with online didactic material alone (n=527) among physicians and nurses after four months. Sassen et al. (24) compared a website with educational modules (n=48) with a waiting list group (n=33) among orthopedic surgeons after 12 months. Two studies involved only medicine residents/fellows (23,25). Bell et al. (23) compared self-study online guidelines (n=79) with print-based guidelines (n=83) among family and internal medicine residents at immediate post- test and four to six months post-intervention. Wolpin et al. [25] compared a website with enhanced learning modules (n=33) with a website containing usual care instructions (n=36) among medicine residents and fellows at 12 weeks post-intervention.

Usability

Perceived usefulness was assessed in one study (17). There was no statistically significant difference between intervention groups in regards to the proportion of physicians and nurses finding the intervention to be usable for integrating the learning into clinical practice. However, 76.7% (218/284) of physicians and nurses in the interactive web-based tool plus online didactic material found the intervention to be "very useful/useful". Usability was not measured in the online didactic material alone group and no comparative statistical analyses were performed.

Perceived ease of use was assessed in three studies (22, 23, 25). Findings from Balamuth et al. (22) revealed that physicians using the online one-page summary reported that the supplemental materials were "simpler" to use when compared with the web link to guidelines group (odds ratio [OR] 6.1; 95% confidence interval [CI], 2.8 to 13.6). In one of the studies involving only medicine residents/fellows by Bell et al. (23), the median (95%CI) learner satisfaction scale score (out of 20) was statistically significantly greater (P<.001) in the self-study online guidelines group (17.0 [16.0 to 18.0]) compared with the print-based guidelines group (15.0 [15.0 to 16.0]). In Wolpin et al (25), the other study involving only medicine residents/fellows, there was no statistically significant difference in overall satisfaction with learning experience between interventions groups.

Practice Behaviour

Knowledge was assessed in four studies (17, 22, 23, 25). In all four studies, there was no statistically significant improvement in knowledge when compared with respective comparators.

Intention to use CPGs and reduction in barriers were assessed in one study (24). There was no statistically significant difference between groups for intention to use material to educate patients, and no statistically significant difference in reduced barriers to using the material to educate patients.

Computer software

Three studies (26-28) assessed the use of computer software for the dissemination of CPGs among health professionals (Table 4). Bullard et al. (26), used a cross-over design to compare a wirelessly networked mobile computer program with a desktop computer program among physicians (n=10) after eight-hour shifts. Butzlaff et al. (27) compared CPGs provided by compact disc read-only memory (CD-ROM) and Internet (n=53) with no intervention (n=66) among physicians after approximately 70 days. Jousimaa et al. (28) compared CD-ROM computer-based guidelines (n=72) with text-book-based guidelines (n=67) among physicians after one month.

Usability

Perceived usefulness was assessed in one study (26). Statistically significant mean (95%CI) satisfaction scores (out of 7, with 7 representing excellent) favoured the wireless network mobile computer program group when compared to the desktop computer program group for several items such as “impact on efficiency” (3.2 [2.6 to 3.8] vs. 4.3 [4.0 to 4.6], P = .02), “increase use of CPGs” (4.1 [3.6 to 4.6] vs. 3.5 [2.9 to 4.0], P = .03), and “saving time” (3.1 [2.3 to 3.9] vs. 4.2 [3.6 to 4.7], P = .05). Other satisfaction items such as “configuration”, “availability”, “reduced communication with staff and patients”, and “accessibility” did not show statistically significant differences between intervention groups. Physicians appeared to be indifferent regarding the usability of the wireless computer had on their efficiency with a mean (95%CI) score (out of 7, with 7 representing strongly agree) of 3.30 (2.33 to 4.27). Usability of the desktop computer program was not assessed.

Practice Behaviour

Knowledge was assessed in one study (27). There was no statistically significant difference in knowledge scores between intervention groups.

Skills were assessed in one study (28). There was no statistically significant difference between intervention groups for compliance skills with CPGs for laboratory, radiological, or physical examinations.

Online Workshops

Two studies (20, 29) assessed the use of online workshops for the dissemination of CPGs among health professionals (Table 3). Epstein et al. (20) compared an online didactic education session/workshop (n=27) with no intervention (n=22) among pediatricians after 6 months. Participants in the online didactic education workshop group received four one-hour training sessions with instructions to use an Internet portal to assess attention deficit hyperactivity disorder (ADHD), titrate and monitor responses to medications, and communicate with patients and their parents and teachers using an online report card. Fordis et al. (29) compared a live online continuing medical education (CME) workshop (n=51) with an online (non-live) CME workshop (n=52), and no intervention (n=20) among physicians after 12 weeks.

Usability

Perceived usefulness was assessed in one study (29). The proportion of physicians satisfied with the learning experience was 100% (49/49) for the live CME group and 94% (44/47) for the online CME group. No comparative statistical analyses were performed for the perceived usefulness outcome.

Practice Behaviour

Skills were assessed in both studies (20, 29). In Epstein et al. (20), the online didactic education workshop group demonstrated statistically significant improvements (mean % change from baseline) in ADHD care practices when compared to no intervention for the following CPG recommendations: “use of teacher ratings of ADHD during assessment” (23.8 % vs. 5.7%, P= .03), “use of DSM-IV ADHD criteria

during assessment" (22.6% vs. 6.0%, *P*= .04), "use of outside provider for ADHD diagnosis" (23.8 % vs. 17.9%, *P*= .03), "use of teacher ratings of ADHD to monitor treatment responses" (38.7% vs. 6.3%, *P*= .003). In Fordis et al. (29), among the three intervention groups, there was no change from baseline screening levels following the intervention, and no statistically significant differences between interventions groups. There was a statistically significant (*P* = .04) increase in the mean proportion (95%CI) of patients appropriately treated by the online CME group (5.0% [1.0% to 9.1%]) when compared with the live CME (−1.1% [−4.9% to 2.7%]) and control groups (1.2% [−2.8% to 5.1%]).

Knowledge was assessed in one study [29]. There was a statistically significant (*P* <.001) improvement in knowledge for both online interventions groups combined with a mean (95%CI) change of 31.0% (27.0% to 35.0%) from baseline to immediate post-test, and 36.4% (32.2% to 40.6%) to 12 weeks post-test.

Computer decision support system

Two studies (30, 31) assessed the use of computerized decision support systems (CDSS) for the dissemination of CPGs among health professionals (Table 3). According to Peremans et al. (31), a CDSS is defined as "as any software designed to directly aid clinical decision making, whereby individual patient records are matched with a computer database of guidelines" (p.281). Peremans et al. (31) compared an electronic health record (EHR)-based CDSS intervention (n=15) with a group receiving a visit by a simulated "empowered" patient (n=15), and no intervention (n=13). Gill et al. [30] compared an EHR-based CDSS intervention (n=53) with no intervention (n=66) among physicians and clinicians in ambulatory practices after 12 months.

Practice Behaviour

Skills were assessed in both studies (30, 31). In Peremans et al. (31), the role of the simulated patient was to ask the physician specific clinical questions (a clinical scenario which was agreed upon by a panel of authors and researchers) regarding the prescribed pills she had received. The "empowered patient" group was the only group that had statistically significant improved mean scores (out of 48 points) for consultation and prescribing skills after 5 months post-intervention when compared with no intervention

with a mean (95% CI) difference of 4.92 (1.96 to 7.89). In Gill et al. [30], there was a statistically significant difference favouring the EHR-based CDSS intervention compared with no intervention for delivering guideline-concordant care (OR 1.19; 95% CI, 1.01 to 1.42).

Online educational game

One study (21) assessed the use of an online educational game for the dissemination of CPGs among health professionals (Table 3). Kerfoot et al. (21) compared an online educational game with a survey containing two questions distributed every two days (n=735) with a group receiving the same game, but with a survey containing four questions distributed every four days (n=735) among urologists after 34 weeks.

Practice Behaviour

Both online game groups demonstrated statistically significant (*P* <.001) improvements in knowledge when compared to baseline with median scores of 48.0% (18) vs. 100.0% (3) for the online game 2 questions every 2 days cohort, and 45.0% (15) vs. 98.0% (8) for the 4 questions every 4 days cohort.

Email

Two studies (19, 32) assessed the use of email for the dissemination of CPGs among health professionals (Table 3). Lobach et al. (19) compared bi-weekly emails of computer-based audit/feedback program (n=22) with no intervention (n=23) among physicians, general internists, nurses, physician assistants, and family medicine residents after 12 weeks. Stewart et al. (32) compared the use of email to disseminate two separate evidence-based modules on diabetes and prevention (n=27) compared with a waiting list (n=31) among physicians after 6 months.

Practice Behaviour

Skills were assessed in both studies (19, 32). In Lobach et al. (19), there was a statistically significant difference favouring the email intervention compared with no intervention for median rate of compliance

with CPGs (35.3% vs. 6.1%, *P*=.01). In Stewart et al. [32], there was a statistically significant difference (*P*=.03) in skills favouring the email intervention when compared to the waiting list with mean (SD) compliance scores (out of 100) of 55.0 (10.0) vs. 50.0 (14.4) for the prevention modules at 6 months. There was no statistically significant difference in compliance scores between intervention groups for the diabetes modules at 6 months, and for both modules at 2 months.

Knowledge was assessed in one study (32). There was a statistically significant difference (*P*=.002) favouring the email intervention when compared to the waiting list with mean (SD) knowledge scores (out of 100) of 63.8 (17.6) vs. 50.5 (13.8) and 65.7 (15.2) vs. 53.3 (10.5) for the prevention modules at 2 months and 6 months respectively. There was no statistically significant difference in knowledge scores between intervention groups for the diabetes modules at 2 and 6 months.

Multifaceted ICT interventions

Six studies (18, 33- 37) assessed the use of a multifaceted intervention including an ICT with more than one CPG dissemination strategy among health professionals (Table 3). Bernhardsson et al. (33) compared the combination of an implementation seminar with group discussion, a website, and email with no intervention (n=88) among physiotherapists after 12 months. Shenoy (37) compared the combination of online education and audit and feedback (n=24) with mailed CPGs (n=21) among physicians after five months. Fretheim et al. (18) compared the combination of an educational outreach visit, audit and feedback at the outreach visit, computerized reminders, risk assessment tools, patient information material, and telephone follow-up (n=257), with passive guideline dissemination (no additional active promotion or encouragement for use of guidelines) (n=244) among physicians and practice nurses after 45 days. Chan et al. (34) compared the combination of an in-person education session and online support (n=31) with no intervention (n=22) among nurses after two weeks. Desimone et al. (35) compared the combination of in-person education, online support, and printed materials (n=11) with usual education (n=11) among internal medicine residents after four weeks. McDonald et al. (2005)(36) compared the combination of email reminders with provider prompts, patient education material, and clinical nurse specialist outreach (n=97) with email reminders of recommendations only (n=121), and usual care

(n=118) among primary care and family medicine residents after 24 months.

Usability

Usability was assessed in one study (33). There was no statistically significant difference between intervention groups for change in proportion of physiotherapists who felt the CPGs were easy to access, and the proportion of those who used the CPGs frequently.

Perceived usefulness was assessed in one study (34). There was a statistically significant improvement in proportion of nurses who were satisfied in following the CPGs at 2 weeks post-intervention when compared with baseline among the multifaceted intervention group with a mean (95% CI) of 40.7% (16.1% to 59.6%).

Practice Behaviour

Knowledge was assessed in three studies (33, 35, 37). In Bernhardsson et al. (33), there were statistically significant improvements from baseline favouring the intervention group when compared with no intervention for the proportion of physiotherapists aware that guidelines exist (27.9% vs. 7.3%, *P*= .02) and the proportion of physiotherapists aware where to find guidelines (25.2% vs. 4.8%, *P*=.007). In Shenoy (37), there was no statistically significant improvement in knowledge among either the multifaceted intervention or the mailed guidelines groups. In the study involving only medicine residents/fellows by Desimone et al. (35), there was a statistically significant improvement in correct responses (out of 11 items) from baseline in both intervention groups with a mean (SD) proportions for the multifaceted intervention group (83% [2.1%] vs. 69% [1.7%], *P*= .003) and the usual education group (84% [1.4%] vs. 76% [1.2%], *P*= .02).

Skills were assessed in three studies (18, 33, 36). In McDonald et al. (36), the probability of nurses completing bowel movement assessments was statistically significantly lower in the email reminder intervention group (*P*= .02) compared with usual care with an adjusted mean difference of -5.7% (89.0% vs. 94.7%), representing a decrease in performance. There was no statistically significant difference compared with the multifaceted intervention group. Other nurse assessment and instruction practices did

not reach statistical significance when the email reminder and multifaceted interventions were compared with usual care. In Fretheim et al. (18), there was a statistically significant difference in proportion of physicians and practice nurses prescribing in concordance to CPGs from baseline to 12 months favouring the multifaceted group (11.5%) when compared with the passive guidelines dissemination group (2.2%) with a relative risk (95%CI) of 1.94 (1.49 to 2.49). There was no statistically significant difference between intervention groups for physicians and practice nurses performing risk assessments at 12 months. In Bernhardsson et al. (33), there was no statistically significant difference between interventions groups for change in proportion of physiotherapists who “frequently or almost” always” used the CPGs.

Beliefs about capabilities and intention to use CPGs were assessed in one study (34). There was a statistically significant improvement in proportion of nurses who were self-confident in following the CPGs at 2 weeks post-intervention when compared with baseline among the multifaceted intervention group with a mean (95% CI) of 25.9% (4.2% to 45.5%). There was a statistically significant improvement in intention to use the new CPGs when compared with baseline among the multifaceted intervention group with a mean (95% CI) change in score (out of 4, with 4 representing willingness to use all CPGs) of 0.74 (0.36 to 1.1). There was no statistically significant improvement among the control group for each of the outcomes listed above.

Table 5: Summary of Findings of Included Studies

Study (Publication Date)	Interventions	Outcome (s)	Effect size	Conclusion
			Website	
Balamuth et al. [22] (2010)	Online 1-page summary sheet of guidelines (n=128)	**Knowledge**: correctly diagnosed patients OR (95%CI)	0.82 (0.49 – 1.4)	No statically significant difference between two groups in correctly diagnosing patients according to guidelines. Participants using the online 1-page summary reported that the supplemental materials were more simple to use when compared with the weblink group
	Web link to guidelines (n=109)	**Perceived ease of use**: simplicity of supplemental materials OR (95%CI)	6.1 (2.8-13.6)	
Bell et al. [23] (2000)	Self-study online guidelines (n=79)	**Knowledge**: Median (95%CI) score (out of 20) scores after immediate post-test	Online: 15.0 (14.0 – 15.0)	No statistically significant difference in knowledge at immediate post-test or after 4-6 months. Online guideline users were more satisfied with learning.
	Print-based guidelines (n=83)		Print based: 14.5 (14.0 – 15.0) *P* = .20	
		Knowledge: Median (95%CI) score (out of 20) after 4 -6 months	Online: 12.0 (11.0 – 13.0)	
			Print based: 11.0 (10.0-12.0); *P* = .12)	
		Perceived ease of use: Median (95%CI) learner satisfaction scores (range 5 to 20, higher = better)	Online: 17.0 (16.0 –18.0)	
			Print-based: 15.0 (15.0 –16.0); *P* < .001	
Schroter et al. [17] (2011)	Website with educational modules (n=48)	**Knowledge**: mean % change (SD) from baseline knowledge at 4-months	Web-based+ online material: 47.4% (12.6) to 66.8% (11.5)	No statistically significant differences in knowledge change or usability between the two groups. Participants in web-based tool plus online material group found it to be useful. Usefulness was not measured in the other group.
	Waiting list (n=33)		Online material: 47.3% (12.9)	

			to 67.8% (10.8); *P* =.19	
		Perceived Usefulness: % of participants who reported the tool to be "very useful"/"useful"	Web-based+ online material: 77%	
			Online material: NR	
Sassen et al. [24] (2014)	Website with educational modules (n=48)	**Intention**: to use material to educate patients: mean (SD) score / 7 (higher = easier) at baseline and 12 months	Website: 6.25 (1.00), 6.06 (1.11)	No statistically significant differences in intention to use and barriers between interventions groups at 12 months.
	Waiting list (n=33)		Waiting list: 5.87 (1.15), 6.02 (0.91), *P* = .12	
		Barriers: to using the material to educate patients: mean (SD) score out of 7 (higher = easier) at baseline and 12 months	Website: 3.11 (1.17), 3.18 (1.12)	
			Waiting list: 2.78 (1.01), 2.63 (0.96), *P* = .46	
Wolpin et al. [25] (2011)	Website enhanced learning (additional case studies) (n=33)	**Knowledge**: mean (SD) score % on knowledge content of CPGs pre- and immediate post test	Overall (pooled both groups): 79.28% (12.17), 82.32% (13.84), *P* = .10	No statistically significant difference in knowledge or satisfaction at post-test between intervention groups. No statistically significant differences were seen between interventions groups for both outcomes.
	Website with usual care instructions (same content, without case studies) (n=36)		Website (enhanced) 78.18 % (11.1), 79.39% (15.0)	
			Website (usual): 80.28% (13.2), 85.0% (12.3)	
		Perceived ease of use: overall satisfaction with learning experience, mean (SD) score (1 to 5, higher = very	Overall (pooled both groups): 4.08 (0.860)	

		satisfied), pre- and immediate post test		
			Website (enhanced) 78.18 (11.1), 79.39 (15.0)	
			Website (usual): 80.28 (13.2), 85.0 (12.3), *P* = .13	
		Computer Software		
Bullard et al. [26] (2004)	Wirelessly networked mobile computer program (n=10)[a]	**Perceived Usefulness**: "impact on efficiency" mean (95%CI) score out of 7	Wireless: 3.2 (2.6 – 3.8);	Statistically significant greater satisfaction for several items ("impact on efficiency", "increase use of CPGs", and "saving time") when using the wireless computer compared with the desktop computer. Other satisfaction items such as "configuration", "availability", "reduced communication with staff and patients", and "accessibility" did not show statistically significant differences (results not shown). Participants appeared to be indifferent regarding the usability of the wireless computer had on their efficiency.
	Desktop computer program (n=10)[a]		Desktop: 4.3 (4.0 -4.6), *P* = .02	
		Perceived Usefulness: "increased use of CPGS" mean (95%CI) score out of 7 (7 = excellent)	Wireless: 4.1 (3.6 – 4.6)	
			Desktop: 3.5 (2.9 – 4.0), *P* = .03	
		Perceived Usefulness: "wireless computer program made participant more efficient", mean (95%CI) score out of 7 (7 = strongly agree)	Wireless: 3.30 (2.33 – 4.27)	
			Desktop: NR	
Butzlaff et al. [27] (2004)	CPGs via CD-ROM/Internet (n=53)	**Knowledge**: median (IQR) score out of 25 at baseline	CD/Internet: 13 (12 – 16)	There was no statistically significant difference between intervention groups at baseline and ~70 post-intervention in knowledge scores.
	No intervention (n=66)		No intervention: 13 (10 -15.25), *P* = .40	

		Knowledge: median (IQR) score out of 25 at ~70 days post-test	CD/Internet: 15 (12-17)	
			No intervention: 13 (11-15.25), P = .10	
Jousimaa et al. [28] (2002)	CD-ROM computer-based guidelines (n=72)	**Skills**: compliance with CPGs, "laboratory examinations", OR (95%CI)	1.07 (0.79 – 1.44)	There was no statistically significant difference between intervention groups for compliance with CPGs for laboratory, radiological, or physical examinations.
	Text-book-based guidelines (n=67)	**Skills**: compliance with CPGs, "radiological examinations", OR (95%CI)	1.09 (0.81 – 1.46)	
		Skills: compliance with CPGs, "physical examinations", OR (95%CI)	0.74 (0.51 – 1.06)	
Online Workshops				
Epstein et al. [20] (2011)	Online didactic education session/workshop (n=27)	**Skills**: compliance with CPGs, "use of teacher ratings of ADHD during assessment", mean % change from baseline at 6 months	Online: 23.8 %	Statistically significant changes from baseline to 6 months were seen among participants complying with CPG recommended ADHD care practices, with the exception of one recommendation "Use of parent ratings of ADHD to monitor treatment responses" (results not shown)
	No intervention (received intervention after 6 months) (n=22)		No intervention: 5.7%, *P* = .03	
		Skills: compliance with CPGs, "v, mean % change from baseline at 6 months	Online: 22.6%	
			No intervention: 6.0%, *P* = .04	
		Skills: compliance with CPGs, "use of outside provider for ADHD diagnosis", mean % change from baseline at 6 months	Online: 23.8 %	
			No intervention: 17.9%, *P* = .03	
		Skills-: compliance	Online: -60.7%	

		with CPGs, “use of parent ratings of ADHD to monitor treatment responses”, mean % change from baseline at 6 months		
			No intervention: -10.7%, *P* < .001	
		Skills: compliance with CPGs, “use of teacher ratings of ADHD to monitor treatment responses”, mean % change from baseline at 6 months	Online: 38.7%	
			No intervention: 6.3%, *P* = .003	
Fordis et al. [29] (2005)	Live online CME workshop (n=51)	**Knowledge**: The two active CME interventions combined: mean % change (95%CI) from baseline to immediate post-test	31.0% (95%CI, 27.0%-35.0%), *P* < .001	A statistically significant improvement in knowledge was seen over time for both online interventions groups. A statistically significant decrease in appropriately screening patients was seen in the Live Online CME group at 12 weeks post-test when compared with baseline. No statistically significant differences were seen for screening patients between interventions groups. There was a statistically significant increase in the proportion of patients appropriately treated by the online CME group when compared with the live CME and control groups. Participants in the online interventions were satisfied with the learning experience
	Online CME workshop (n=52)	**Knowledge**; The two active CME interventions combined: mean % change (95%CI) from baseline to 12 weeks post-test	36.4% (95% CI, 32.2%-40.6%), *P* < .001	
	No intervention (n=20)	**Knowledge**: The two active CME interventions combined: mean % change (95%CI) from immediate post-test to 12 weeks post-test	5.4% (95% CI, 2.6%-8.2%)	

		Skills: Patients Appropriately Screened for Dyslipidemia, mean % change (95%CI) from baseline to 12 weeks-post intervention	Live Online: −3.3 (−5.9 to −0.7)	
			Online: −0.1 (−2.9 to 2.6)	
			No intervention −0.8 (−3.5 to 1.8), *P* = .24	
		Skills: Patients Appropriately treated for Dyslipidemia, mean % change from baseline to 12 weeks-post intervention	Live Online: −1.1 (−4.9 to 2.7)	
			Online: 5.0 (1.0 to 9.1)	
			No intervention: 1.2 (−2.8 to 5.1), *P* = .04	
		Perceived Usefulness: % of participants satisfied with the learning experience	Live online: 100% (49/49)	
			Online: 94% (44/47)	
			No intervention: NA	
Computer Decision Support System				
Gill et al. [30] (2011)	EHR-based clinical decision support (n=53)	**Skill**: % of patients receiving guideline-concordant care, OR (95%CI)	EHR: 25.4%	There was a statistically significant difference favouring the EHR intervention compared with no intervention for the proportion of patients receiving guidelines concordant care.
	No intervention (n=66		No intervention: 22.4%, OR = 1.19 (1.01-1.42)	
Peremans et al. [31] (2010)	EHR-based clinical decision support (n=15)	**Skill**: consultation and prescribing skills based on a 48-item checklist, mean difference (95%CI) from baseline to 5 months-post intervention	EHR: -1.79 (-4.97 – 1.65)	The "Empowered patient" group was the only group that had improved consultation and prescribing skills scores after 5 months post-intervention and the only intervention that demonstrated a statistically significant difference when compared to no intervention.

	Empowered patient group (n=15)		Empowered: 4.92 (1.96–7.89)	
	No intervention (n=13)		No intervention: -0.91 (-3.37 – 1.92)	
		Online Educational Game		
Kerfoot et al. [21] (2009)	Online game/survey 2 questions every 2 days (n=735)	**Knowledge**: median % (IQR) scores for knowledge test baseline	Online Game 2 questions every 2 days: 48% (18)	Both Online game cohorts demonstrated statistically significant improvements in knowledge when compared to baseline.
	Online game/survey 4 questions every 4 days (n=735)		Online Game 4 questions every 4 days: 45% (15)	
		Knowledge: median % (IQR) scores for knowledge test post-intervention (12 or 24 weeks), p-value	Online Game 2 questions every 2 days: 100% (3)	
			Online Game 4 questions every 4 days: 98% (8), *P* < .001	
		Email		
Lobach et al. [19] (1996)	Bi-weekly emails of computer-based audit/feedback program (n=22)	**Skill**: median %(IQR) participant compliance with guidelines, p-value	Email: 35.3% (NR[b])	The email intervention demonstrated statistical significance in greater compliance with guidelines compared with no intervention.
	No intervention (n=23)		No intervention: 6.1% (NR[b]), *P* = .01	
Stewart et al. [32] (2005)	Email on-line learning for two evidence-based modules (type 2 diabetes, prevention) (n=27)	**Knowledge**: mean (SD) score (out of 100) at baseline	Email (diabetes): 66.8 (14.1)	The intervention group (prevention module) demonstrated statistically significant improvements compared to the control group for knowledge at 2 and 6 months, as well as compliance at 6 months. There was no statistically significant difference with the diabetes modules.
	Waiting list (n=31)		Email (prevention): 53.8 (12.8)	
			Waiting list (diabetes): 68.6 (10.4)	
			Waiting list (prevention): 51.9 (9.5)	
		Knowledge: mean (SD) score (out of 100)	Email (diabetes): 72.7 (14.1)	

	at 2 month post-intervention, p-value	
		Email (prevention): 63.8 (17.6)
		Waiting list (diabetes): 67.7 (16.8), *P* = .57
		Waiting list (prevention): 50.5 (13.8), *P* = .002
	Knowledge: mean (SD) score (out of 100) at 6 month post-intervention, p-value	Email (diabetes): 73.2 (7.7)
		Email (prevention): 65.7 (15.2)
		Waiting list (diabetes): 68.6 (11.4), *P* = .14
		Waiting list (prevention): 53.3 (10.5), *P* = .004
	Skill: mean (SD) score for compliance with guidelines (out of 100) at baseline	Email (diabetes): 53.8 (12.5)
		Email (prevention): 52.2 (11.1)
		Waiting list (diabetes): 51.2 (11.6)
		Waiting list (prevention): 51.1 (14.4)
	Skill: mean (SD) score for compliance with guidelines (out of 100) at 2 month post-intervention, p-value	Email (diabetes): 51.7 (12.9)
		Email (prevention): 52.2 (11.7)
		Waiting list (diabetes): 51.6 (9.5), *P*= .90
		Waiting list (prevention): 47.7 (13.8), *P* = .11
	Skill: mean (SD) score for compliance with guidelines (out of 100)	Email (diabetes): 47.1 (9.2)

		at 6 month post-intervention, p-value		
			Email (prevention): 55.0 (10.0)	
			Waiting list (diabetes): 50.8 (9.1), *P* = .14	
			Waiting list (prevention): 50.0 (14.4), *P* = .03	
			Multifaceted	
Bernhardsson et al. [33] (2014)	Multifaceted: Implementation seminar/group discussion, website and email reminders (n=168)	**Knowledge**: change in % of participants who were aware that guidelines exist from baseline to 1 year follow-up, p-value	Intervention: 27.9%	There was a statistically significant difference favouring the intervention group for change in awareness, knowledge of where to find, and accessibility of guidelines at 1-year follow-up. There were no significant differences in frequent use of CPGs
	No intervention (n=88)		No intervention: 7.3%, *P* = .02	
		Knowledge: change in % of participant knew of where to find guidelines from baseline to 1 year follow-up, p-value	Intervention: 25.2%	
			No Intervention: 4.8%, *P* = .007	
		Perceived Ease of Use: change in % of participant who felt guidelines were easy to access from baseline to 1 year follow-up, p-value	Intervention: 17.4%	
			No Intervention: −4.3%, *P* <. 001	
		Skills: change in % compliance with use of CPGs (frequently or almost always)	Intervention: 9.2%	
			No Intervention: −0.2%, *P* =. 30	
Chan et al. [34] (2013)	Multifaceted in person education session and	**Beliefs about capabilities**: change	Intervention: 25.9% (4.2 to 45.5)	There were statistically significant improvements in self-confidence to use, satisfaction in following, and willingness to

	online support (n=31)	in % (95%CI) of participants who were self-confident in following CPGs at 2 week post-intervention		follow CPGs among the intervention group at 2 weeks post-intervention. There were no significant improvements among the control group.
	No intervention (n=22)		No intervention: 6.3% (−2.0 to 32.1)	
		Perceived Usefulness: change in % (95%CI) of participants who were satisfied in following CPGs at 2 week post-intervention	Intervention: 40.7% (16.1 to 59.6)	
			No intervention: −12.5 (−37.3 to 12.7)	
		Intention: willingness to use new CPGs, mean score change (95%CI) (out of 4, 4 = all CPGs) at 2 week post-intervention	Intervention: 0.74 (0.36 to 1.1)	
			No intervention: 0.19 (−0.10 to 0.48)	
Desimone et al. [35] (2012)	Multifaceted: In person education, online support, printed materials (n=11)	**Knowledge**: mean % (SD) of correct responses (11 items) at baseline	Multifaceted: 69% (1.7)	There was a statistically significant improvement in knowledge in both groups at 1-month post-intervention. There were no observable differences between groups (between-group statistical analyses not performed).
			Usual education: 76% (1.2)	
	Usual education (n=11)	**Knowledge**: mean % (SD) of correct responses (11 items) at 1-mont post-intervention, p-value	Multifaceted: 83% (2.1), *P*= 0.003	
			Usual education: 84% (1.4), *P* = .02	
McDonald et al. [36] (2005)	Multifaceted: Email reminder with provider prompts, patient education material, and	**Skills**: adjusted mean difference in probability that participant performed bowel	Email reminder: -5.7, *P*= .02	In the email reminder intervention group, there was a decrease in performance as the probability of nurses completing bowel movement assessments was statistically significant lower compared with usual care. There was no statistically significant

	clinical nurse specialist outreach (n=97)	movement assessment based on CPG compared with usual care, p-value		difference compared with the multifaceted group. Other nurse assessment and instruction practices did not reach statistical significance when the email reminder and multifaceted interventions were compared with usual care (results not shown).
	Email reminder of recommendations (n=121)		Multifaceted: -2.7 *P*= .26	
	Usual care (n=118)			
Fretheim et al. [18] (2006)	Multifaceted: Educational Outreach Visit, Audit and Feedback at Outreach Visit, Computerized Reminders, Risk Assessment Tools, Patient Information Material, Telephone follow-up (n=257)	**Skills**: mean change in % participants prescribing in concordance to CPGs from baseline to 12 months, between-group difference RR (95%CI)	Multifaceted: 11.5%	There was a statistically significant difference in participants prescribing in concordance to CPGs from baseline to 12 months favouring the multifaceted group when compared to passive guidelines dissemination. No statistically significant differences were demonstrated for differences in participants performing risk assessments at 12 months
	Passive guideline dissemination (no additional active promotion or encouragement for use of guidelines) (n=244)		Passive dissemination: 2.2%, 1.94 (1.49 to 2.49)	
		Skills: between-group difference in mean % participants performing risk assessments according to CPGs at 12 months, RR (95%CI)	1.04 (0.60; 1.71)	
Shenoy [37] (2013)	Multifaceted: online education, audit, feedback (n=24)	**Knowledge**: mean change (95%CI) in total score (18 clinical vignettes) from baseline to 12 weeks post-intervention	0.04 (1.22 to 1.31)	There was no statistically significant change in knowledge between intervention groups from baseline to 12 weeks post-intervention. There was no statistically significant difference between intervention groups for the proportion of patients receiving CPG adherent care at 12 weeks post-intervention (results not shown).
	Mailed guidelines (n=21)			

ANCOVA = analysis of covariance; CD-ROM = compact disc read-only memory; CDSS = computerized decision support system; CME = continuing medical education; CI = confidence interval; EHR = electronic health record; IQR = interquartile range (25^{th} and 75^{th} percentile); NR = not reported; OR = odds ratio; RR = relative risk

[a] cross-over design same participants in both groups
[b] IQR values illustrated in diagram, however values are not explicit

Discussion

The aim of this review was to identify research on health professionals' perceived usability and practice behaviour with ICTs for the dissemination of CPGs. In summary, results varied by the type of ICT used. While rapidly changing technologies may pose challenges for the development, implementation and evaluation of ICT-based interventions as they may be associated with greater barriers for adoption by health professionals (38), there were no apparent trends when comparing established and older ICTs (e.g., email and computer software) versus newer emerging ICT interventions (e.g., online educational games, online workshops and the multifaceted ICT interventions). Studies using websites to disseminate CPGs (17, 22- 25), demonstrated no improvements in knowledge (17, 22, 23, 25), reduced barriers (25), or intentions to use CPGs (25). There were positive effects for perceived usefulness (17) and perceived ease of use (22, 23) (two of three studies). Studies using computer software (26-28), demonstrated no improvements for knowledge (27), skills (28), but an effect on perceived usefulness (26). Two studies using online workshops (20, 29), demonstrated improvements for knowledge (29) and perceived usefulness (29) and skills (20, 29). Studies using computer decision support systems demonstrated variable results for skills as one study (30) demonstrated a positive effect, while the other did not (31). While both studies were compared to no intervention, it should be noted that in the latter study (31), the non-ICT intervention ("empowered" patient group) was the only group that demonstrated a positive effect when compared with no intervention. The one study that used an online educational game (21) demonstrated an improvement for knowledge. Studies using email (19, 32) demonstrated improvements for knowledge (32) and skills (19, 32). Studies using multifaceted ICT interventions (18, 33- 37) demonstrated improvements for knowledge (33, 35) (two of three studies), perceived usefulness (34), perceived ease of use (33), intention to use CPGs (34), beliefs about capabilities (33) and skills (37) (one of two studies). While the multifaceted interventions in this review mostly demonstrated positive findings for improvements in usability and practice behavior, it remains unclear whether they are in fact superior to single interventions. Grimshaw et al. (8) revealed that effect sizes in multifaceted interventions do not necessarily increase with increasing number of components and these types of interventions appear to be more costly than single interventions. Similarly, a review by Squires et al. (39) concluded that there is a lack of compelling evidence to demonstrate that multifaceted intervention are more effective than single

interventions.

Outcome selection was guided by both the TAM2 (16) and the TDF (2). The former was chosen as it was originally designed to predict ICT acceptance and usage in the workplace, and has been widely used for diverse set of ICT users (40); the latter was chosen as it simplifies and integrates a plethora of behaviour change theories including social cognitive theory, learning theory, and diffusion theory (2). The TAM2 is a validated and robust theoretical framework that has been used for predicting and explaining behavior related to ICTs (16). In addition to cognitive instrumental processes, the TAM2 encompasses social influence processes, including subjective norms, which has shown to explain the perceived usefulness of ICTs (41). Developed from a synthesis of psychological theories, the TDF is an integrative framework that has shown to be useful and flexible for the assessment of behaviour change and barriers among a diverse group of health professionals working in various clinical settings (42). Together both theoretical frameworks provided a comprehensive list of outcomes to measure health professionals' usability and practice behaviour change of ICTs for the dissemination of CPGs.

The variable findings in knowledge improvement are supported by a recent systematic review (7) of educational strategies for teaching medical trainees which concluded no difference in learner outcomes when comparing lecture versus online strategies. While previous reviews have assessed interventions for promoting ICT adoption (43) and KT dissemination strategies focusing on practice behaviour change among health professionals (8) distinctly, this systematic review adds to the current body of literature by summarizing current evidence pertaining to health professionals' perceived usability and practice behaviour change with ICTs, specifically for the dissemination of CPGs. A systematic review by Gagnon et al. (43) concluded that there is very limited evidence on effective interventions promoting the adoption of ICTs by healthcare professionals, while a systematic review by Grimshaw et al. (8) concluded that the evidence to guide choice of KT strategies targeting health professionals is incomplete. Understanding how health professionals engage and use ICTs to access CPGs will enable health care provider organization to create content that is more online-friendly (44). While there is limited evidence, ICTs have shown promising findings in studies included in this review. ICTs are novel ways of disseminating CPGs, compared with more traditional methods such as printed educational materials (9), educational meetings

(10), educational outreach (11), local opinion leaders (12), and audit and feedback (13). This review highlights which ICTs were successfully used as a dissemination strategy for CPGs, however it remains unclear whether one ICT is more effective than another. It is also unclear whether other ICTs not captured in this review, such as social media, can be used as effective dissemination strategy for CPGs. Further research, conducting well-designed RCTs comparing, is necessary to determine if the use of ICTs is an effective strategy to disseminate evidence-base medicine to health professionals. There were differences in study durations and measurements among the included studies. As none of the studies measured sustainability, researchers should consider what is an appropriate timeframe to expect meaningful differences in behavior change. Future studies, designed to compare these strategies head-to-head, would provide further guidance. While the scope of the review focused on the dissemination of CPGs to health professionals, future research should also assess how ICT dissemination strategies can be used as a tool to share information between health professionals and patients. As only one of the included studies (24) assessed barriers, future research should consider barriers as crucial outcome of interest.

The strengths of this systematic review include the broad eligibility criteria that were used, allowing for numerous types of ICTs, and various health professional populations (i.e., physicians including medical residents, nurses, and physiotherapists) to be included and summarized in this review. Additionally, a systematic approach was used to review the literature and the methodological quality of each included study was assessed. This systematic review was conducted following the PRISMA checklist (14).

Nevertheless, there are limitations of this review that should be considered. Information published in languages other than English were not included, thus, some relevant findings may have been excluded. The small number of included studies per ICT and the heterogeneity between studies in regards to the included health professional populations, definitions of outcomes assessed, selected comparators (some compared interventions to no intervention, while others used active comparators), and duration of studies, did not allow for comparisons between studies. As a result, we were not able to calculate pooled effect-sizes or perform meta-analyses. The terminology of outcomes in the included studies sometimes differed from the identified concepts from the TAM2 and domains of the TDF used to define the usability and

practice behavior change outcomes respectively. Several studies measured numerous outcomes and it remains uncertain whether these studies were adequately powered to detect meaningful differences. Furthermore, the overall findings are limited by the high loss to follow-up in numerous studies (17, 21, 23, 25, 30,32, 34, 36). While reasons for loss to follow-up remain unclear, one potential cause as suggested by study authors may be professional or organizational barriers related to the use of these ICTs. CPG dissemination and KT strategies should be tailored and barrier-driven to improve adherence in practice (44).

The study authors did not always assess the quality of information being presented or quality of ICT. The quality of information being presented was previously assessed and deemed appropriate by authors in four of five (80%) studies using websites (17 23-25), one of the two (50%) studies using online workshops (29), the study using an online educational game (21), one of three (33%) studies using computer software (26), both studies using email (19, 32), both studies using CDSSs (30,31), and four of six studies (67%) using a multifaceted intervention including an ICT (33, 35-37). It was unclear whether the quality of information was assessed and deemed appropriate in the remaining studies. The quality of the ICT was assessed and deemed appropriate in two of five studies (40%) using websites (24, 25), one of the two (50%) studies using online workshops (29), the study using an online educational game (21), one of three (33%) studies using computer software (26), one of two (50%) using email (19), and one of six studies (35) using a multifaceted intervention including an ICT. In studies using CDSSs, the quality of the ICT was assessed in one of two studies (50%) (30), but was not generally accepted by users. It was unclear whether the quality of the ICTs was assessed and deemed appropriate in the remaining studies.

The overall methodological quality of included studies was strong for the website studies, while uncertain for the online education game, email and multifaceted studies (Appendix 3.4). Studies using computer software, online workshops and computer decisions support systems were of variable methodological quality as some studies were predominantly strong, while others were of uncertain quality. Several studies were conducted and are predated since the last ten years, thus the relevance of these ICTs may not be reflective of current technology. The goal of this systematic review was to transparently present the

current state of knowledge about ICT use among health professionals and allow readers to make informed decisions regarding their relevance.

Conclusion

The findings of this systematic review suggest that health professionals' perceived usability and practice behaviour change vary by type of ICT. Website studies demonstrated improvements in perceived usefulness and perceived ease of use, but not for knowledge usability, barriers and intentions. Computer software studies demonstrated improvements in perceived usefulness, but not for knowledge and skills. Online workshop and email studies demonstrated improvements in knowledge, perceived usefulness, and skills. An online educational game intervention demonstrated an improvement from baseline in knowledge at after 12 or 24 weeks. Computer decision support system studies demonstrated variable findings for improvement in skills. Multifaceted ICT interventions demonstrated improvements in beliefs about capabilities, but not for usability. Most multifaceted ICT studies demonstrated improvements in knowledge, perceived usefulness, perceived ease of use, and beliefs about capabilities. In summary, heterogeneity and the paucity of properly conducted studies did not allow for a clear comparison between studies and conclusion on the effectiveness of ICTs as a dissemination strategy for the dissemination of CPGs.

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Chapter 4: Systemic Review of the perceived usability of social media by health professionals to facilitate chronic disease self-management with their patients

Chapter 3 presented a manuscript of a systematic review of ICTs as a guideline dissemination strategy for health professionals. The conclusion of this review did not allow for a clear comparison between studies and conclusion on the effectiveness of ICTs as a dissemination strategy for CPGs.

This chapter presents a manuscript of a systemic review of the perceived usability of social media by health professionals to facilitate chronic disease self-management with their patients (Milestone 3). As opposed to the systematic review in chapter 3, which consisted of a broader scope looking at all ICTs, this review is more focussed on social media and chronic disease self-management. Thus the scope of this review reflects the feasibility study that was conducted and presented in Chapter 5. The published version of this manuscript can be found in Appendix 1.2: Publication #2. The objective of this systematic review was to summarize the evidence pertaining to the use of social media by health professionals to facilitate chronic disease self-management with their patients

The use of social media among health professionals to facilitate chronic disease self-management with their patients: a systematic review

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Abstract

Objective: The objective of this systematic review was to summarize the evidence pertaining to the use of social media by health professionals to facilitate chronic disease self-management with their patients.

Methods: A systematic approach was used to retrieve and extract relevant data. A total of 5,163 citations were identified, of which seven unique studies met criteria for inclusion; one was an RCT, two were prospective cohort studies, and four were qualitative studies. The following social media platforms were evaluated: discussion forums (6 studies) and collaborative project (1 study).

Results: The available evidence suggests that health professionals perceived discussion forums and collaborative projects to be useful social media platforms to facilitate chronic disease self-management with patients. No relevant evidence was found regarding the use of other social media platforms. Most studies indicated positive findings regarding health professionals' intention to use discussion forums, while the one study that used a collaborative project also indicated positive findings with its perceived ease of use as health professionals felt that it was useful to facilitate chronic disease self-management with patients. Mixed findings were seen in regards to health professionals' perceived ease of use of discussion forums. The most common barrier to using social media platforms was the lack of time in health professionals' schedules.

Conclusions: Discussion forums and collaborative projects appear to be promising resources for health

professionals to assist their patients in self-managing their chronic conditions; however further research comparing various social media platforms is needed.

Introduction

The prevalence rates of major chronic diseases among Canadian adults continue to increase, and the population over 65 years of age is growing almost four times greater than the overall population (1). Chronic disease has also resulted in significant use of health care services as adults with multiple chronic disease account for over two-thirds of health care spending (2). Given that more Canadians are living longer with chronic diseases (1), there is a need for health professionals to promote evidence-based self-management support to their patients.

In an effort to improve joint partnerships between health professionals and patients for the collaborative care of chronic diseases, health professionals are supplementing traditional patient education by providing technical skills and information allowing their patients to self-manage their chronic conditions (3).

Self-management support, such as the provision of personalized feedback, creation of small action plans and goal setting, enlisting social support, and determining goal achievement (4), allows health professionals to complement traditional patient education (3). Self-management support may allow patients to make appropriate decisions and manage their conditions through the use of technical skills and information to identify problems (3).

There remains a lack of clarity on how health professionals can optimally enhance self-management support (5) while addressing many challenges associated with provision including limited time and difficulties with ensuring patients are willing and able to understand instructions (6). New methods to provide successful self-management support to patients are therefore needed to minimize resource demand and improve patient education.

Self-management support can be enhanced by online information and communication technologies (ICTs) as chronic disease patients are increasingly using them to access health information (7) and these tools appear to be a promising resource allowing new strategies for patients and health professionals to communicate with one another and to educate themselves (8,9). Online ICTs, such as social media, have

the potential to reach a broad population (10), and allow for improved social support and knowledge acquisition (10,11). Furthermore, online self-management interventions have been associated with improvements in health behaviors and health status among older patients with chronic diseases (7).

Social media have been defined as “a group of online applications that allow for the creation and exchange of content generated by users” (p.1376) (12) and has been categorized into the following groups: collaborative projects, content communities, blogs or microblogs, social networking sites, virtual gaming or social worlds (13), and online discussion forums (12). Collaborative projects (e.g., Wikipedia) are “websites which allow users to add, remove, and change text-based content” and “enable the joint and simultaneous creation of content by many end-users” (p.62) (13). Content communities (e.g., YouTube) allow users to share media content such as videos, text, photos, and presentations (13). Blogs and microblogs (i.e., Twitter) are specific websites that come in different formats such as reviews of relevant information in one content area, to personal memoirs (13). These forms of social media are typically managed by one individual (13) and are usually displayed by date-stamped entries (14). Social networking sites (e.g., Facebook) are “applications that enable users to connect by creating personal information profiles, inviting friends and colleagues to have access to those profiles, and sending e-mails and instant messages between each other” (p. 63) (13). Virtual game worlds (e.g., Second Life) are “platforms that replicate a three dimensional environment in which users can appear in the form of personalized avatars and interact with each other as they would in real life” (p.64) while virtual social worlds “allow inhabitants to choose their behavior more freely and essentially live a virtual life similar to their real life” (p.64) (13). Online discussion forums, sometimes referred to as bulletin boards, allow users to have conversations using posted messages, and have been considered a form of social media as they incorporate user-generated content (12).

Social media have demonstrated to be a potentially successful resource tool for patients to self-manage their chronic conditions as it has provided them with empowerment (15), improved health indicators (9), and enhanced patient knowledge and confidence (16). Social media use among health professionals has also increasingly become popular (17,18) and has engaged learners and disseminated accurate information to enhance education (17,19,20). Social media allows for multimedia-sharing (e.g., disease

management videos, podcasts, and wikis) and has also shown to facilitate public health promotion (21) and respond to public health concerns (22).

While evidence shows that health professionals are using social media more regularly (17,18), and with a growing need to improve self-management strategies for patients, there is a lack of clarity regarding its use for chronic disease management and the role played by health professionals (9).

This systematic review was designed to address this knowledge gap. The objective of this systematic review was to summarize the evidence pertaining to the use of social media by health professionals to facilitate chronic disease self-management with their patients. Specifically, the aim of this systematic review was to provide new knowledge on health professionals' perceived usability and change in practice behaviour when using social media to assist patients in self-managing their chronic conditions.

Methods

This systematic review was conducted using the Preferred Reporting Items for Systematic Reviews and Meta Analyses (PRISMA) guidelines (23). To summarize the evidence, a systematic approach was adopted to retrieve relevant papers from the literature. Articles were selected for this review using the pre-defined selection criteria guided by the PICOS (population, intervention, comparison, outcome, and study design) in Table 6.

Table 6: Selection Criteria for Systematic Review

Population	Health professionals (e.g., physicians, nurses, dieticians)
Intervention	Chronic disease self-management programs disseminated using social media platforms (i.e., collaborative project, blog or microblog, content community, social networking site, virtual world, discussion forum)
Comparator	• Other social media platforms • Information and communication technologies (e.g., email, websites) • No comparator

Outcomes	• Usability (e.g., perceived usefulness and ease of use) • Practice behaviour change (e.g. barriers, knowledge, skills, social/professional role and identity, optimism, beliefs about capabilities, beliefs about consequences, intentions, memory/attention /decision, environmental context and resources, social influences, and emotion)
Study Designs	Randomized controlled trials (RCTs), non-randomized comparative controlled trials (CCTs), observational studies, qualitative studies

Studies were excluded if they did not meet the selection criteria (Table 6). Duplicate publications, narrative reviews, case series, case reports, data presented in abstract form only, conference proceedings, study protocols, and publication not written in English were also excluded.

Search Strategy

The literature search was performed by an information specialist. Published literature was identified by searching the following bibliographic databases up to April 2016: Medline, Cochrane Central Register of Controlled Trials, Embase, CINAHL, ERIC, and PsycINFO. The search was performed using terms to identify peer-reviewed research in which social media and chronic disease self-management were important features (Appendix 4.1 Literature search strategy). Grey literature (literature that is not commercially published) was conducted by searching Google and other Internet search engines to identify for additional web-based publications. In addition, the searches were supplemented by hand searching the bibliographies of key papers. A date limit of 2004 onwards was placed to ensure the most relevant social media technologies were included.

Two reviewers independently screened the titles and abstracts of all citations retrieved from the literature search using Covidence (www.covidence.org), an online systematic review tool. Independent reviews of the full-text articles were then performed based on the selection criteria. Disagreements were resolved through discussion until consensus was reached. The study selection process is presented in a PRISMA flow diagram (Figure 2).

Descriptive data were extracted by one reviewer for each eligible article. The extraction was subsequently verified by a second reviewer. Data extraction forms were designed a priori to document and tabulate relevant study and patient characteristics, study findings, and author's conclusions. Data from figures were not used if they were not explicit. Studies were categorized by the type of social media intervention used as categorized by Hamm et al. (12) (Table 7).

Given the broad inclusion criteria and heterogeneity of the interventions and methodological characteristics of included studies (PICOS), a meta-analysis was deemed inappropriate, and a narrative synthesis and summary of study findings was therefore conducted. The outcomes of interest included the usability of social media platforms for chronic disease self-management and practice behaviour change among health professionals (Table 6).

Quality Appraisal of the Selected Literature

One reviewer independently assessed the quality of each study using the Scottish Intercollegiate Guidelines Network (SIGN 50) tool for cohort studies and RCTs (24), and the Critical Appraisal Skills Program (CASP) tool (25) for qualitative studies, which was subsequently checked for accuracy by a second reviewer. Disagreements were resolved through consensus. Risk of bias was assessed at the study level. Summary scores were not calculated, rather the strengths and limitations of each included study were described (Appendix 4.3).

Usability

The usability outcomes were guided by the Technology Acceptance Model (TAM2) (26) which illustrates that behaviour intention to use a system is determined by perceived usefulness and perceived ease of use. Perceived usefulness is defined by Venkatesh & Davis (2000) (26) as "the extent to which a person believes that using the system will enhance his/her job performance" (p. 187), and perceived ease of use is defined as "the extent to which a person believes that using the system will be free of effort" (p. 187).

Practice Behaviour

Practice behavior change outcomes were guided by The Theoretical Domains Framework (TDF) (27). The TDF identifies numerous behaviour constructs and consists of 12 domains: 1) knowledge, 2) skills, 3) social/ professional role and identity, 4) beliefs about capabilities, 5) beliefs about consequences, 6) motivation and goals, 7) memory, attention and decision processes, 8) environmental context and resources, 9) social influences, 10) emotion regulation, 11) behavioural regulation, and 12) nature of the behavior. Practice behavior outcomes were categorized by the domains listed above.

Results

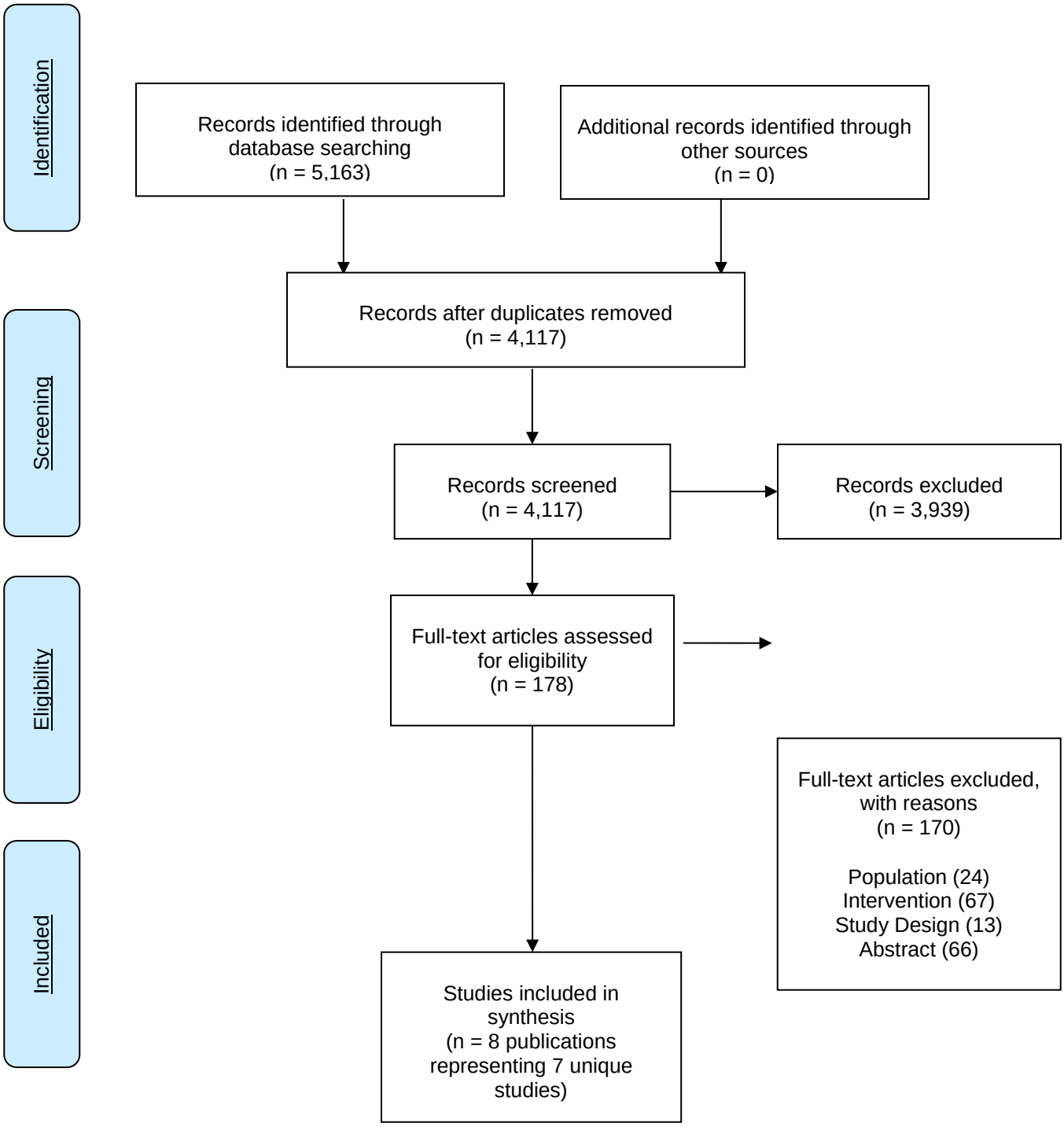
Included Studies

A total of 5,163 citations were identified through the initial database search. After removing duplicates, 4,117 publication abstracts and titles were screened. The full-texts of 178 articles were assessed, of these, 170 were excluded for the following reasons: irrelevant population (24 studies), irrelevant intervention (67 studies), inappropriate study design (13 studies), and presented as abstract only (66 studies). Two publications (28,29) present on findings from one unique study. The excluded studies are listed in Appendix 4.2.. The PRISMA flow diagram is shown in (Figure 2).

Of the 7 unique studies that were included in our systematic review, one was a RCT (30), two were prospective cohort studies (28,29,31), and four were qualitative studies (9,32–34). In regards to the types of social media platforms, six studies (9,30–34) assessed discussion forums while one study assessed a collaborative project (28,29). The included studies were conducted in Denmark (31), Finland (32), Canada (28,29) , United States (28–30), Australia (28,29), Republic of Korea (34), and Sweden (9,33). The following chronic conditions were assessed: asthma (28–31), chronic mental illness (32), diabetes (9,33), and gout (34). The following health professionals were represented in the included studies: nurses working in acute psychiatric wards (32), diabetes nurses (9,33), outpatient arthritis nurses (34); in-patient arthritis nurses (34); asthma nurse (30), pulmonologists (28–30), primary care physicians, (9,28–31,33,34), certified asthma educators (28,29) , and dieticians (9,33). Further details regarding the

included study characteristics can be found in Table 7.

Figure 2: PRISMA Flow diagram of included studies



Methodological Quality

The strengths and limitations of each included study are summarized in Appendix 4.3. The RCT by Wiecha et al. (30) addressed an appropriate and focused question and the assignment of subjects to intervention groups was randomized. However, there was no mention on how randomization was concealed. While a RCT design was used allowing patients and health professionals to be randomized to their respective interventions, comparative analyses were not conducted among the health professional sample. A self-reported survey was used to measure health care professionals' experience with the discussion forum. The authors indicated the use of validated tools to assess patient outcomes (population and outcomes outside the scope of this review), however, the reliability and validity of the survey used among the health professional sample is uncertain. Limited information regarding the health professional sample was provided. Blinding of study subjects was not relevant given the nature of the study design. The study was also limited to a single site.

Both prospective cohort studies (28,29,31) addressed appropriate and focused questions and indicated the number of subjects who were invited to participate. Outcomes were clearly defined in both studies and blinding was not feasible given the nature of the interventions. Gupta et al (28,29) used a validated tool (System Usability Scale), assessed participants at multiple time points while it was unclear whether the study by Anhoj et al. (31) used a validated measurement tool and assessments were only conducted at one time point. While, no effort was made to minimize confounding or risk of bias in Anhoj et al. (31), focus groups and development testing was used to identify barriers and analyses were stratified by type of health professional in Gupta et al (28,29).

There was a clear statement of the aim of the research in all four qualitative studies (9,32–34). The qualitative methodology was appropriate in 3 studies (9,32,33); however it was unclear whether the methodology used in the study by Oh et al. (34) was appropriate as it was based on a structured interview with only one open-ended question. While Nordqvist et al. (9) clearly described their reasoning why qualitative methods were used, the other study authors opted to use surveys rather than focus groups or open ended interviews to collect information (32–34). Only the study by Anttila et al (32) provided details

on how participants were recruited and whether ethical issues were taken into consideration. Data analyses appeared to be rigorous in three studies (32) (9,33), but were unclear in the study by Oh et al (34). All studies provided a clear statement of findings.

Social Media Interventions, Measures, and Results

Of the seven included studies, six used a discussion forum (9,30–34) while one used a collaborative project (28,29). All studies assessed health professionals' *perceived usefulness* (TAM2), four studies assessed *perceived ease of use* (corresponding to similar concepts used by TAM2) (28,29,32–34), four studies assessed *environmental context and resources* (TDF) (9,28,29,32,33), three studies assessed *intention to use* (TAM2) (28,29,33,34), and one study assessed *knowledge* (TDF) (28,29), *social influences* (TDF) (28,29), *beliefs about capabilities* (TDF) (28,29), *output quality* (TAM2) (33), *beliefs about consequences* (TDF) (9) *social/professional role* (TDF) (9), and *job relevance* (TAM2) (9). Further details on the reported baseline characteristics of included study participants (health professionals) can be found in Appendix 4.4. A summary of findings of the included studied can be found in Appendix 4.5.

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Table 7: Characteristics of included studies

Author, (year) country(ies)	Study design	Data collection	Chronic Disease	Participants (sample)	Social Media Intervention	Duration/ Follow-up
Anhøj J (2004), Denmark	Prospective Cohort	Online survey, mailed survey and interviews (location not specified)	Asthma	Health-care providers that according to the manufacturer's (AstraZeneca) customer database had received a user name and password for LinkMedica Survey: n= 131 Interview: n=5	Discussion Forum	1 month
Anttila M (2008), Finland	Qualitative	Online survey, Multi-centre	Chronic Mental Illness (Psychiatric Care)	Nurses working on nine acute wards in two psychiatric hospitals n=56	Discussion Forum	1 month (duration) 1-year follow-up post intervention
Gupta S (2011) and Gupta (2012), Canada, United States, Australia	Prospective Cohort	Online survey, Multi-centre	Asthma	Pulmonologists, primary care physicians, and certified asthma educators from academic and community clinics Development stage: n=16; Wiki stage: n=35	Collaborative Project	3 weeks
Nordfeldt S (2012), Sweden	Qualitative	Online survey/essay (setting/location not specified)	Diabetes	Members of 2 pediatric diabetes care teams, including physicians, nurses, dieticians, and a social welfare officer n=18	Discussion Forum	Not specified
Nordqvist C (2009), Sweden	Qualitative	Telephone interview, Single-centre (clinic)	Diabetes	Members of 2 diabetes teams, including seven physicians, eight nurse specialists in diabetes, one nurse, two dieticians, and two social welfare officers n=20	Discussion Forum	~1 year
Oh H (2011), Republic of South Korea	Qualitative	Face-to-face or telephone interview, or e-mail communication, Single centre	Gout	An expert panel consisting of four physicians, one outpatient nurse, and 20 inpatient nurses n=25	Discussion Forum	Not specified
Wiecha J (2015), United States	RCT	Survey, Multi-centre,	Asthma	Primary care providers from community health centers, a medical center, and other practices n=14	Discussion Forum	6 months

Discussion Forum

Anttila et al. (32) assessed nurses' (n=56) experiences of an online portal (Mieli.Net) developed for patients with schizophrenia spectrum psychosis. The portal is intended to support patient self-management skills in mental health services and includes processes to support knowledge, develop patient problem-solving skills, and improve self-efficacy. Specifically, the interactive internet-based portal, included patient-centered, tailored information using multimedia material (text, sound, figures, photos), a channel for peer support for patients (i.e., discussion forum, chat room, open Internet diary), and an eSupport tool for counseling and support between patients and nurses. While the study was designed to compare the portal intervention with standardized patient education using leaflets, only findings from the portal intervention were presented. Surveys were distributed to the nurses following one year of using the online portal. The questionnaires also included open-ended items that allowed them to describe their experiences in their own words. Qualitative data from the surveys indicated that nurses experienced the online portal as a broad information source and a "self-help" aid for patients, and felt that it was useful for patients when their mental state was healthy (*Perceived Usefulness*, TAM2). Additionally, they felt that the portal supported patients' self-management abilities as it enabled autonomous access to information and could be used independently, separate from educations sessions (*Perceived Usefulness*, TAM2). Nurses felt that the absence of ICT skills was an obstacle in patients' use of the portal and felt it was difficult to use themselves (*Perceived ease of use*, TAM2). Nurses also felt that that there were inadequate resources (e.g., lack of space or quiet room with available computer and internet connection) as it took too much time away from their basic work (*Environmental context and resources*, TDF). Another common theme from the surveys was nurses' hesitancy to use the portal with patients because of their lack of experience with it (*Intention to use*, TAM2)

Anhøj et al. (31) assessed physicians' and nurses' (n=136) use of the LinkMedica website, an asthma self-management tool which includes an electronic asthma diary for patients, a knowledge centre which includes over 100 articles about asthma and allergies, and an unmoderated discussion forum that allows users to engage in discussion and pose questions with experts. A mailed questionnaire was sent to 131 physicians and nurses. Surveys were evaluated five to seven months following the launch of the website.

Findings from the survey revealed that 73% of participants felt that there is a need for Internet tools like LinkMedica in medical practice (*Perceived Usefulness*, TAM2). Additionally, 22% did not use the tool, but wanted to try it (*Intention to use*, TAM2), and only 3% had looked at it, but did not find it useful (*Perceived Usefulness*, TAM2). Based on the results of the questionnaires, different types LinkMedica users (n=5) (i.e., level of familiarity with tool and experience as a general practitioner [GP]) were selected for semi-structured interviews. Findings from the interviews concluded that the GPs were not confident "PC" users and found it difficult to instruct patients in the system (*Beliefs about capabilities*, TDF). Though the GPs had a positive attitude towards the tool, they felt it was difficult to use (*Perceived Ease of Use*, TAM2). They also indicated that their use of the tool is influenced by external factors such as time and economy (*Environmental context and resources*, TDF).

Nordfeldt et al. (33) assessed the perceptions of physicians, nurses, dieticians, and a social welfare officer (n=18) in pediatric diabetes care teams of using an open-access interactive online portal (Diabit LIST) tailored to young diabetes type 1 patients and their guardians or significant others. In addition to providing access to general and local diabetes-related information, the online portal also provided peer-mediated information and dialogues through open-access forums and blogs. A local news feed, including staff presentations, was integrated in the portal and was managed by a member of each clinical diabetes team. Approximately 18 months following the launch of the portal, the health professionals were each asked to write an essay on their experience using the portal, focusing on both positive and negative user experiences. Each survey was then analyzed using qualitative content analysis. Overall, the survey respondents felt that the online portal functioned well, its design was easy to understand, and felt it was a manageable tool for seeking information (*Perceived Usefulness*, TAM2). Respondents also believed that the online portal was a source of scientifically sound information (*Output Quality*, TAM2), and the information was easily accessible to primary care and other hospital staff (*Perceived Ease of Use*, TAM2). They also felt comfortable recommending the online portal as the source of information came from a reputable source, produced by a multi professional community of practitioners (*Intention to Use*, TAM2). Some respondents identified barriers and difficulties with the online portal including lack of time and computer access, and inadequate computer experience (*Environmental context and resources*, TDF).

Nordqvist et al. (9) also assessed the Diabit List open-access interactive online portal among physicians, nurses, dieticians, and social welfare officers (n=20) from two pediatric diabetes teams. The objective of this study was to assess pediatric health professionals' attitudes towards the use of the online portal, and determine barriers and facilitators to introducing, such systems into clinical practice. The assessments took place approximately over a one-year duration (between the creation of the piloted prototype in 2005 to the launch in the spring of 2006). The investigators conducted semi-structured interviews and analyzed data using qualitative (phenomenological) methods. Overall findings from the interviews suggested that health professionals were confident that in addition to being part of the internal routine of the clinics, the online portal's use could extend beyond the clinics (*Beliefs about consequence*, TDF). Health professionals also felt that the portal was useful for providing families with newly updated diabetes information and provided a closer interaction between diabetes teams and families (*Perceived Usefulness*, TAM2). Several health professionals believed that the shared information provided on the online portal, including references to verified websites and assuming it is regularly updated, would be a great tool to support their practice with patients (*Job Relevance*, TAM2). Some of the interviewees shared their concerns regarding privacy, whether the current legislation permitted email contact with patients, and whether email communication would be safe (*Social/Professional role and identity*, TDF). Another barrier that was noted was the lack of time and determining how to incorporate the online tool into routine practice, while other health professionals expected the online portal to save time during consultations when providing general information to patients (*Environmental context and resources*, TDF).

Oh et al. (34) assessed an interactive website that consisted of a discussion forum for posting patients' gout-related experiences, as well as an expert section to introduce recent gout-related scientific information among an expert panel consisting of physicians, inpatient and outpatient nurses (n=25). The content of the gout-related information was based on a systematic review of the literature and the website was structured into the following sections: overview, causes, risk factors, symptoms, diagnosis, progress, treatments, and complications. The website was placed on a web server and was implemented to the expert panel. Following one week after its implementation, face-to-face or telephone interviews, or email communication were used to assess content access, satisfaction of the program contents, and ease of site navigation. When asked about the information content of the website, most experts (between 80%-

88%) felt that the causes, symptoms, diagnosis, treatments, and prognosis of gout sections were useful to understand gout, and 84% were satisfied with the self-management techniques (*Perceived Usefulness*, TAM2). The majority of experts indicated that the website was useful in understanding patients' gout-related experiences, however only 44% stated that the website was of interest to them (*Perceived Usefulness*, TAM2). Additionally, 60% of the experts suggested that further information on diet and gout progress/medications were needed (Perceived Usefulness, TAM2). Findings from the evaluation on ease of site navigation and content access indicated that experts were highly satisfied (*Perceived Ease of Use*, TAM2) and all respondents indicated a willingness to use the website frequently (*Intention to Use*, TAM2).

Wiecha et al (30) assessed an interactive website (BostonBreathes) for patients and primary care providers (physicians and nurses) to promote asthma self-management. The website allows primary care providers to participate in a private discussion forum with patients and/or asthma nurses, while also allowing for the review of patient-level data on symptoms, medication usages, emergency room visits and patient graphical data of peak flow. Children with persistent-level asthma and their primary care providers were randomized to either usual care (n=21) or monitoring and self-management using the interactive website (n=37). Some of the primary care providers in the intervention arm (n=14) completed a survey on their experience with the website during the six-month study period. The primary care providers used a separate interface to monitor their patients' website use and were able to communicate online via the discussion board with patients. Findings from the primary care provider survey using a Likert scale (0=strongly disagree to 10 = strongly agree) indicated a neutral response in that the discussion board was an effective way to communicate with patients (mean score of 5.6) and marginally agreed that the website provided useful information about their patients that they would not have had otherwise (mean score of 6.5) (*Perceived Usefulness*, TAM2). Overall, there was an agreement that the website was easy to use (mean score of 6.9) (*Perceived Ease of Use*, TAM2), and agreement that they would recommend the website for their asthmatic patients (mean score of 6.2) (*Intention to Use*, TAM2). There was overall disagreement that the primary care providers had enough time in their schedules to use the website (mean score of 4.6) (*Environmental context and resources*, TDF).

Collaborative Project

Gupta et al. (28,29) used a Wiki-based system to develop an asthma action plan (AAP) by multiple stakeholders including pulmonologists and primary care physicians, asthma educators, and patients (n=51). The intervention was described by the authors as "a system that allows multiple users to collaboratively design an AAP by inputting preferences for the content and format (visual layout and design) of the AAP plan through a Web-based wiki-inspired platform" (p.2)(29). The AAP underwent a development phase (n=16) where the investigators established the AAP content, tested the tool among stakeholders, and revised the tool based on stakeholder feedback. The tool then underwent three separate one-week "wiki" periods where the content was collaboratively compiled by stakeholders (n=35). The visual design features of the AAP were then optimized, and underwent face validity testing in three one-hour focus groups consisting of two pulmonologists, two asthma educators, two patients and two primary care physicians who were not involved in the development process. During the Wiki stage, the mean System Usability Scale score (range from 0 to 100, with higher scores representing greater usability) improved to 75.9 (SD 19.6) compared to 72.2 (SD 10.2) in the development stage. Pooled results from 35 participants (including 19 patients) indicated that 80% were satisfied with the overall AAP that was created, and 77% felt that the wiki tool was an effective way to design an asthma action plan (*Perceived usefulness*, TAM2). The majority (91%) of respondents indicated they would be able to use the Wiki tool and AAP that was created (*Perceived ease of use*, TAM2). Almost half (49%) of respondents indicated if their schedules permitted, they would have used the site more often (*Environmental context and resources*, TDF). Most respondents (86%) indicated they would be willing to use a wiki tool to design visual media in the future (*Intention to use*, TAM2). Most respondents (67%) felt that the chat room feature allowed them to understand the preferences of other participants (*Knowledge*, TDF). The Wiki tool did not appear to be impacted by social influences as only 26% of respondents indicated that were certain participants whose opinions were more influential than others (*Social/professional role and identity*, TDF), and only 37% felt that they were able to make more changes and suggestions through the web-based process than they would have been able to in a face-to face group discussion (*Beliefs about capabilities*, TDF). See Appendix 5 for further details on findings from Gupta et al. (28,29).

Discussion

This review contributes to the growing literature on social media used by health professionals. To our knowledge, there has been no other synthesis of evidence pertaining to the use of social media by health professionals to facilitate chronic disease self-management with their patients. In summary, the available evidence suggests that health professionals perceived discussion forums to be a useful social media platform in the majority of included studies (9,31–34), while the one study that used a collaborative project (Wiki) (28,29) also indicated that it was a useful to facilitate chronic disease self-management in patients.

Research has revealed that social media can be used among health professionals as a useful and dynamic tool to access up-to-date information, maintain professional connections (18,35), and to share knowledge and health promotion (18,36). Additionally, social media have shown to enable professional networking, community outreach, and building social capital (37).

The collaborative project in Gupta et al. (28,29) had positive findings in regards to its perceived ease of use. Mixed findings were seen in regards to health professionals' perceived ease of use as three studies demonstrated positive findings (30,33,34), while two studies noted difficulties with using the discussion forum interventions (31,32). The interventions in Anttila et al. (32) and Anhoj et al. (31) included multiple components in addition to the discussion forums such as online patient diaries, e-support tools, and chat rooms, thus it remains unseen whether the complexity of these interventions led to health professionals' perceived difficulties. Similarly, there appeared to be an observed pattern between health professionals' perceived ease of use and their intention to use the discussion forum interventions as the studies by Anttila et al. (32) and Anhoj et al. (31) also noted that most respondents were hesitant to use the tool.

Nordqux ist et al. (9) demonstrated that health professionals anticipated positive outcomes (beliefs about consequences) for using discussion forums, indicating that its use could extend beyond internal use in clinics. Health professionals felt that discussion forums were a great tool to support their practice (9).

Findings from Gupta et al. (28,29) indicate that there remains uncertainty of the benefits of using a web-based process versus face-to-face group discussion. Other research comparing social media-based

outreach dissemination of clinical practice guidelines to traditional methods concluded no difference in awareness and knowledge of the guideline recommendations (38). Conversely, in comparison to traditional face-to-face methods, online chronic disease self-management interventions have the potential to reach a broader population of chronic disease patients (10), while online communities may allow for improved social support (10,11).

The included studies noted several barriers to using social media to facilitate chronic disease self-management with their patients. The most common barrier identified was the lack of time in their schedules to use these tools (9,28–30,32,33). Online ICTs, such as social media, can enhance self-management support, providing a potential demand-reducing and time-saving opportunity for health professionals (3,7,10). For example, encouraging patients to use social media platforms to access educational material and to engage in discussion with other patients may provide health professionals with an additional option to improve self-management support, while potentially allocating less time for patient education and behaviour change counselling during consultations (39).

Previous research has shown that although perceived barriers to using social media are high, health professionals still frequently use them (34). While the findings of this review suggest that health professionals believe they do not have enough time to engage in social media interventions, research has shown that disseminating evidence and educational programs through social media may in fact be a time-saving and a potential demand-reducing option for patient care (3,7,10).

Another barrier noted in the included studies was lack of space or computer access within the work place. (32,33). The need for access to internet and online technologies is necessary as clinics and hospital settings continue to evolve, and technology can enable health professional and patient shared decision making (3).

Health professionals also noted a lack of computer skills and unfamiliarity using these types of interventions resulting in hesitancy to use the instructing patients to use these types of interventions (31). The promotion of using and incorporating social media in chronic disease care requires adequate training. Research has indicated that most health professionals have basic knowledge of how to use some social

media platforms such as social networking sites, yet there remains uncertainty for other types of social media use as evidence is lacking (18).

As seen in the study by Nordqvist et al.(9), another concern that health professionals and workplaces should consider are policies on patient privacy. Concerns over confidentiality and privacy when using social are a common concern among health professionals (39). With the evolution of professional interactions and communications, there is a need to establish and inform health professionals about guidelines of social media use in the workplace (18,40). Guidelines would provide direction on how to use social media while maintaining professionalism (40). Some work settings and environments may have a negative perception of using social media as it may be seen as inappropriate and unprofessional because of the risk of mixing personal and professionals limits and the potential for confidentiality breaches (37). It is important to note that not all clinical settings and practices may support the use of social media in the work setting. For example, a policy statement by the American College of Physicians, has recommended that health professionals not contact patients through social networking sites (i.e., Facebook) and to use high privacy settings (41).

To our knowledge, no other systematic reviews have been conducted on health professionals' use of social media in chronic disease self-management. Hamm et al. conducted a scoping review of the literature on social media use by health care professionals and trainees (12). Similar to the present review, the most common social media platform used in general by health professionals was discussion forums. The objectives of most social media platforms were to facilitate communication (61.5% of studies) or improve knowledge (42.7% of studies) of health professionals. The scoping review concluded that social media use among health professionals is common, particularly in education settings and the versatility of these tools suggest that that may be appropriate for use in a wide variety of professional activities (12). While the scoping review did not evaluate the effectiveness of the social media platforms, it was suggested that further research on their effectiveness could inform future practice. The decision to include discussion forums as an additional social media category of interest in this systematic review was decided a priori, and is in agreement with the review by Hamm et al. (12). While discussion forums do not fall within one of the social media categories identified by Kaplan and Haenlein (13), Hamm et al. (12)

indicated that because discussion forums incorporate user-generated online content, should be considered precursors to modern social media platforms.

A recent systematic review of the literature was conducted on health professionals' perceived usability and practice behaviour change of ICTs for the dissemination of clinical practice guidelines (42). While the review looked at comparative evidence of various ICTs such as websites, web-based workshops, email, computer software; however no research was found on social media use. The review concluded that health professionals' perceived usability and practice behaviour change varied by type of ICT. Websites, computer software, and web-based workshops all demonstrated improvements in perceived usefulness (42). Smailhodzic et al. (15) conducted a systematic review on empirical research regarding the effects of social media use by patients for health related reasons. While the review focused on patients' rather than health professionals' use of social media, the authors concluded that social media use by patients were found to affect the health professional and patient relationship by stimulating more equal communication between them, and that social media can lead to greater confidence in their relationships with health professionals.

The selection of outcomes for this review were guided by the TDF (27) and TAM2 (26). The TDF was chosen as it integrates and clarifies several behaviour change theories including learning theory, diffusion theory and social cognitive theory (27). The TAM2, a validated and robust theoretical framework, was chosen as it was originally designed to predict the acceptance and usage of ICTs, such as social media, among various users and settings (43). The TAM2 also considers social influence processes which have shown to explain the perceived usefulness of technologies (44). The TDF was developed from a synthesis of psychological theories, and has shown to be useful for assessing barriers and behaviour change among health professionals from various clinical disciplines and settings (45). Together, both theoretical frameworks provided a comprehensive list of outcomes to measure health professionals' usability and practice behaviour change for the use of social media to facilitate chronic disease self-management with their patients.

The strengths of this systematic review include the broad eligibility criteria that were used, allowing for numerous types of social media platforms, various health professional populations, and study designs

(including qualitative) to be considered for inclusion in this systematic review. Furthermore, a systematic approach was used to select the relevant articles in the literature and to assess the methodological quality of each included study. This systematic review was conducted following the PRISMA checklist (23).

There are several limitations of this review that should be considered. Information published in languages other than English were not included; thus, it is possible that some relevant findings may have been excluded. Given the paucity of included studies with quantitative study designs and heterogeneous populations, interventions, and outcomes, meta-analyses were not feasible. Interpretation of study findings is limited by the methodological concerns noted in the Methodological Quality section. Other key methodological limitations include small sample sizes (n<100) in most studies, the lack of subgroup analyses to compare differences between types of health professionals (e.g., physicians versus social welfare officers), the pooling of patients with health professionals in the analyses (28,29), and potential industry funding bias (31). The assessment of health professionals was not always the population of interest, but rather a subgroup that was considered (30). It remains unclear whether social media platforms are appropriate self-management resources for all chronic conditions as only a select few were assessed in this review. The terminology of outcomes in the included studies sometimes differed from the identified concepts in the TAM2 and domains of the TDF that were used to define the usability and practice behaviour change outcomes, respectively. None of the included studies were designed to perform direct comparisons between different social media platforms. Overall, there was a paucity of evidence for the use of collaborative projects, and no evidence for other social media platforms met the selection criteria for this review. Lastly, it remains uncertain whether study findings are generalizable as clinical practice may vary by geographic region.

The potential implications of this review are twofold. Firstly, this research provides a summary of the current evidence pertaining to health professionals' perception of social media use to assist patients self-manage their chronic conditions, while identifying common barriers and knowledge gaps for future research. Knowledge gaps include the lack of evidence regarding other social media platforms not captured in this review, and the absence of studies comparing social media platforms with each other.

Future research of well-conducted and properly designed studies is therefore needed. Secondly, the findings of this review suggest that discussion forums and collaborative projects may supplement traditional care as additional resource for sharing evidence-based self-management information and facilitating communication with patients.

Conclusion

The findings of this systematic review suggest that health professionals perceived discussion forums and collaborative projects appear to be useful social media platforms to facilitate chronic disease self-management with patients. No evidence was found regarding the use of other social media platforms. Most studies suggested positive findings regarding health professionals' intention to use discussion forums. Mixed findings were seen in regards to health professionals' perceived ease of use of discussion forums. The most common barrier to using social media platforms was the lack of time in health professionals' schedules. Other notable barriers included lack of space or computer access within the work place, and computer competency. Paucity of evidence and lack of high quality studies limited the interpretation of evidence. In summary, discussion forums and collaborative projects appear to be promising resources for health professionals to assist their patients to self-manage their chronic conditions; however further research comparing various social media platforms is needed.

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Chapter 5: Advisory Committee and Feasibility Study

Chapter 3 and 4 provided the methodology and findings of two systematic reviews which identified the current literature on ICTs as a guideline dissemination strategy for health professionals, and the perceived usability of social media by health professionals to facilitate chronic disease self-management with their patients. Both reviews highlighted current knowledge gaps in the literature and provided a rationale for further research for innovative strategies to disseminate CPGs and evidence-based educational material. Specifically, the current literature indicated that a high quality study was needed to further determine whether social media could be perceived as a useful and easy to use dissemination strategy by arthritis health professionals to share an evidence-based self-management program with their patients.

This chapter presents a manuscript on an advisory committee (Milestone 2) and a feasibility study (Milestone 4). The objective of the study was to determine the feasibility of using Facebook as a dissemination strategy for the PGrip program by arthritis health professionals to patients. The PGrip Facebook group page can be found at www.facebook.com/pgriponline. The published version of this manuscript can be found in Appendix 1.3 Publication #3.

The use of social media by arthritis health professionals to disseminate a self-management program to patients: A feasibility study

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Abstract

Objective: The objective of this study was to determine the feasibility of Facebook as a dissemination strategy for the People Getting a Grip on Arthritis self-management program by arthritis health professionals to their patients.

Methods: The feasibility study comprised a single arm, pre-post design that included a convenience sample of 78 arthritis health professionals across Canada. Assessments were performed at baseline, two weeks post-intervention, and at three months follow-up using online questionnaires. The primary outcome measure was change in perceived usability of Facebook as a dissemination strategy for the People Getting a Grip on Arthritis program with patients at two weeks post-intervention using an instrument based on the Technology Acceptance Model 2 questionnaire. Comparisons with baseline were assessed using t-test analyses.

Results: Statistically significant improvements from baseline were seen for all items of the Technology Acceptance Model 2 domains: *perceived ease of use* (4 items), *intention to use* (2 items) and *output quality* (2 items) domains. Variable results were seen for the *job relevance*, *perceived usefulness*, *voluntariness* domain, *result demonstrability*. There were no statistically significant improvements for the *subjective norm* and *image* domains.

Conclusions: Facebook may provide arthritis health professionals with an additional option of how to

best share evidence-based information to allow their patients to successfully self-manage their arthritis.

Introduction

With an increasing aging Canadian population with chronic diseases such as arthritis (1), there is an urgent need for health professionals to promote evidence-based arthritis self-management support to their patients.

As we continue to move towards a paradigm of patient and health professional partnerships for the collaborative care of chronic diseases involving self-management support, health professionals are complementing traditional patient education by providing patients with technical skills and information to identify problems, allowing them to make appropriate decisions, and take action to manage their conditions (2). Self-management support can involve a variety of techniques including the creation of small actions plans and goal setting, providing personalized feedback, enlisting social support, and determining goal achievement (3).

While the effective self-management of chronic diseases among patients continues to be essential in optimizing health outcomes, and with a need to empower patients, there is uncertainty on how health professionals can enhance self-management support among their patients (4).Presently, the majority of time spent by health professionals caring for patients with chronic disease is taken up by patient education and behaviour change counseling, creating a burden on primary care providers (2). Furthermore, ensuring that patients are willing and able to understand instructions can be challenging for health professionals (5). Increasing the use and discovering new methods of providing successful self-management support may facilitate patient education and help reduce the demand for more human health resources to care for chronic diseases.

Web 2.0 refers to the next generation of the internet allowing individuals to share information and collaborate online (6)while eHealth is defined by Health Canada as “the application of information and communication technologies within the health sector”(7). Online technologies such as eHealth interventions and Web 2.0 technologies can enhance self-management support as it provides a time-

saving and a potential demand-reducing option for health professionals (2), (8), (9), and have increasingly become more popular among chronic disease patients to access health information (8). Online chronic disease self-management interventions have shown to reach a broad population of chronically ill patients (9), and online communities have allowed for improved social support and knowledge acquisition (9,10). A systematic review by Stellefson et al. (8) concluded that older adults with chronic disease may be associated with improvements in health behaviors and health status when using Web 2.0 self-management interventions. The increasing popularity of social media and social networking applications offers health professionals with a communication tool to share health education information with patients, including self-management programs. Positive uses of social media among health professionals include disseminating accurate information to enhance education, countering inaccuracies and engaging learners (11). With its capabilities to allow for multimedia-sharing such as disease management videos, podcasts, and wikis, social media has shown to be successful in public health promotion and advocacy (12), disseminating evidence-based health information (13), responding to public concerns during outbreaks (14), and as an effective medical teaching tool (15).

Different types of social media include collaborative projects, blogs, content communities, and social networking sites (16). Facebook, one of the most popular social networking sites with more than a billion active users (17), allows for the sharing of opinions and information through pictures, texts, and links (18), allowing for new forms of interaction between health professionals and their patients (19). While current research has been undertaken to measure the effectiveness of Web 2.0 and online interventions for the self-management of chronic disease among patients (9,10), there is limited research on how health professionals, specifically working in arthritis care, perceive the usability of Facebook to disseminate self-management programs to their patients. A recent scoping review of the literature on social media use by health professionals and trainees (20) included 96 studies of which, only 16 (17%) included a social networking site. The most common medical specialties as categorized by the authors were administration, critical appraisal and research (11/96, 11.5%), public health (9/96, 9.4%), and mental health (6/94, 6.3%). The most common outcomes measured in the included studies were clinician's peer-to-peer communication (43/96, 44.8%), satisfaction (36/96, 37.5%), and conditions and complications (22/96, 22.8%). Only two of 16 studies (12.5%) that used a social networking site intervention measured usability.

Given that only five of the 96 studies (5.2%) were randomized controlled trials (RCTs), with only 16 studies (16.7%) including a social networking site intervention, 3 studies (3.1%) and 2 studies (2.1%) consisting of allied health professionals and nurses in a practice setting respectively, there is a need for further research to measure the perceived usability of Facebook as a dissemination strategy among arthritis health professionals. This feasibility study was designed to address this knowledge gap and further explore Facebook as an innovative dissemination strategy for self-management programs.

Objectives

The objective of this study was to determine the feasibility of using Facebook as a dissemination strategy for the People Getting a Grip on Arthritis (PGrip) program by arthritis health professionals to patients. We refer to arthritis health professionals as individuals who are involved with the care of people with rheumatic disease. The hypothesis of the proposed feasibility study was that arthritis health professionals would demonstrate improvements in the perceived usability of Facebook to share information from the PGrip program with patients after two weeks and three months. In addition, we hypothesized that the Facebook intervention could improve practice behaviour change among arthritis health professionals as a strategy to disseminate PGrip after two weeks and three months.

Methods

Arthritis Self-Management Program

PGrip (21) is a bilingual (English/French) , educational, evidence-based online self-management program for patients with osteoarthritis (OA) and rheumatoid arthritis (RA). The PGrip program is based on results of comparative controlled trials which investigated the efficacy of various self-management interventions for people living with arthritis and the findings were synthesized and graded by the Ottawa Panel (22–27). Through knowledge synthesis, systematic reviews were performed and rigorous methods were used to develop the Ottawa Panel clinical practice guidelines (CPGs) for the self-management of arthritis. The self-management interventions presented in PGrip were those that achieved positive recommendations (Grades A, B and C+) in the Ottawa Panel CPGs (22–27). The Ottawa Panel CPGs for OA and RA are

recognized as high quality CPGs according to several systematic reviews using the Appraisal of Guidelines Research and Evaluation (AGREE I & II)(28) criteria (29–33). Knowledge from the Ottawa Panel CPGs have been translated into lay terms and tailored into a set of didactic videos for the PGrip program. The Ottawa Panel self-management interventions for OA included: ice massage, hand exercises, aquatic therapy exercises, weight management, and a stationary bicycling program. The RA self-management interventions included: insoles and footwear, yoga, tai chi, aquatic jogging, wrist orthotics, and transcutaneous electrical nerve stimulation. For each self-management intervention identified in the Ottawa Panel CPGs, two video presentations were created: 1) a narrated PowerPoint presentation of simplified instructions on how to perform/apply the self-management intervention with case scenarios illustrating the appropriateness and relevance of each; and 2) practical sessions with an arthritis health professional providing step by step instructions while performing/applying the self-management intervention with a patient.

For the current study, a PGrip Facebook group page was created and videos of the presentations and practical sessions for various PGrip self-management interventions were posted on the page. Additionally, instructions on how to access the videos and how to post comments or questions were also provided on the page.

Advisory Committee

To engage potential knowledge users in the research process, an advisory committee consisting of six arthritis health professional users (two registered nurses, two physiotherapists, and two occupational therapists) was convened to identify barriers of using and accessing Facebook as a dissemination strategy for the PGrip program and to identify how the PGrip Facebook group page can be tailored to improve usability among arthritis health professionals.

To be eligible to participate, advisory committee members must have been: 1) trained as a nurse, or physical/occupational therapist; 2) registered with their provincial professional regulatory body; 3) currently practicing clinically which was defined as spending a minimum of 50% of their time (work week) in direct arthritis patient care 4) had internet access, 5) able to communicate in English. Additionally, to

ensure that measured barriers were solely reflective of the Facebook intervention, and not the content of the PGrip program, advisory committee members were previous PGrip users who were familiar with the content of the program. The advisory committee members were recruited from local hospitals (The Ottawa Hospital and Children's Hospital of Eastern Ontario) and The Arthritis Society (Ottawa branch) by poster, e-mail or social media sites of their respective institutions. The advisory committee met on three separate occasions that were facilitated by the principal investigator (GD).

The purpose of the first meeting, which took place three months prior to commencing the feasibility study, was to obtain detailed feedback regarding various barriers to engaging in a Facebook group page to disseminate educational material (such as the PGrip program) to patients and to provide recommendations of how the Facebook group page could be tailored to improve usability. Advisory committee members were provided with instructions on how to access the Facebook group page prior to the first meeting. The advisory committee was asked to provide feedback on the usability of the Facebook intervention using the Technology Acceptance Model (TAM2) questionnaire (34). A discussion to obtain feedback on barriers took place with an interview guide based on the Theoretical Domains Framework (TDF)(35). The discussion was digitally recorded and field notes were taken by a non-participant observer. Following the first meeting, results from the usability questionnaire were analyzed descriptively. Discussion responses were analyzed and coded following the constructs of the TDF (Appendix 2.2 Definitions of TDF Domains). Results were analyzed by two assessors and differences were resolved by consensus.

The purpose of the second meeting, one month before the commencement of the feasibility study, was to provide an opportunity for the advisory committee members to comment and provide insight on the design and methodology of the feasibility study. Specifically, advisory committee members discussed the findings from the first meeting and how the Facebook group page could be tailored to address the identified barriers and facilitators discussed. Based on results from the usability questionnaire in the first meeting, the Facebook group page was to be deemed "usable" if the majority of participants (at least 4 of the 6 respondents) achieved a total score of 120 points or greater out of a possible 168 points. The threshold of 120 points was calculated by multiplying a minimum mean score of 5 (*somewhat agree*) out

of a possible 7 points for each of the 24 questions (Appendix 5.1). In the event that the Facebook intervention was not found to be “usable”, the advisory committee would have reconvened at a later date following the second meeting to complete the usability questionnaire once again after the Facebook intervention had been tailored. This process was to be followed until the committee came to a consensus that the Facebook intervention was deemed to be “usable” and ready for the feasibility study.

The purpose of the third and final meeting, one month after the completion of the feasibility study, was to allow the advisory committee members an opportunity to contribute to the interpretation of findings, and brainstorm ideas on how the feasibility study results could be disseminated. They were also asked to provide guidance on the methodology for a future RCT.

Feasibility Study

A single arm, pre-post design was used for the feasibility study. Arthritis health professionals were recruited and provided with instructions on how to access the Facebook group page.

Participants

A convenience sample of 78 arthritis health professionals were recruited across Canada by online advertisements using e-mail or online newsletters from the following organizations: Arthritis Health Professions Association, The Arthritis Society, Canadian Physiotherapy Association, Vancouver Coastal Health, St. Elizabeth Health Care, Ontario Physiotherapy Association, and Montfort Hospital. New PGrip users and those already familiar with the PGrip program were invited to participate. In order to be eligible for the feasibility study, participants must have been: 1) trained as a nurse, or physical/occupational therapist; 2) registered with their provincial professional regulatory body; 3) currently practicing clinically which was defined as spending a minimum of 50% of their time (work week) in direct arthritis patient care 4) had internet access, 5) communicate in English, and 6) not have participated in the advisory committee. Individuals not meeting all inclusion criteria were excluded and were not deemed eligible for the study. Prior to being enrolled in the study, participants were assessed for eligibility through the use of an online admission questionnaire. Participants registered to the study by e-mail and completed an

electronic consent form approved by the University of Ottawa Research Ethics Board (H11-12-10).

Measures

Participants completed three assessments using the Fluid Survey online platform (36). The survey links were sent to participants by email. The first assessment included baseline measurements prior to participating in the Facebook group page. The second assessment was performed immediately after posting the material on the Facebook group page (two weeks after baseline). The third and final assessment was at three months post-intervention.

The primary outcome measure was change in perceived usability of Facebook as a dissemination strategy for the PGrip program with patients at 2-weeks post-intervention, measured using an instrument based on the TAM2 questionnaire, a validated tool showing internal consistency reliability and construct validity (34). Change in perceived usability at 3-months post-intervention was also assessed. The TAM2 is a 26-item questionnaire consisting of 9 domains: *intention to use* (2 items), *perceived usefulness* (4 items), *perceived ease of use* (4 items), *subjective norm* (2 items), *voluntariness* (3 items), *image* (3 items), *job relevance* (2 items), *output quality* (2 items), and *result demonstrability* (4 items). The TAM2 questionnaire is measured on a 7-point Likert scale (1 = *strongly disagree* to 7 *strongly agree*). Given that Facebook may not be accessible due to firewalls in the workplace for all study participants, 2 items from the *image* domain were removed. Thus a tailored 24-item TAM2 questionnaire was used (Appendix 5.1). Definitions for each domain of the TAM2 questionnaire can be found in Appendix 2.1 Definitions of TAM2 Domains.

Other outcomes included: 1) change in perceptions of barriers to using Facebook as a dissemination strategy for the PGrip program with patients at two weeks post-intervention and three months follow-up; 2) practice behaviour change in using Facebook as a dissemination strategy for the PGrip with patients at two weeks post-intervention and three months follow-up; and 3) changes in Facebook use and impact measures at two weeks post-intervention and three months follow-up

To measure change in perceptions of barriers, participants were asked to list 3 barriers to engaging in the Facebook group page. Each response was coded following the constructs of the TDF and was analyzed descriptively.

Practice behaviour change was measured using an instrument based on the TDF questionnaire (35). The TDF questionnaire is a validated tool that has shown high internal consistency reliability and discriminant validity (35). As identified by Huijg (2014), the TDF questionnaire is generic and can be used to measure TDF- based determinants of healthcare professionals' specific implementation behaviors. The TDF questionnaire is a 32-item tool that allows for application within a range of different contexts in which implementation research takes place. Each domain contains a different amount of items: *knowledge* (4 items), *skills* (3 items), *social/professional role and identity* domain (4 items), *optimism* (2 items), *beliefs about capabilities* (3 items), *beliefs about consequences* (2 items), *intentions* (4 items), *memory/attention /decision* (4 items), *environmental context and resources* (2 items), *social influences* (2 items), and *emotion* (2 items). The TDF questionnaire is scored by a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree) for most domains, though not all 32 items use the same 5-point Likert scale. For example, one item asks "how many in the next 10 patients do you intend to use Facebook to implement PGrip with patients?". Options for this question consisted of a 5-point Likert scale ranging from 0 patients to > 4 patients. Another question asked "How strong is your intention to use Facebook to implement (share/discuss) PGrip with patients?" Options for this question consisted of a 5-point Likert scale ranging from 5 = very strong to 1 = very weak. Four items (one from the *skills* domain, one from the *beliefs about capabilities* domain, and two from the *emotions* domain) were removed, as they were not deemed to be appropriate for the nature of the Facebook intervention in the health professional workplace. As a result, the *emotion* domain was not evaluated. Thus, a tailored 28-item TDF questionnaire was used (Appendix 5.2 Tailored TDF Questionnaire). Definitions for each domain of the TDF questionnaire can be found in Appendix 2.2 Definitions of TDF Domains.

Facebook impact measures were assessed by asking participants to rank the number of times they used the following Facebook tools using a 5-point Likert scale ranging from 1 (>8 times) to 5 (0 times): 1) posted a comment on the "Wall" of the Facebook page, 2) posted a comment on a video on the Facebook

page, 3) Used the “Like” feature on a comment and/or video on the Facebook page, and 4) shared a link to a video or other website on the Facebook page.

Statistical analyses

Data analyses were performed using SPSS v. 22. Descriptive statistics such as proportions, means and standard deviation were used to summarize baseline characteristics. For the primary outcome of usability, a paired t-test was conducted to compare changes from baseline scores to 2-weeks post-intervention for each item of the TAM2 questionnaire. Additional t-test analyses were conducted comparing baseline scores to the 3-month follow up period. For the secondary outcome of TDF domain item scores, the same analysis strategy was considered. Descriptive statistics were used to summarize the perceived barriers and Facebook impact measures. For the analyses of the TAM2 and TDF scores, missing values were imputed using the last observation carried forward approach. Additionally, complete case analyses were performed for each.

Results

Advisory Committee

During first advisory committee meeting, several common barriers and facilitators to using Facebook as a dissemination strategy were discussed. The advisory committee felt that the internet is an easier method for accessing clinical practice guidelines and evidence based material using printed articles and materials. Ultimately, committee members would not have initially thought to use Facebook as a dissemination strategy, but if they were aware that the information was there, they would refer it to their patients. Generally, the committee members were not familiar with Facebook however after using the group page, it was deemed more straightforward than what was previously believed. Several barriers to using the Facebook group page with patients were brought forward including privacy concerns using social media platforms. While there was a consensus and hesitancy for both clinicians and patients to use personal accounts to interact and post comments, this concern was mitigated after it was identified that personal accounts were not needed to access the content of the group page. Access to the internet,

computer, and mobile devices, and having general computer skills were other potential barriers identified. Committee members felt that Facebook was useful for patients in clinical settings (i.e. patients in the waiting room can scroll through the page). They also felt that it was appropriate and liked the idea of providing patients with a web link, as oppose to a pamphlet. In order to tailor and improve the PGrip Facebook group page for the feasibility study, advisory committee member provided feedback, such as minor glitches in some of the videos, and suggestions on page accessibility (e.g. instructions on navigating the site, and improved ordering of videos) were provided. These comments were addressed prior to commencing the feasibility study. Results from the TAM2 questionnaire revealed that all advisory committee members believed that the Facebook group page was “usable” as all demonstrated a total score greater than 120 points. Total scores ranged from 121 to 139 points out of a possible 168 points.

During the second advisory committee meeting, members brainstormed and discussed the methodology for the proposed feasibility study. In addition to Facebook being a dissemination strategy for arthritis health professionals to use with patients, the original scope of the proposed feasibility study was to also examine the use of Facebook as a tool for health professionals to access evidence-based information, such as the PGrip program, to improve their own knowledge. The committee members came to a consensus and decided that the usability questionnaire (TAM2) should only focus on Facebook as a dissemination tool for health professionals with patients. The committee felt that questions pertaining to the use of Facebook as an information source for health professionals could be omitted. While the committee was enthusiastic about Facebook as a dissemination tool that health professionals can use with their patients, they did not believe that Facebook would be as useful as an information source for health professionals. The main reasoning for this was that according to one of the inclusion criterion "spending a minimum 50% of the time in direct patient care", health professionals should already have the knowledge of the material presented in PGrip. This important feedback was considered and implemented in the feasibility study.

During the third advisory committee meeting, results from the feasibility (discussed below), were presented. The committee also provided ideas for disseminating the results of this study which included publishing the findings in a peer-reviewed journal and providing an electronic information brief to patient

organization groups who could then include them in their newsletters, websites, or social media pages. The committee also brainstormed ideas for a future full-scale RCT that would compare the Facebook group page with other information and communication technologies such as websites, YouTube channels, or device applications (“apps”).

Feasibility Study

A summary of baseline demographic information can be found in Table 8. A total of 78 arthritis health professionals, comprising 14 (17.9%) occupational therapists, 53 (67.9%) physiotherapists, and 11 (14.1%) registered nurses participated in the study. The mean age of participants was 40.0 years and the majority resided in Ontario (65.4%) and were female (93.4%). While the majority had a Facebook account (93.6%), only 39.7% had access to Facebook at the workplace, though 89.7% stated they would use Facebook outside work hours. In regards to work setting, 54.1% worked in group practice, seeing on average approximately 9 patients per day. Most (29.5%) worked in a hospital, 23.0% worked in private practice, 16.4% in a community health centre, 9.8% in a rehabilitation facility, and 21.3% in other settings (e.g. home or outpatient). Most had greater than 20 years of clinical experience (31.1%) and were not familiar with the PGrip program (88.5%). All 78 participants completed the baseline questionnaire, 76 (97.4%) completed the second questionnaire at 2-weeks post interventions and 75 (96.2%) completed the final questionnaire at 3-months post interventions.

Table 8: Baseline Characteristics and Facebook Use (n=78)

	N	%
Province of Residence		
Ontario	51	65.4
Quebec	6	7.7
British Columbia	17	21.8
Other	4	5.1
Profession		
OT	14	17.9
PT	53	67.9
RN	11	14.1
Age[a]		
Mean (SD)*	40.0 (10.3)	
Sex[a]		
Male	4	6.6
Female	57	93.4
Practice Location[a]		
Urban	37	60.7
Rural	11	18.0
Suburban	13	21.3
In which of the following settings do you usually work?[a]		
Private practice	14	23.0
Hospital	18	29.5
Rehabilitation facility	6	9.8
Community health centre	10	16.4
Other (home, outpatient, community care)	13	21.3
What is your primary employment role?[a]		
Clinician	57	93.4
Other	4	5.1
On average, how many clients do you see per day?[a]		
Mean (SD)	8.64 (4.68)	
In regards to your work setting, do you work in [a]		
Solo practice	28	45.9
Group practice	33	54.1
Group practice role:		
Primary therapist	23	37.7
Educator	3	4.9
Multidisciplinary	2	3.3
Interdisciplinary	2	3.3
Manager/Chair of team	1	1.6
Did not state	2	3.3
Level of education (as practitioner degree)[a]		
Diploma	4	6.6
Bachelor's degree	35	57.4
Master's degree	22	36.1
How many years of clinical experience do you have as a PT/OT/RN[a]		
0 to 4	8	13.1
5 to 9	14	23.0
10 to 14	8	13.1
15 to 19	10	16.4
>20	19	31.1
Familiar with Facebook		
Yes	72	92.3
No	5	6.4
Did not respond	1	1.3
Has a Facebook account		
Yes	73	93.6
No	5	6.4
Has access to Facebook at the workplace		

Yes	31	39.7
No	46	59.0
Did not respond	1	1.3
Would use Facebook outside work hours		
Yes	70	89.7
No	3	3.8
Did not respond	5	6.4

[a] Based on responses from 61 participants
OT = occupational therapist; PT=physiotherapist; RN = registered nurse; SD = standard deviation

Change in perceived usability

For the primary outcome of usability based on the TAM2 questionnaire at two weeks post-intervention, the mean absolute change from baseline for each item is presented in Table 9. The mean baseline scores for items in the *intention to use* domain ranged from 4.4 to 4.5 (*neutral*), 4.1 to 5.1 (*neutral* to *somewhat agree*) for the *perceived usefulness* domain, 4.0 to 4.8 (*neutral*) for the *perceived ease of use* domain, 3.5 to 3.6 (*somewhat disagree*) for the *subjective norm* domain, 5.8 to 6.6 (*somewhat agree* to *moderately agree*) for the voluntariness domain, 2.79 (*moderately disagree*) for the *image* domain, 3.3 to 4.3 (*somewhat disagree* to *neutral*) for the *job relevance* domain, 4.0 (*neutral*) for the *output quality* domain, and 4.2 to 5.2 (*neutral* to *somewhat agree*) for the *result demonstrability* domain.

Statistically significant improvements from baseline were seen for all items of the *perceived ease of use* (4 items), *intention to use* (2 items) and *output quality* (2 items) domains. Statistically significant improvements were seen for one of two items for the *job relevance* domains, two of four items for the *perceived usefulness* domain, one of three items for the *voluntariness* domain, and one of four items for the *result demonstrability* domain. There were no statistically significant improvements for the *subjective norm* and *image* domains. At three months, there were statistically significant improvements in the mean absolute change from baseline for all items of the *output quality* (2 items) domain, three of four items for the *perceived ease of use* domain, one of two items for the *job relevance* domain, and one of three items for the *voluntariness* domain. There was a statistically significant decrease in the *image* domain, and no statistically significant differences in the *intention to use*, *perceived usefulness*, *subjective norm*, and *result demonstrability* domains. There were no differences between the complete case analysis and last observation carried forward analysis.

Table 9: Usability (TAM2) n=78

TAM2 Domain		Baseline		Absolute change Baseline to 2 weeks					Absolute change Baseline to 3 months				
Question #		Mean	SD	Mean	SD	95%CI		pvalue	Mean	SD	95%CI		pvalue
Intention to Use													
1	Assuming I have access to the Facebook group page, I intend to use it with patients	4.41	1.78	0.54	1.82	0.13	0.95	0.01	0.42	2.02	-0.03	0.88	0.07
2	Given that I have access to the Facebook group page, I predict that I would use it with patients	4.51	1.68	0.47	1.44	0.14	0.80	0.01	0.05	2.01	-0.40	0.51	0.82
Perceived Usefulness													
3	Using the Facebook group page may improve my performance in my job	4.51	1.26	0.33	1.50	0.00	0.67	0.05	0.09	1.64	-0.28	0.46	0.63
4	Using the Facebook group page in my job may increase my productivity	4.06	1.42	0.21	1.32	-0.09	0.50	0.18	-0.04	1.56	-0.39	0.31	0.83
5	Using the Facebook group page may enhance my effectiveness in my job	4.56	1.25	0.36	1.39	0.05	0.67	0.03	-0.01	1.56	-0.36	0.34	0.94
6	I find the Facebook group page may be useful in my job	5.10	1.20	0.09	1.39	-0.22	0.40	0.57	-0.21	1.52	-0.55	0.14	0.24
Perceived Ease of Use													
7	My interaction with the Facebook group page is clear and understandable	4.08	1.41	1.21	1.72	0.82	1.59	0.00	1.10	1.60	0.74	1.46	0.00
8	Interacting with the Facebook group page does not require a lot of my mental effort	4.82	1.48	0.69	1.62	0.33	1.06	0.00	0.55	1.79	0.15	0.96	0.01
9	I find the Facebook group page easy to use with patients	4.03	1.06	0.53	1.45	0.20	0.85	0.00	0.34	1.43	0.02	0.67	0.04
10	I find it easy to get to the Facebook group page to do what I want it to do	4.71	1.42	0.83	1.78	0.43	1.24	0.00	0.28	1.90	-0.15	0.71	0.19
Subjective Norm													
11	People who influence my behaviour think that I should use the Facebook group page with patients	3.56	1.29	0.15	1.60	-0.21	0.52	0.40	-0.08	1.55	-0.43	0.27	0.66
12	People who are important to me think that I should use the Facebook group page with patients	3.53	1.36	0.24	1.51	-0.10	0.58	0.16	0.09	1.56	-0.26	0.44	0.61
13	My use of the Facebook group page with patients is voluntary	5.85	1.41	0.69	1.45	0.36	1.02	0.00	0.73	1.48	0.40	1.07	0.00
14	My supervisor does not require me to use the Facebook group page with patients	6.35	1.30	0.23	1.29	-0.06	0.52	0.12	0.28	1.53	-0.06	0.63	0.11
15	Although it might be helpful, using the Facebook group page with patients is certainly not compulsory in my job	6.60	0.92	-0.09	1.07	-0.33	0.15	0.46	-0.05	1.32	-0.35	0.25	0.73
Image													
16	People in my organization who use the Facebook group page with patients have more prestige than those who do not	2.79	1.41	-0.31	1.78	-0.71	0.09	0.13	-0.51	1.74	-0.91	-0.12	0.01
Job Relevance													
17	In my job, usage of the Facebook group page with patients is important	3.29	1.36	0.24	1.50	-0.10	0.58	0.16	0.40	1.73	0.01	0.79	0.05
18	In my job, usage of the Facebook group page with patients is relevant	4.26	1.44	0.56	1.68	0.19	0.94	0.00	0.38	1.77	-0.02	0.78	0.06
Output Quality													
19	The quality of the output I get from the Facebook group page is high	3.97	0.94	0.78	1.31	0.49	1.08	0.00	0.81	1.33	0.51	1.11	0.00
20	I have no problem with the quality of the Facebook group page output	4.06	1.06	0.91	1.39	0.60	1.22	0.00	1.12	1.46	0.79	1.44	0.00
Result Demonstrability													
21	I have no difficulty telling others about the results of using the Facebook group page with patients	4.94	1.47	0.24	1.62	-0.12	0.61	0.19	0.18	1.66	-0.19	0.55	0.34
22	I believe I could communicate to others the consequences of using the Facebook group page with patients	5.19	1.46	-0.03	1.59	-0.38	0.33	0.89	-0.23	1.55	-0.58	0.12	0.19

23	The results of using the Facebook group page with patients are apparent to me	4.18	1.25	0.28	1.56	-0.07	0.63	0.12	0.22	1.54	-0.13	0.57	0.22
24	I would have no difficulty explaining why using the Facebook group page with patients may or may not be beneficial	5.03	1.40	0.41	1.42	0.09	0.73	0.01	0.21	1.66	-0.17	0.58	0.28

Missing values were imputed using last observation carried forward method; Scores based on 1 = Strongly Disagree to 7 = Strongly Agree

Change in perceptions of barriers

Prior to receiving the Facebook intervention at baseline, the most common barriers to using Facebook as a dissemination strategy for the PGrip with patients, as categorized by the TDF, were *environmental context and resources* (environmental constraints) (45.6%), *social/professional role and identity* (16.4%) and *beliefs about consequences* (anticipated outcomes/ attitude) (9.7%) (Table 10). Following the intervention after two weeks, the most common barriers were *environmental context and resources* (50.2%), *skills* with using the Facebook group page (11.0%) and *knowledge* about Facebook (10.1%). After three months, the most common barriers were *environmental context and resources* (55.5%), *beliefs about capabilities* (self-efficacy) in using Facebook (10.6%), and *skills* with using the Facebook group page (10.1%).

Table 10: Barriers n=78

Barrier (Based on TDF)*	Baseline	2 Weeks	3 Months
Knowledge	9.3%	10.1%	7.3%
Skills	9.7%	11.0%	10.1%
Social/professional role and identity	16.4%	10.1%	5.3%
Beliefs about capabilities (self-efficacy)	7.1%	7.7%	10.6%
Beliefs about consequences (anticipated outcomes/ attitude)	9.7%	10.1%	7.3%
Motivation and goals (intention)	0.4%	0.0%	0.0%
Memory, attention and decision processes	0.4%	0.00%	0.00%
Environmental context and resources (environmental constraints)	45.6%	50.2%	56.5%
Emotion	1.3%	0.5%	0.5%
Nature of behaviours (habits)	0.0%	0.5%	2.4%

*participants listed top three barriers

Practice behaviour change

For the outcome of practice behaviour change based on the TDF questionnaire at two weeks post-intervention, the mean absolute change from baseline for each item is presented in Table 11. At baseline, the mean scores showed that participants were in agreement with the *knowledge* domain (mean range 2.3 to 2.6), and were neutral for the *optimism* (mean range 3.1 to 3.6)*, beliefs about capabilities* (mean range 3.2 to 3.6), and *beliefs about consequences* (mean range 3.4 to 3.7) domains. Participants were in

disagreement with the *environmental context and resources* domain (mean range 2.9 to 2.8). Baseline mean scores varied ranging from disagreement to neutral for the *social/professional role and identity (mean range* 2.3 to 3.0), *intentions (mean range* 2.6 to 3.3), and *social influences (mean range* 2.6 to 3.2) domains. Baseline scores also varied ranging from strong disagreement to neutral for the *skills (mean range* 1.7 to 3.4) and *memory/attention/decision* (mean range 1.9 to 3.3) domains.

Statistically significant improvements from baseline were seen for all items of the *knowledge* (4 items) and *skills* (2 items) domains. Statistically significant improvements were seen for three of four items for the *memory/attention/decision* domain, one of two items for the *optimism*, *beliefs about capabilities* and *beliefs about consequences* domains, and one of four items for the *intentions* domain. There were no statistically significant improvements for the *environmental context and resources* and *social influences* domains. The "*social/professional role and identify* demonstrated variable findings as there was a statistically significant improvement for one of the four items, and a statistically significant decrease for another item. At three months, there were statistically significant improvements in the mean absolute change from baseline for all items of the *knowledge* (4 items), *skills* (2 items), *social professional role and identity* (4 items) and *beliefs about capabilities* (2 items) domains, three of four items for the *memory/attention/decision* domain, and one of two items for the *beliefs about consequences* domain. There were no statistically significant improvements for the *optimism*, *intentions*, *environmental context and resources* and *social influences* domain

Table 11: Practice Behaviour (TDF) n=77*

TDF Domain		Baseline		Absolute change Baseline to 2 weeks					Absolute change Baseline to 3 months				
Question #		Mean	SD	Mean	SD	95%CI		pvalue	Mean	SD	95%CI		pvalue
Knowledge													
1	I am aware of the content and objectives of the Facebook group page	2.58	1.21	1.58	1.28	1.29	1.88	0.00	1.52	1.31	1.22	1.82	0.00
2	I know the content and objectives of the Facebook group page	2.26	1.07	1.69	1.23	1.41	1.97	0.00	1.74	1.23	1.46	2.02	0.00
3	I am familiar with the content and objectives of the Facebook group page	2.27	1.10	1.60	1.26	1.31	1.88	0.00	1.77	1.23	1.49	2.05	0.00
4	I am aware of how to use the Facebook group page to disseminate PGrip with patients	2.29	1.22	1.58	1.27	1.30	1.87	0.00	1.69	1.35	1.38	1.99	0.00
Skills													
5	I have the skills to use the Facebook group page to disseminate PGrip with patients	3.40	1.34	0.74	1.23	0.46	1.02	0.00	0.69	1.34	0.38	0.99	0.00
6	I have practiced using the Facebook group page to disseminate PGrip with patients	1.73	0.87	0.94	1.34	0.63	1.24	0.00	1.53	1.28	1.24	1.82	0.00
Social/professional role and identity													
7	Using the Facebook group page to disseminate PGrip with patients is part of my work as an arthritis health professional	2.34	0.94	0.36	1.01	0.13	0.59	0.00	0.56	1.01	0.33	0.79	0.00
8	As an arthritis health professional, it is my job to use the Facebook group page to disseminate PGrip with patients	2.34	1.05	0.14	1.16	-0.12	0.41	0.28	0.31	1.03	0.08	0.55	0.01
9	It is my responsibility as an arthritis health professional to use the Facebook group to disseminate PGrip with patients	2.45	1.06	0.14	1.43	-0.18	0.47	0.38	0.34	1.02	0.11	0.57	0.01
10	Using the Facebook group page to disseminate PGrip with patients is consistent with my job as a health professional	3.00	0.99	-0.40	1.44	-0.73	-0.07	0.02	0.42	1.13	0.16	0.67	0.00
Optimism													
11	I am confident that I can use the Facebook group page to disseminate PGrip with patients even when there is little time	3.10	0.94	0.05	1.00	-0.17	0.28	0.65	-0.04	1.19	-0.31	0.23	0.77
12	I am confident that if I wanted I could use the Facebook group page to disseminate PGrip with patients	3.64	1.00	0.27	1.06	0.03	0.51	0.03	0.21	1.10	-0.04	0.46	0.10
13	With regard to using the Facebook page to disseminate PGrip with patients in uncertain times, I usually expect the best	3.19	0.81	0.27	0.79	0.09	0.45	0.00	0.30	0.93	0.09	0.51	0.01
14	With regard to using the Facebook group page to disseminate PGrip with patients I'm always optimistic about the future	3.56	0.80	0.12	0.76	-0.06	0.29	0.18	0.25	0.89	0.04	0.45	0.02
Beliefs about consequences													
15	If I use the Facebook page to disseminate PGrip with patients, it will benefit public health	3.68	0.87	0.23	0.83	0.05	0.42	0.02	0.18	0.94	-0.03	0.40	0.09
16	If I use the Facebook group page to disseminate PGrip with patients, it will not have disadvantages for my relationship with them	3.42	0.91	0.19	0.96	-0.02	0.41	0.08	0.27	1.03	0.04	0.51	0.02
Intentions													
17	For how many of the next 10 patients do you intend to use the Facebook group page to disseminate PGrip?	2.64	1.51	0.09	1.23	-0.19	0.37	0.52	0.29	1.46	-0.05	0.62	0.09
18	I will definitely use the Facebook group page to disseminate PGrip with patients	3.12	0.84	0.14	0.94	-0.07	0.36	0.19	0.14	0.97	-0.08	0.36	0.20
19	I intend to use the Facebook group page to disseminate PGrip with patients	3.32	0.90	0.29	0.97	0.07	0.51	0.01	0.19	0.97	-0.03	0.42	0.08
20	How strong is your intention to use the Facebook group page to disseminate PGrip with patients?	3.10	1.02	0.12	1.09	-0.13	0.36	0.35	-0.08	1.16	-0.34	0.18	0.56

Memory/attention /decision													
21	How often do you forget to use the Facebook group page to disseminate PGrip with patients?	1.92	1.00	0.58	1.15	0.32	0.85	0.00	0.73	1.24	0.45	1.01	0.00
22	When I need to concentrate to use the Facebook group page to disseminate PGrip with patients, I have no trouble focusing my attention	3.26	0.75	0.36	0.89	0.16	0.57	0.00	0.44	0.88	0.24	0.64	0.00
23	When trying to focus my attention on using the Facebook group page to disseminate PGrip with patients, I have no difficulty blocking out distracting thoughts	3.29	0.84	0.44	0.85	0.25	0.63	0.00	0.55	0.93	0.34	0.76	0.00
24	When concentrating on using the Facebook group page to disseminate PGrip with patients, I can focus my attention so that I become unaware of what's going on around me	3.16	0.76	0.08	0.89	-0.12	0.28	0.44	0.13	0.98	-0.09	0.35	0.25
Environmental context and resources													
25	Within the socio-political context (clinical unit) there is sufficient financial support (e.g., from local authorities, insurance companies) for using the Facebook group page to disseminate PGrip with patients	2.91	0.81	-0.21	1.02	-0.44	0.02	0.08	0.03	0.86	-0.17	0.22	0.79
26	Within the socio-political context (clinical unit) there are good networks between parties involved in using the Facebook group page to disseminate PGrip with patients	2.84	0.76	0.04	0.98	-0.18	0.26	0.73	0.12	0.90	-0.09	0.32	0.26
Social influences													
27	Most people who are important to me think that I should use the Facebook group page to disseminate PGrip with patients	2.62	0.91	0.03	0.85	-0.17	0.22	0.79	0.01	0.82	-0.18	0.20	0.89
28	Most people whose opinion I value would approve me of using the Facebook group page to disseminate PGrip with patients	3.17	0.89	0.12	0.96	-0.10	0.33	0.29	0.09	1.00	-0.14	0.32	0.43

* One participant did not complete the TDF questionnaire. Additionally one participant provided no responses for question #27 (n=76)
Scores based on 1 = Strongly Disagree, 5 = Strongly Agree; Missing values were imputed using last observation carried forward method

Facebook use and impact measures

Facebook use and impact measures at two weeks post-intervention and three months follow-up is presented in Table 12. After two weeks, the majority of participants (93.6%) did not post a comment on the “Wall” of the Facebook group page, while one participant (1.3%), and 2 participants (2.6%) posted a comment once and three times respectively. Similarly, the majority of participants (93.6%) did not post a comment on a video of the Facebook group page, while one participant (1.3%), and two participants (2.6%) posted a comment once and three times respectively. Most participants (64.1%) did not use the “like” feature on a comment and/or video on the Facebook group page, while 15 participants (19.2%) used the like feature once, six participants (7.7%) used the like feature three times, three participants (3.8%) used the like feature five times, and one participant (1.3%) used the like feature 8 times or greater. Most participants (85.9%) did not share a link to a video or other websites on the Facebook group page, while six participants (7.7%), two participants (2.6%), and one participant (1.3%) shared a link once, three times, and 8 times or greater, respectively. After three months, the number or participants who posted a comment on the “Wall”, posted a comment on a video, used the “like” feature, and shared a link to a video or other website generally increased in comparison with the assessment at 2-weeks (Table 12).

Table 12: Facebook Use (n=78)

	2 Weeks		3 Months		Absolute Mean Change
	n	%	n	%	%
Posted a comment on the "Wall" of the Facebook group page					
> 8 times	0	0.0%	0	0.0%	0.0%
5 times	0	0.0%	1	1.3%	1.3%
3 times	1	1.3%	0	0.0%	-1.3%
1 time	2	2.6%	6	7.7%	5.1%
0 times	73	93.6%	68	87.2%	-6.4%
No Response	2	2.6%	3	3.8%	1.3%
Posted a comment on a video on the Facebook group page					
> 8 times	0	0.0%	1	1.3%	1.3%
5 times	0	0.0%	0	0.0%	0.0%
3 times	2	2.6%	2	2.6%	0.0%
1 time	1	1.3%	6	7.7%	6.4%
0 times	72	92.3%	66	84.6%	-7.7%

No Response	3	3.8%	3	3.8%	0.0%
Used the "Like" feature on a comment and/or video on the Facebook group page					
> 8 times	1	1.3%	3	3.8%	2.6%
5 times	3	3.8%	5	6.4%	2.6%
3 times	6	7.7%	3	3.8%	-3.8%
1 time	15	19.2%	16	20.5%	1.3%
0 times	50	64.1%	48	61.5%	-2.6%
No Response	3	3.8%	3	3.8%	0.0%
Shared a link to a video or other website on the Facebook group page					
> 8 times	1	1.3%	2	2.6%	1.3%
5 times	0	0.0%	0	0.0%	0.0%
3 times	2	2.6%	3	3.8%	1.3%
1 time	6	7.7%	7	9.0%	1.3%
0 times	67	85.9%	63	80.8%	-5.1%
No Response	2	2.6%	3	3.8%	1.3%

Discussion

We hypothesized that arthritis health professionals would demonstrate improvements in the perceived usability of Facebook to share information from the PGrip program with patients after two weeks and three months. The sample of participants included a diversity of work settings. As nearly almost all participants (89%) were not previously familiar with the PGrip program, this study highlights the need for additional dissemination strategies. Two weeks after its introduction, the feasibility of the Facebook group page being an easy to use tool was confirmed as arthritis health professionals indicated a greater intention to use the group page, agreeing that they would share it with patients. Participants demonstrated improved ease of use as they agreed that the group page was clear and understandable, did not require a significant amount of mental effort, was easy to use with patients, and easy to accomplish what they intended to do with the page. There were also improvements in output quality as participants agreed that the output they got from the group page was high, and that they had no problem with the quality of group page. There remains uncertainty with improvements regarding the perceived usefulness of the group page (*perceived usefulness* domain), relevance of the group page in relation to participants' jobs (*job relevance* domain), and the perception that that most people believe they should be

using Facebook as a dissemination strategy (*subjective norm* domain). While numerical improvements were seen for all items of these domains, not all items demonstrated statistically significant changes from baseline.

A study that surveyed 485 primary care physicians and oncologists in the United States concluded that social media was perceived as being a useful and efficient method to share medical knowledge (37). Similar to our study, the TAM was used to explore physician's attitudes towards social media, and their perceptions on its usefulness and ease of use. Approximately 46.0% of respondents used social media on a weekly basis to scan or explore medical information, 57.5 perceived social media to be beneficial and engaging as a method to access high-quality information, 57.9% felt it was useful and enabled them to care for patients more effectively, and 60% felt it improved the quality of the care that they delivered.

Other studies have also shown that Facebook can be used as a useful tool among health professionals with patients to share knowledge and health promotion (19,37). In addition, Facebook can be useful among health professionals themselves to obtain up-to date- information and maintain professional connections (19,38), and to facilitate networking, building social capital and community outreach (39).

With variable findings (i.e. some items showing improvements and others showing declines from baseline), further uncertainty remains in relation to the voluntariness of using the group page (*voluntariness* domain), and difficulties in communicating the findings, benefits, and consequences of the group page with others (*result demonstrability* domain). The variable results of the *voluntariness* and *image* domains may be explained by the nature of the intervention, in which the introduction of a Facebook page would likely not have an impact on change in voluntariness (i.e. organization policies would not change because of the intervention), and image (i.e. difficult to change perception of one's image or status in a social system in such a short period of time); however, reasoning for the variable results of the *result demonstrability* domain remains unclear. Furthermore, the variable results of the *voluntariness* and *image* domains may be explained by the baseline mean scores, which were numerically higher for the *voluntariness* domain, and lower for the *image* domain, in comparison to other domains scores, suggesting that participants had strong beliefs about these two domains prior to the study, which may not have allowed for a large margin of change. The Facebook group page did not

appear to have an impact on *image*, as participants did not agree that using the group page would enhance how they would be viewed by their organizations for using the group page. Peluchette et al. found that while the use of social media in the work setting can elicit positive reactions such as improving job satisfaction and strengthening relationships, there may also be negative reactions such as social media use being seen as unprofessional or inappropriate, creating possibilities for confidentiality breaches, or mixing professional and personal boundaries (39).

Findings at three months suggest that the overall perceived usability of the Facebook group page appear to marginally decline over time as changes from baseline were generally similar though inferior to measurements at two weeks. While changes in *perceived ease of use* remained statistically significant, changes in *perceived usefulness* were not. In contrast, improvements in output quality were superior after three months, which may be a result of participants having more time to explore the content and videos of the group page. The findings from the use of the group page suggest that the majority of participants did not use it regularly in their everyday practice, which may explain the marginal decline in item scores after three months.

The successful implementation of evidence-based practice in arthritis care requires an interprofessional approach to identify barriers (33). This study included physiotherapists, occupational therapists and nurses who work in arthritis care. Numerous barriers to engaging in the Facebook group page to disseminate the PGrip program to patients were identified. The most common barriers identified were those related to *environmental context and resources*. Most participants were concerned about internet access or not having access to a computer or mobile devices in the workplace. Similarly, they were concerned whether their patients had internet access, or access to computers and mobile devices. In addition, several participants also felt that they did not have a sufficient amount of time in their work environment to go through the Facebook group page with patients as timing is limited to performing comprehensive assessments. As clinics and hospital settings continue to evolve, there is a need for access to internet and technologies by health professionals in these institutions. Technology in the work setting has shown to facilitate clinical and patient shared decision making (2). If health professionals have limited time to go through the PGrip content, they can simply provide patients with the link to the

Facebook group page to allow them to access the content on their own, and perhaps answer any questions at a future visit. Another common concern of participants was the *social/professional role and identify*. Some institutions prohibit the use of social media while working and some identified that it is perceived “unprofessional” to use Facebook at work. Additionally, participants were hesitant of whether the group page would allow for theirs and their patients’ privacy and confidentiality to be maintained. While these were common barriers identified at baseline, after three months, there was a decrease in the proportion of participants who identified barriers relating to *social/professional role and identify.* After engaging in the PGrip Facebook group page, health professionals may have realized that the group page can be used in a professional manner to assist patients to self-manage their arthritis. In recent years, social media in the workplace has evolved (11), and more and more organizations are creating organizational Facebook pages (19). The PGrip Facebook group page does not require patients or health professionals to identify themselves. While the use of some tools such as posting comments or writing on the “Wall” requires individuals to create an account, the content and videos on the group page are accessible for everyone with or without a Facebook account. Other barriers identified were knowledge relating to Facebook as some participants and their patients were not familiar with the social networking website. Participants were also concerned about their patients not possessing the necessary general computer skills to navigate to the Facebook group page. Findings at three months suggest that barriers associated with knowledge and skills were marginally reduced after participants grew more familiar with the group page. This may suggest that this barrier may continue to be reduced after a longer period of time and greater exposure.

We also hypothesized that the Facebook group page can improve practice behaviour change among arthritis health professionals as a strategy to disseminate PGrip after two weeks and three months. While improvements were seen after two weeks, participants overall did not feel that the Facebook group page had an impact on their practice behaviour in regards to the dissemination of the PGrip program. Based on findings from the TDF questionnaire, baseline scores indicated that participants’ had negative or neutral feelings regarding the various domains. Arthritis health professionals indicated improvements in understanding the content, objectives and how to use the Facebook group page (*knowledge* domain). Participants demonstrated improved skills (*skills* domain), agreeing that they had the skills to use the

group page. While other improvements were seen across other domains, participants either remained neutral or in disagreement on whether the Facebook group page had an impact on their practice behaviour. Though mostly similar to comparisons at two weeks, there were marginal improvements in several domains (e.g.*, knowledge, social/professional role and identity, beliefs about capabilities, memory/attention/decision, and environmental context and resources*) after three months. Two weeks, and three months may not have been a sufficient amount of time to detect meaningful differences in practice behaviour change.

Research has shown that most health professionals already have basic knowledge of how to use Facebook with colleagues and patients, and the implication of using it (19). Another study similarly concluded that social media has a limited impact on change in practice as adding social media-based outreach dissemination methods to traditional methods did not improve awareness of the CPG and knowledge of CPG recommendations, nor did it affect implementation of the recommendations (40).

The majority of participants did not use features of the Facebook group page such as the “Wall” or “Like” button, or posted comments on the videos. There were marginal increases in the use of these features over time, which may suggest that participants grew more comfortable or had more time to use them. Although previous research has shown that health professionals frequently use social media even though the perceived barriers are high (34), the barriers identified in this study by have impacted the overall use of the Facebook group page. One potential reason for the low rate of usage of these features may be related to concerns over confidentiality and privacy as noted in the findings of barriers. Based on these concerns, there have been recommendations made to health professionals to not contact patients through Facebook and to use high privacy settings (41). Laliberte et al. surveyed 322 physiotherapists and physical rehabilitation therapists practicing in Quebec, Canada to determine their knowledge and practice behaviour of using Facebook (19). While the majority (84.3%) had a personal Facebook account, only 3% of respondents reported having a professional profile. Several respondents (35.5%) stated that their workplace had a professional page, 27% had employers as online friends, while 21% had patients as online friends. A study that explored the attitudes and experiences of 682 health professional students using Facebook concluded that 44% of respondents had colleagues as online friends (42). Health

professional students were more cautions with Facebook use with patients as only less than 1% had current patients/clients as online friends and 40% felt it was unprofessional to post any information relating to a patient/client, even in the absence of identifying information. There was a consensus that posting material to Facebook was associated with risks to their current position and future prospects (42).

Both perceived usability and practice behaviour change are complex outcomes, influenced by various factors (domains) (34,43–46). The use of questionnaires based on theoretical frameworks (i.e., TDF and TAM2) allowed for the identification of change across various domains. As highlighted above, greater improvements were seen in certain domains for perceived usability (e.g. intention to use, ease of use, output quality) and certain practice behaviour domains (e.g. knowledge and skills) compared to others. The TDF framework also allowed for the categorization of barriers, highlighting that *environmental context and resources* were by far the biggest concern for arthritis health professionals to using the Facebook group page.

From the overall findings of this feasibility study, we can infer that Facebook offers arthritis health professionals with another option as a dissemination strategy to share evidence-based information, such as the PGrip program, with their patients to successfully self-manage their arthritis. More patients are using the internet to access health information (8). Over a billion of people around the world are currently on Facebook (17), and approximately one in every three older adults who use the internet access social networking sites such as Facebook, and approximately 20% contribute to these sites by commenting or sharing the health and medical information (47,48). A study by Brosseau et al. used Facebook to disseminate the PGrip program to older patients with arthritis (49). Overall, the Facebook group page successfully enhanced patients' knowledge, confidence and improved intention to use PGrip self-management strategies. Facebook may provide arthritis health professionals with an additional option to enhance self-management support among their patients. Furthermore, directing patients to explore the Facebook group page on their own may help reduce the amount of time needed during consultations for patient education and behaviour change counselling.

While social media is increasingly becoming more popular among health professionals (11,19), further research to determine its usability as a dissemination strategy to share evidence is needed. A

randomized controlled trial comparing Facebook with other information and communication technology dissemination strategies would provide further insight on whether it is more usable than other social media platforms or other technologies such as email or websites. Studies should be adequately powered and exploratory subgroup analyses should be performed to consider important factors noted above. Future studies should focus on the strengths of domains that demonstrated successful improvements in this study, as should strive to understand how other perceived usability domains can be improved. As noted in similar research (19,42), there is a need to establish guidelines of social media use in the workplace as professional communications and interaction continue to evolve. Health professionals should be informed on whether current guidelines exist in their workplace (19) as guidance on the use of social networking software can help health professionals maintain professionalism while being able to share material and use these technologies (42)

Limitations

There were limitations of this study that should be considered. Firstly, this feasibility study used a convenience sample and as a result, it remains uncertain whether it was adequately powered to detect meaningful differences. Additionally, the study was not designed to assess specific subgroups to determine the effects of factors such as age, practice setting, and clinical experience. Though based on previously validated tools, the questionnaires used were tailored specifically for the Facebook intervention and this study, thus they were not validated prior to this study. The study also used a short time frame of three months. A longer period of six months or greater would provide useful insight on the long-term effects of the dissemination strategy. As the majority of participants were female, physiotherapists, resided in Ontario, worked in a hospital and urban setting, it remains unclear whether the limited sample of participants was representative of all arthritis health professionals in Canada and may be subject to selection bias. The sample of participants was middle aged (mean age of 40 years), yet the majority possessed several years of clinical experience (>20 years). Previous research has shown that age and gender do not have a significant impact on the adoption or usage of social media and that practice-related characteristics do not appear to be associated with use of Internet-based communication technologies (50). Another study showed that health professionals with a Facebook account were primarily clinicians,

younger, with less work experience (19). Whether older professionals, or those with fewer years of experience would yield similar results remains unclear. Furthermore, while the majority of participants were not familiar with the PGrip program prior to enrolling in the study, the majority were familiar with Facebook and had a registered account. It remains unseen whether familiarity of either the PGrip program or Facebook may have impacted the findings.

Conclusions

This feasibility study suggests that a Facebook group page can be used as a dissemination strategy for the PGrip program by arthritis health professionals that was perceived to be usable with patients after two weeks and three months in regards its ease of use and high output quality. There remains uncertainty in regards to the group page's perceived usefulness, relevance to arthritis health professionals' jobs, the perception of whether these individuals should be using Facebook as a dissemination strategy, the voluntariness of using the group page, and difficulties in communicating the findings, benefits, and consequences of the group page with others. The Facebook group page did not have an impact on arthritis health professionals' image and how they would be viewed by their organizations for using the group page. The most common barriers to engaging in the Facebook group page to disseminate the PGrip program to patients included those related to *environmental context and resources* such as access to internet and technology in the workplace, and patients having this same access at home. While participants' knowledge and skills improved over time, they did not feel that the Facebook group page had an impact on their practice behaviour in regards to the dissemination of the PGrip program. The overall usage of features such as the "Wall", "Like" button, and posting of comments was low, though increased over time.

The potential implications of this work are twofold. Firstly, this research provides new knowledge on how a Facebook group page as a dissemination strategy for an evidence-based self-management program for patients is perceived by arthritis health professionals. Secondly, social media, such as Facebook may provide arthritis health professionals with an additional option of how to best share evidence-based information to allow their patients to successfully self-manage their arthritis, while potentially reducing the amount of time needed during consultations for patient education and behaviour change counselling.

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Chapter 6: Protocol for a Future Pilot Randomized Controlled Trial

Chapter 5 presented the methodology and findings of the advisory committee and feasibility study. The overall conclusion from the feasibility study was that Facebook may provide arthritis health professionals with an additional option of how to best share evidence-based information to allow their patients to successfully self-manage their arthritis. Thus, the next step will be to conduct a pilot RCT comparing Facebook with other ICTs to determine which dissemination strategy would demonstrate greater perceived usefulness among arthritis health professionals.

This chapter presents a manuscript for a pilot RCT proposal that will compare Facebook with an educational website and email to determine which strategy will demonstrate greater perceived usefulness among arthritis health professionals to disseminate the PGrip program with their patients (Milestone 5). This manuscript has been submitted to a peer-reviewed journal and is currently being considered for publication.

The use of information and communication technologies by arthritis health professionals to disseminate a self-management program to patients: a pilot randomized controlled trial protocol

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Abstract

Design and objective: This paper describes the protocol for a three-arm, single-blind, parallel design RCT to investigate the perceived usability of Facebook to share information from an evidence-based arthritis self-management program with patients compared with email or an educational website after two weeks.

Study population: Three-hundred-and-twenty-seven arthritis health professionals (i.e., nurses, or physical/occupational therapists) registered with their regulatory body in Canada, currently practicing clinically defined as spending a minimum of 50% of their time (work week) in direct arthritis patient care.

Interventions: The proposed RCT will include three information and communication technology (ICT) intervention groups: Facebook, email, and an educational website.

Outcome measures: The primary outcome will be perceived usefulness by health professionals of using the ICT intervention to share information with their patients according to the technology acceptance model 2 (TAM2) questionnaire at two weeks post-intervention. Secondary outcomes will include other usability domains of the TAM2 questionnaire (i.e., perceived ease of use, result demonstrability, output quality, job relevance, image, voluntariness, subjective norm, and intention to use) at two weeks, three months, and six months post-intervention.

Analysis: An analysis of variance (ANOVA) will be conducted to compare TAM2 questionnaire scores of the Facebook group, compared with the email and educational website groups.

Introduction

The transfer of research knowledge into clinical practice remains a challenge among health professionals and researchers (1), resulting in ineffective implementation of clinical practice guidelines (CPGs) (2). McGlynn et al. revealed that approximately only 55% of osteoarthritis patients in the United States received recommended care. Similar findings have been seen globally in various disciplines and practice settings (3,4). There is therefore a need to improve the knowledge-to-action gap among the appropriate stakeholders. The process of implementing knowledge into action is known as knowledge translation (KT) (5). Online KT resources, such as information and communication technologies (ICTs), can provide health professionals and consumers with an additional platform to disseminate and access CPGs (6,7). ICTs are defined as "technologies that provide access to information through telecommunications focusing primarily on communication technologies including the Internet and wireless networks, cell phones, and other communication mediums" (8).

Patients are able to manage their chronic conditions when traditional patient education is complemented by self-management support and when information and technical skills to identify problems are provided by health professionals (9). Examples of self-management support techniques for patients include enlisting social support, and determining goal achievement, providing personalized feedback, and the creation of small actions plans and goal setting (10). There is a pressing need for the promotion of evidence-based arthritis self-management support by health professionals with their patients as one in six Canadians aged 15 years and older reported having arthritis, and an estimated 7.5 million adults will have arthritis by 2036 (11).

The People Getting a Grip on Arthritis (PGrip) (12) is a bilingual (English/French), educational, evidence-based online self-management program for patients with rheumatoid arthritis (RA) and osteoarthritis (OA) based on Ottawa Panel CPGs (2004-2017). The program is based on findings from randomized controlled trials (RCTs) that assessed the efficacy of various self-management interventions among patients with arthritis. The study findings were then synthesized through systematic reviews and graded by the Ottawa Panel (13–18). Rigorous methods were then used to develop the Ottawa Panel CPGs for

the self-management of RA and OA.

A recent systematic review that identified research on health professionals' perceived usability and practice behaviour change using ICTs to disseminate CPGs concluded variable findings by type of ICT (19). However, the heterogeneity between studies did not allow for a clear comparison and the paucity of properly conducted studies did not provide a strong conclusion on the effectiveness of ICTs as a dissemination strategy for CPGs (19). Another recent systematic review summarized the evidence pertaining to the use of one type of ICT, social media, by health professionals to facilitate chronic disease self-management with their patients (Chapter 4). The review concluded that health professionals perceived discussion forums and collaborative projects to be useful social media platforms to facilitate chronic disease self-management with patients. Similar to the review of ICTs, there was a paucity of evidence and lack of high quality studies which limited the interpretation of findings (Chapter 4). Thus, to address the knowledge gap of determining which ICTs are perceived as having the greatest usability among health professionals, a high-quality, randomized comparative study is therefore needed.

Hypothesis and Objectives

The general hypothesis of the proposed RCT is that arthritis health professionals will demonstrate greater perceived usability with Facebook to share information from the PGrip program with patients compared with email or an educational website after two weeks. Usability is the behaviour intention to use a system as determined by its perceived usefulness and perceived ease of use (20). The primary research question presented below will address the comparative differences between the three ICT interventions for one component (i.e. perceived usefulness) of perceived usability according to the technology acceptance model (TAM2). The secondary research question will address the comparative differences for other components of usability according to the TAM2 (i.e., perceived ease of use, result demonstrability, output quality, job relevance, image, voluntariness, subjective norm, and intention to use) (20). Further secondary and exploratory research questions are described in Table 13.

.

Table 13: Study research questions

Primary research question

1. Do arthritis health professionals demonstrate greater **perceived usefulness** with Facebook to share information from the PGrip program with patients compared with email or an educational website after two weeks?

Secondary research questions

2. Do arthritis health professionals demonstrate greater **perceived ease of use** with Facebook to share information from the PGrip program with patients compared with email or an educational website at two weeks assessment?

3. Do arthritis health professionals demonstrate greater improvements in **other usability outcomes** (i.e., result demonstrability, output quality, job relevance, image, voluntariness, subjective norm, and intention to use) with Facebook to share information from the PGrip program with patients compared with email or an educational website at two weeks assessment?

4. Do arthritis health professionals demonstrate greater **perceived usability** (i.e., as measured by TAM2 domains: perceived usefulness, perceived ease of use, result demonstrability, output quality, job relevance, image, voluntariness, subjective norm, and intention to use) with Facebook to share information from the PGrip program with patients compared with email or an educational website at three months, and six month assessments?

Exploratory research questions

5. Do arthritis health professionals demonstrate greater **perceived ease of use** over time (two weeks compared with three months or six months) with either Facebook, email or an educational website to share information from the PGrip program with patients?

6. Do arthritis health professionals demonstrate greater **perceived usability** (i.e., as measured by the System Usability Scale [SUS]) with Facebook to share information from the PGrip program with patients compared with email or an educational website at two weeks, three months, and six months assessments?

7. What **perceived barriers** (as identified by the Theoretical Domains Framework [TDF]) are associated with using Facebook, email or an educational website to share information from the PGrip program with patients at two weeks, three months, and six months assessments?

8. How often do arthritis health professionals **actually use** Facebook, email or an educational website to share information from the PGrip program with patients two weeks, three months, and six months assessments?

Methods

This study will be guided by one of the milestones of the Knowledge-To-Action (KTA) framework (5).

Specifically, this study will address the “select, tailor, and implement interventions” milestone as the

objective described above will assess strategies to disseminate the evidence-based PGrip self-management educational program. The findings of this study will be reported in concordance with the CONSORT- EHEALTH checklist (21).

Study design

A three-arm, single-blind, parallel design RCT will be conducted to assess the three ICT interventions (dissemination strategies). The total observation period will be six months, with follow-up assessments taking place at two weeks, three months, and six months following the delivery of each intervention. The study participants will have access to the online material for the complete duration of the study. Given the nature of the ICT interventions, blinding of study participants is not possible. However, the research coordinator and investigators will be blinded to participants' intervention allocation. All communication (e.g., automated email reminders to complete online questionnaires will be generic (i.e., no specific mention of which ICT) to ensure blinding in maintained.

Recruitment

Participants will be recruited over a two-month duration. Study participants will be recruited across Canada by online advertisements using email or online newsletters from arthritis health professional organizations (e.g., Arthritis Health Professions Association, The Arthritis Society, Canadian Physiotherapy Association, Canadian Association of Occupational Therapists, and Canadian Nurses Association). The advertisements will include an email address in which participants can inquire and register to participate in the study. To ensure eligibility criteria is met prior to randomization, participants will be asked to complete an online admission questionnaire. If participants meet the eligibility criteria, they will then be sent an electronic invitation letter by email, which will also include and require informed consent to be acknowledged. After obtaining informed consent, participants will then be invited to complete the baseline questionnaire. All participants will begin the study at the same time. This recruitment process has proven to be successful in a previous feasibility study (22). Similar recruitment methods used in the feasibility study were approved by the University of Ottawa research ethics board.

Feasibility

For this proposed RCT, we anticipate similar compliance rates as in our feasibility study (ref). All participants completed the baseline questionnaire, while 76 of 78 participants (97.4%) completed the questionnaire at two weeks follow-up, and 75 of 78 participants (96.2%) completed the final questionnaire at 3 months follow-up. Participants were considered dropouts if they indicated they no longer wished to continue in the study.

Inclusion Criteria

In order to be eligible to participate in this study, participants must meet the following criteria: (a) trained as a nurse, or physical/occupational therapist; (b) registered with their provincial professional regulatory body; (c) currently practicing clinically defined as spending a minimum of 50% of their time (work week) in direct arthritis patient care; (d) has Internet access; e) is computer literate; (f) communicate in English; and g) did not participate in the feasibility study (including the Advisory Committee). Individuals not meeting all inclusion criteria were excluded and were not deemed eligible for the study.

Participant Allocation

Health professionals will be randomly assigned to one of three intervention groups based on a sequence of computer-generated random numbers using a blocking factor (randomly varying between 6 and 9). A research coordinator will contact potential participants and will confirm their eligibility after they register to the study via email. Once participants have been deemed eligible and have provided consent, they will be randomly allocated to one of the three intervention groups using the central randomization scheme by a data manager at the research study Methods Center. The data manager will document the participants' initials (first and last) as well as their date of birth (month and year) before running the randomization program. To ensure concealment of allocation, the data manager with document the intervention assignment and assign a study identification (ID) number after running the randomization program. This information will then be provided to a research assistant, not involved in data collection. Participants will

then be informed by email to their group assignment following randomization.

Intervention

The proposed RCT will include three ICT intervention groups (Figure 1), in which the PGrip program will be provided online to participants. Similar methodology used in the feasibility study has been approved by the University of Ottawa Ethics Committee (certificate number: H11-12-10).

Educational Website (The Arthritis Society Website)

The PGrip educational website by TAS (www.arthritis.ca/peoplegettingagrip) includes a collection of evidence-based self-management videos and slide presentations for OA and RA. The didactic videos are based on knowledge from the Ottawa Panel CPGs, which have been translated into lay terms and tailored for the PGrip program. The self-management interventions presented in PGrip were those that achieved positive recommendations (Grades A, B and C+) in the Ottawa Panel CPGs (13–18). According to the Ottawa Panel grading recommendations, a Grade C+ is considered positive and acceptable as it signifies 20% in clinical importance although the finding may not be statistically significant ($p < 0.05$). The self-management intervention videos for OA include: ice massage, hand exercises, aquatic therapy exercises, weight management, and a stationary bicycling program. The RA self-management interventions include: insoles and footwear, yoga, Tai Chi, aquatic jogging, wrist orthotics, and transcutaneous electrical nerve stimulation. For each self-management intervention, two video presentations were created: (a) a narrated PowerPoint presentation of simplified instructions on how to perform/apply the self-management intervention with case scenarios illustrating the appropriateness and relevance of each; and (b) practical sessions with an arthritis health professional providing step by step instructions while performing/applying the self-management intervention with a patient. Participants in the educational website group will be emailed a link to the TAS PGrip website, and will be provided instructions on accessing the didactic videos.

Email (Electronic Pamphlets)

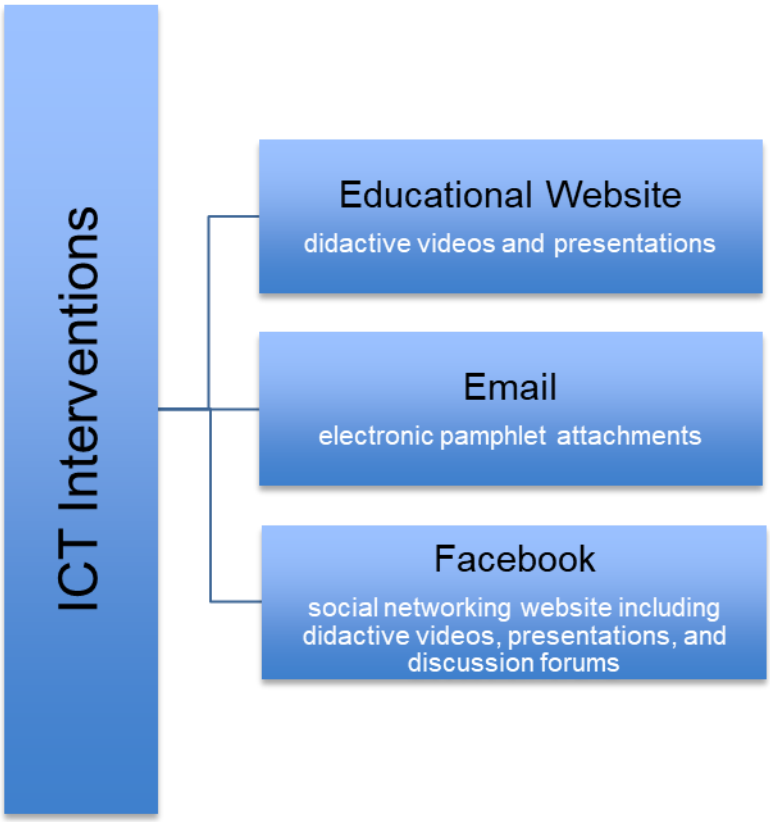
Participants in the email group will be provided with electronic TAS educational pamphlets on general

self-management interventions for OR and RA. The educational pamphlets will be emailed directly to participants as portable document format (PDF) attachments and will contain the same content of these as the information provided in the PGrip didactic videos described above. Participants will be emailed once for the entire duration of the study, and will not be provided with the links to the TAS PGrip website link or PGrip Facebook group page.

Facebook (Social Networking Website)

Participants in the Facebook group will be provided a link to the PGrip Facebook group page. The group page will include all videos of the presentations from the TAS PGrip educational website. On the group page, the videos will be clearly labeled and categorized by type of arthritis (i.e. OA or RA) and type of video (i.e. narrated presentation or practical session), to simplify access. The group page also allows for a discussion forum as users can post comments or questions under each video. Other information on the group page will provided, including an “About” section which provides a brief description of the PGrip program, and a web link to The Arthritis Society’s PGrip website. Participants will be provided with instructions on how to access the videos and how to post comments or questions.

Figure 3: Proposed ICT intervention groups



Outcome Measures

Four different measurement assessments will be conducted throughout this RCT for each participant in all three ICT intervention groups (Table 14 and Figure 3). All assessment will be conducted using SurveyMonkey, an online questionnaire platform (23). The questionnaire links will be sent to participants by email. Participants will be given two weeks to complete each questionnaire, and will be sent a reminder email one week after being provided each questionnaire. For participants in the Facebook group, a reminder message to complete questionnaires will also be posted on the "wall" of the group page. The first assessment will include baseline measurements prior to participating in the ICT interventions. Findings from the questionnaires will be reported using the Checklist for Reporting Results of Internet E-Surveys (CHERRIES) (24).

Monetary compensation (C$30.00) in the form of a gift card will be provided to participants for each completed questionnaire as an incentive to complete measurement assessments. This approach was adopted and successful in the feasibility study (22). In order to receive this compensation, participants will need to provide their mailing address and consent to use this personal information.

The outcome measures will be assessed at two weeks following the delivery of the PGrip program via the various ICT interventions, and at three month and six month follow-up to determine whether effects are maintained (Table 2). The 2-week assessment will be considered as the primary endpoint, a timeframe that was considered by the study authors to be a sufficient timeframe to detect differences in usability and subsequently confirmed in the feasibility study as statistically significant improvements in usability from baseline were demonstrated (22). Measurements at three month and six month follow-up will be considered secondary endpoints for this study. Participants who are unable to complete two consecutive assessments will be considered lost to follow-up.

Primary Outcome

Perceived Usefulness (TAM2, two weeks post-intervention)

Usability outcomes will be guided by the TAM2 (20), which illustrates that behaviour intention to use a system is determined by perceived usefulness and perceived ease of use. The primary outcome of this proposed RCT will be one component of usability: perceived usefulness. Perceived usefulness is defined by Venkatesh and Davis (20) as “the extent to which a person believes that using the system will enhance his/her job performance” (p. 187). The perceived usefulness of each ICT as a dissemination strategy for the PGrip program with patients will be measured using an instrument based on the TAM2 questionnaire, a validated tool showing internal consistency reliability and construct validity (20). The TAM2 questionnaire contains 26 items consisting of nine domains: perceived usefulness (four items), perceived ease of use (four items), intention to use (two items), subjective norm (two items), job relevance (two items), output quality (two items), voluntariness (three items), image (three items), and result demonstrability (four items). The TAM2 questionnaire is measured on a seven-point Likert scale (1 = strongly disagree to 7 = strongly agree). A tailored 24-item TAM2 questionnaire was used and piloted in

the feasibility study as Facebook may not be accessible due to firewalls in the workplace for all study participants, thus two items from the image domain were removed. The modified TAM2 questionnaire can be found in Appendix 6.1 Tailored Technology Acceptance Model 2 (TAM2) questionnaire and definitions for each domain of the TAM2 questionnaire can be found in Appendix 2.1 Definitions of TAM2 Domains.

Secondary Outcomes

Perceived Ease of Use (TAM2, two weeks post-intervention)

Another component of usability, as per the TAM2, is perceived ease of use. Perceived ease of use is defined by Venkatesh and Davis as “the extent to which a person believes that using the system will be free of effort” (p. 187) (20). Similar to the primary endpoint, perceived ease of use will be measured by the tailored TAM2 questionnaire at two weeks post-intervention.

Other Usability Domains (TAM2, two weeks post-intervention)

Other usability domains as per the TAM2 such result demonstrability, output quality, job relevance, image, voluntariness, subjective norm, and intention to use will be assessed at two weeks post intervention using the tailored TAM2 questionnaire.

Other Usability time points

TAM2 usability domain scores (perceived usefulness, perceived ease of use, result demonstrability, output quality, job relevance, image, voluntariness, subjective norm, and intention to use) will also be assessed at three month and six month follow-up using the tailored TAM2 questionnaire. TAM2 usability domain scores (perceived usefulness, perceived ease of use, result demonstrability, output quality, job relevance, image, voluntariness, subjective norm, and intention to use) at two weeks post-intervention compared with three month and six month follow-up (change over time).

Exploratory Outcomes

The following exploratory outcomes will also be assessed:

- Usability measured by the System Usability Scale (SUS) instrument (25) at two weeks post-intervention and three month and six months follow-up. The SUS is an empirically validated 10 item questionnaire with five responses from 1 = “Strongly disagree” to 5 = “Strongly agree” (25).
- Perceived barriers to using Facebook, email or an educational website to share information from the PGrip program with patients at two week post-intervention, three months and six months follow up. Participants will be asked to identify their top three barriers to engaging in the ICT intervention as tool to share information from the PGrip program with their patients. Each identified barrier will be coded and categorized according to constructs of the theoretical domains framework (TDF) (26). This measurement of barriers was also conducted in the feasibility study (22)
- Actual use of the ICTs to share information from the PGrip program with their patients. Participants will be asked to rank the number of times they used the ICT using a five-point Likert scale ranging from one (>8 times) to five (0 times). This measurement of actual use was also posed in the feasibility study (22).

Table 14: Assessment schedule and outcome measures

Assessment	Admission	Baseline	2 weeks post-intervention	3 month follow-up	6 month follow-up
Informed consent (pre-admission)	•				
Demographics	•				
Perceived Usability (TAM2 questionnaire)		•	•	•	•
Perceived Usability (SUS)		•	•	•	•
Barriers (TDF)			•	•	•
Actual Use			•	•	•

SUS = system usability scale; TAM2 = technology acceptance model 2; TDF = theoretical domains framework

Statistical methods

Data analysis will be conducted on an intention-to-treat basis using SPSS21 software. The multiple imputation technique will be used to adjust for missing data. Baseline characteristics of included participants in all three ICT intervention groups (Figure 1) will be summarized using descriptive statistics

(e.g. proportions, means, and standard deviations). To ensure no differences among the ICT intervention groups, baseline characteristics will be assessed and compared.

For the primary outcome (perceived usefulness at 2 weeks post-intervention), an analysis of variance (ANOVA) will be conducted to compare TAM2 questionnaire scores of the Facebook group, compared with the email and educational website groups. Specifically, Tukey's HSD (honest significant difference) test will be used in conjuction with the ANOVA to determine whether means of the primary outcome measure between the three ICT groups are different from eachother. If important differences in baseline variables are found, the ICT intervention groups will be compared adjusting for these baseline variables using multiple regression and similar multiparameter tests will be conducted.

For secondary outcomes (perceived ease of use, result demonstrability, output quality, job relevance, image, voluntariness, subjective norm, and intention to use), a similar approach to the primary outcome will be used to compare TAM2 scores of the Facebook group with the email and educational website groups at two weeks post-intervention. These analyses will also be conducted for the following exploratory outcomes: TAM2 usability outcomes at three and six month follow-up and SUS scores at 2 weeks post-intervention, three month, and six month follow-up. Interpretation of both usability measurements (TAM2 and SUS) will be compared with each other to determine whether both tools are concordant (no statistical testing).

To investigate the exploratory outcome of change in TAM2 scores over time from baseline, 2 weeks post-intervention, three month and six month follow-up, a two-way repeated measures ANOVA will be conducted involving the within factor time (0, 2 weeks, 3 months, 6 months) and between factor (ICT intervention group), following a similar strategy as outlined above for the primary outcome measure.

For the remaining exploratory outcomes of perceived barriers and actual use, findings will be analyzed descriptively using proportions.

Sample size

The following sample size was calculated using the PASS software based on methodology by Desu and

Raghavarao (27). In a one-way ANOVA study, samples sizes of 109 for each group are obtained from the three intervention groups (Website, Email, and Facebook) whose means are to be compared. The total sample of 327 subjects achieves 80% power to detect differences among the means versus the alternative of equal means using an F test with a 0.05 significance level. Based on findings from the feasibility study (22), the common standard deviation of the primary outcome within a group is assumed to be 0.39. Given that a minimally important difference for the primary outcome using TAM2 questionnaire remains unknown from a clinical standpoint, a small effect size (0.2) based on Cohen's *d* was deemed to be reasonable by consensus from users of the TAM2 questionnaire. Thus a minimally important difference of 0.8 was considered for this study. To account for a potential loss to follow-up, the sample size has been adjusted to accommodate a 5% loss to follow-up, a conservative estimate compared to the feasibility study (3.8%) (22).

Methodological Considerations

Population: In the feasibility study, there was an imbalance in the representation of arthritis health professionals from across Canada (22). While efforts will be made to recruit participants from across Canada, there may be similar limitations obtaining adequate representation from each Canadian jurisdiction. Furthermore, arthritis health professionals working in rural and remote areas may have limited Internet access, thus limiting their ability to participate in the study (and not meet inclusion criteria). Despite these potential limitations, efforts will be made to reach to out to arthritis health professional organizations that include representation from rural and remote regions.

Intervention and Comparators: While the comparators (email and educational website) will not change throughout the course of the pilot RCT, the investigators may not be able to guarantee that there will be no changes to Facebook group page. Since Facebook developers are regularly updating and evolving the platform, there in uncertainty whether any additional tools and features will be included during the course of the pilot study. These changes will be made by the Facebook team, and out of the control of the study investigators. Such changes would likely have a minimal effect on measurement outcomes, but will regardless still be documented and recorded.

Concerns surrounding privacy issues will be mitigated by informing participants prior to randomization that the study investigators cannot guarantee the safety of any personal information shared on the Facebook group page. The study investigators will be responsible for maintaining confidentiality of any collected data from measurement assessments (questionnaires). This will be communicated to participants in their letter of information (consent form), as well as reminders on the Facebook group page.

Outcomes: The tools used to measure the primary and secondary outcomes have not undergone formal validation testing. While the modified TAM2 and TDF questionnaires were used in the feasibility study (22), further validation studies are required. This limitation will be considered during the interpretation of findings of the pilot RCT.

Data sharing

All datasets will be made available from the corresponding author following the completion of analyses on reasonable request.

Dissemination

The study findings will be written by the research team for publication in academic peer-reviewed journals. Findings will also be made available in lay summary format for various arthritis professional and patient organization websites and newsletters.

Ethical approval: Ethics approval will be sought from the University of Ottawa Research Ethics Board.

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Part III: Discussion

Chapter 7: Synthesis and Implications

Chapters 3 to 5 presented two systematic reviews of the literature (Chapters 3 and 4), methodology and findings of an advisory committee and a feasibility study (Chapter 5). Chapter 6 presented a protocol for a future pilot randomized controlled trial (RCT) (Chapter 6)

This chapter provides a discussion of the syntheses and implication of the research findings from the prior chapters. Specifically, the guidance of the KTA framework on this research, strengths and limitations of this thesis and suggestions for next steps and future research are described.

Synthesis of overall findings

The overall objective of this thesis was to determine the feasibility of using Facebook as a CPG dissemination strategy using an evidence-based online self-management educational program by arthritis health professionals with their patients. The overall findings from this thesis suggests that a tailored Facebook group page that takes health professionals' barriers into consideration may provide relevant and credible evidence using a medium that provides unlimited access, speed, and ease of use. Facebook may provide an opportunity for health professionals to participate in a collaborative information-sharing system (e.g., an online network), providing a new and emerging means of communication between other health professionals and patients.

This thesis and the research milestones (see Overview of Milestones) were guided by the KTA framework (1). As outlined in Chapter 1: the KTA framework provides an approach that combines commonalities of various planned-action theories, and is used to develop knowledge translation (e.g., dissemination) strategies. The first phase of the KTA framework's action cycle, which depicts the application of knowledge, is the identification of knowledge to action gaps (1). As previously mentioned, the two systematic reviews (Chapter 3 [Milestone 1] and Chapter 4 [Milestone 3]) identified knowledge gaps and needs for further research. Specifically, the first systematic review revealed that perceived usability and practice behaviour change varies by type of ICT and that currently, the heterogeneity and the paucity of properly conducted studies does not allow for a clear comparison of ICTs with each other (Chapter 3: Systematic review of ICTs as a guideline dissemination strategy for health professionals). The second systematic review revealed that while specific social media platforms, such as discussion forums and collaborative projects appear to be promising resources for health professionals to assist their patients in self-managing their chronic conditions, there is a paucity of evidence for other social media platforms, such as social networking sites, wikis, further research comparing various social media platforms such as collaborative projects, content communities, blogs or microblogs, social networking sites, and virtual gaming or social worlds is needed.

The second phase of the KTA action cycle, adapting knowledge to local contexts, illustrates that knowledge should be refined into clear and concise tools and products, such as CPGs, decision aids and

care pathways (1). This was achieved during the creation of the PGrip program in which evidence on arthritis self-management interventions were identified by the Ottawa Panel (2–12). Dissemination strategies such as ICTs should be customized to improve reach to the appropriate users (13). During the development of the PGrip program, to facilitate the processes of adapting knowledge to a local context, evidence from the Ottawa Panel CPGs was summarized in lay terms using video presentations. A previous pre-post study that evaluated the PGrip program (14), suggested that knowledge uptake improved when evidence was translated for the knowledge users (i.e. 99 arthritis patients). The findings from Brosseau et al. revealed that knowledge acquisition scores, when compared with baseline, improved by 2.2 points (out of 21) ($P \leq 0.05$) among patients with OA and 1.6 points (out of 21) ($P \leq 0.05$) among patients with RA, immediately following the use of Facebook (14). The study also indicated that more than half of the patients felt that Facebook was a good method for disseminating arthritis self-management information and felt comfortable using Facebook to access the PGrip material (14). Thus, it appears that the use of Facebook to disseminate the PGrip program has demonstrated positive findings among both health professionals and patients. Knowledge gaps that remain include understanding barriers and facilitators to using Facebook to access the content of the PGrip program, and determining how its use by patients may impact the relationship with their health care providers. Furthermore, understanding the perspective and experiences of patients' family and informal caregivers would also provide valuable insight, and could provide suggestions for the improvement of the Facebook group page.

The third phase of the KTA action cycle describes the assessment of barriers and facilitators to knowledge use (1). Each phase of knowledge creation can be tailored to meet the needs and to address barriers and facilitators of dissemination for potential knowledge users. In the previous phases described above, the "knowledge" is referred to as the PGrip program. Given that the objective of this research was focussed on the dissemination strategy, rather than the content of the PGrip program, for this and remaining phases of the KTA cycle, the "knowledge" is referred to as the Facebook dissemination strategy. As seen in the feasibility study (Chapter 5: Advisory Committee and Feasibility Study), the use of social media (i.e., Facebook) as a dissemination strategy for CPGs and evidence-based educational materials (i.e., PGrip) can pose several barriers if health professionals are not comfortable using online strategies. In order to assess barriers and facilitators to knowledge use, an advisory committee consisting

of arthritis health professional knowledge users was convened (Chapter 5: Advisory Committee and Feasibility Study). An inter-professional approach for identifying barriers is required for successful dissemination of evidence-based practice in arthritis care (15). The advisory committee consisted of physiotherapists, occupational therapists and nurses (RNs) engaged in arthritis care who provided insight on the barriers and facilitators of using Facebook as a guideline dissemination strategy for PGrip. The collection of information on barriers and facilitators was also collected and synthesized in the feasibility study.

The fourth phase of the KTA action cycle described the need for selecting, tailoring, and implementing interventions (1). It is recommended that CPG dissemination be tailored for the appropriate knowledge users and should address barriers related to the individual practitioner, social context, and organizational and environmental context (16). Advisory committee members were provided with the opportunity to use the Facebook intervention hands-on. Based on the discussions and feedback provided by the committee, the Facebook intervention was tailored to improve usability and accessibility prior to being used in the feasibility study.

The last phase of the KTA action cycle which guided this thesis is the monitoring of knowledge use (1). This last phase will be achieved during future research in a proposed pilot RCT by measuring actual use of the ICT intervention (i.e., Facebook, email or an educational website) to share information from the PGrip program with their patients will be assessed in the proposed pilot RCT proposal.

The research of this thesis was strengthened and facilitated by the use of a conceptual framework (KTA framework), which provided guidance to address the objective of this thesis. Additionally, two frameworks defined the outcome measures; the TAM2, a model that is specific for identifying factors that influence an individual's decision about how and when to use a new technology (e.g. Facebook) (17); and the TDF, a framework that identifies several behaviour change constructs that relate to dissemination and implementation of evidence-based practice (e.g., sharing/discussing the PGrip program with their patients) (18). Perceived usability and practice behaviour change are complex outcomes that are influenced by various factors (17–21). Integrative conceptual frameworks, such as the TDF and TAM2, recognize that dissemination and implementation are multidimensional processes that consist of multiple

interacting influences (22). The multiple domains of each the TAM2 and TDF allowed for a more in depth analysis to identify which determinants impact both perceived usability and practice behaviour change. For example, in the feasibility study (Chapter 5: Advisory Committee and Feasibility Study), greater improvements were seen in certain domains for perceived usability (e.g., intention to use, ease of use, output quality) and certain practice behaviour domains (e.g., knowledge and skills). While further research (i.e., a large RCT) is needed to confirm these findings, it provides insight on where focus should be placed in order to improve and develop innovative strategies to disseminate CPGs and evidence-based information, such as the PGrip program.

Considerations for future research and next steps

This thesis has demonstrated and discussed the potential benefits of arthritis health professionals using Facebook as a dissemination strategy for the PGrip program with their patients. In addition to conducting future research to investigate the comparative evidence of Facebook compared to other ICT strategies, considerations regarding the sustainability of using Facebook as a dissemination tool for PGrip, and further thoughts about the credibility of online dissemination strategies such as Facebook are needed.

Sustaining Knowledge Use

The two remaining phases of the KTA framework not yet discussed in this thesis are the “evaluate outcomes” and “sustain knowledge use” (1). The “evaluate outcomes” phase indicates strategies for evaluating knowledge implementation should use “explicit, rigorous methods, considering both qualitative and quantitative methodologies” (1). As indicated in Chapter 6: Protocol for a Future Pilot Randomized Controlled Trial, further evaluation of outcomes will be explored in the proposed future pilot RCT.

According to the “sustain knowledge use” phase, “sustenance of knowledge use refers to the continued implementation of evidence over time” and should include the discussion of budgetary resources, human resources, and health care system (1). To understand sustainability, one of the most significant implementation science challenges, Moore et al. searched the literature for existing systematic and scoping reviews on knowledge syntheses of sustainability and abstracted sustainability definitions (23).

Their revised definition of sustainability included five constructs: 1) after a defined period of time, 2) a program, clinical intervention, and/or implementation strategies continue to be delivered and/or 3) individual behaviour change (i.e., clinician, patient) is maintained; 4) the program and individual behaviour change may evolve or adapt while 5) continuing to produce benefits for individuals/systems (23).

As indicated by Moore et al, the appropriate time to start measuring sustainability will vary depending on the nature of the intervention and its outcomes (23). Social media, Facebook in particular, is a regularly evolving platform. For example, over the last ten years, Facebook has undergone several changes including the incorporation of instant messaging and real-time news feeds. While improvements were seen in perceived usability and practice behaviour change after two weeks in the feasibility study, the changes from baseline were not always maintained after three months (24). Though the pilot RCT proposes to evaluate outcomes over a longer duration (i.e., six months), sustainability outcomes (e.g., perceived usability and actual use of ICT interventions by health professionals to disseminate PGrip) should be continuously and regularly measured bi-annually. One suggestion would be to involve arthritis professional associations (e.g., The Arthritis Society) to conduct such measurements.

Moore et al. also indicates that the continued delivery of an intervention or program refers to whether an organization is continuing to provide a program or continuing to use the strategies necessary to support behaviour change (23). The sustainability of using Facebook as a dissemination strategy for the PGrip program will need to be assessed at the institutional level by hospitals and clinics, and also at the individual level by arthritis health professionals. Theoretical frameworks such as the TAM2 and TDF, which identify the influence of determinants on usability and behaviour change outcomes, imply a systems approach and multiple levels of influence (22). Identifying barriers at various levels (e.g., institutional and individual) is needed to recognize what limits arthritis health professionals from disseminating evidence-based programs with their patients. In this thesis, the KTA framework (1) highlights the importance of assessing barriers and the TDF framework proved to be successful in identifying and categorizing various barriers. The findings of the feasibility study indicated that *environmental context and resources (*e.g., internet access, technology in the workplace*)* were the greatest concern for arthritis health professionals to using the Facebook group page. Moving forward, the

assessment of barriers to using ICTs such as social media as a dissemination strategy, and addressing these limitations at the various levels (i.e., institutional and individual) will be needed to ensure the successful sustainability of using Facebook to disseminate PGrip. Communication across jurisdictions at the health systems level (e.g. local health integration networks), such as sharing barriers and discussing suggestions for facilitators, may also be needed to support the sustainability of the Facebook group page.

According to Moore et al., the maintenance of behaviour change at the individual level pertains to how the implementers (e.g., arthritis health professionals) are following the recommendations of the evidence-based program (e.g., PGrip) and how they interact with their patients and patient support groups (e.g., The Arthritis Society) (23). Barriers and contextual factors identified in the feasibility study (24) should be considered as they may increase or decrease the likelihood of sustainability (25). For example, lack of time was a common barrier identified by arthritis health professionals in the feasibility study (24). Patient education and behaviour change counselling are activities that can consume a significant amount of health professionals' time while caring for patients with chronic diseases (26). It will be important that arthritis health professionals acknowledge that using Facebook as a dissemination strategy may prove to be timesaving in the long-term. While a longer initial session between the arthritis health professional and patients may be needed to introduce the PGrip program and the Facebook group, future sessions and consultations may be brief (or not necessary) if patients are adhering to the PGrip program and using the Facebook group page to interact with other patients and professionals. Online ICTs have been found to enhance self-management support as it provides a time-saving and a potential demand-reducing option for health professionals (26-28). It appears a shift in paradigm is needed as arthritis health professionals need to be informed on the benefits of using ICTs, such as social media and Facebook in comparison to more traditional dissemination methods (e.g., printed educational materials). Although access to ICTs in the work setting can facilitate patient and clinical shared decision making (26), not all institutions permit the use of social media in the work place. In recent years, social media use in the workplace has evolved (27), with an increasing number of institutions creating their own Facebook pages (28). Realizing that institutionalization and maintenance evolve over time, we propose that organizational policies and considerations be reviewed by arthritis health professionals and managers at bi-annual time points (concurrently while measuring sustainability outcomes).

The last concept from the definition of sustainability by Moore et al. pertains to continuing to produce benefits for individuals/systems. The benefit of using a proven effective program is that they can be expected to produce anticipated outcomes if they are delivered appropriately with high-quality strategies (29). In contrast to newly developed and untested programs, the PGrip program is evidence-based and has been proven effective among arthritis patients. A pre-post study by Brosseau et al., which disseminated PGrip to ninety-nine arthritis patients from across Canada, suggested that self-efficacy was maintained from immediate post-intervention to 3 months follow-up, and confidence improved as the study progressed (14). The study also revealed improved knowledge acquisition scores at 3 months follow-up and participants successfully followed through on their intention to use the self-management interventions. A separate pre-post study by Brosseau et al. included 49 arthritis patients and investigated other dissemination strategies for PGrip such as face-to-face workshops, press media, and video teleconferences. The face-to-face workshop was well accepted and suggested to be the most promising dissemination strategy as participants were focused and immersed in the topic and were able to receive immediate responses to any questions they had (30). The study did not compare any of the dissemination strategies mentioned above with social media. As mentioned in the systematic review in Chapter 3, online chronic disease self-management interventions, in comparison to traditional face-to-face methods, have the potential to reach a broader population of chronic disease patients (31). Online communities (e.g., Facebook) may allow for improved social support (31,32). Further research should continue to explore what additional benefits online dissemination stratgies have over more traditional methods among both patients and health professionals.

To ensure patients continue to remain engaged, it is suggested that the PGrip Facebook group page be be continuously monitored. This would require the involvement of arthritis professional associations (e.g., The Arthritis Society) to designate web page administrators. The web page administrators would not necesarrily need to be arthritis health professionals, but would have the responsibility of monitoring, managing and performing enhancements to the group page. These individuals would also assist finding arthritis health professionals who could respond to queries posed by patients on the group page.

Credibility of online information and need for patient education

While the research of this thesis outlines the potential benefits of using innovative strategies, such as Facebook to disseminate CPGs and evidence-based programs, an important topic that should be considered is the credibility of online information and patient education. As more and more patients use the Internet to access medical information, and with greater accessibility to vast amounts of information, the credibility of the information may be questioned or considered outdated. Although accessible and relevant, information will only be used by patients if it is perceived to be credible (33). One of the most important factors responsible for the credibility of information is determining 'who' should be the messenger (34). Grimshaw et al. suggests that researchers typically are responsible for conducting knowledge translation; however they should only be the messenger if and when they have credibility with the appropriate target audience (35). This approach was followed in the research of this thesis as the Ottawa Methods Group, who developed and synthesized the foundational evidence of the PGrip program (Ottawa Panel CPGs), were not the messengers. Instead, to improve credibility, arthritis health professionals were included in the development process of the Ottawa Panel CPGs as they provided expert consensus of the recommendations. Ellen et al. have suggested that the development and use of research knowledge infrastructures (e.g. instruments, such as programs, tools or devices) may be an effective and sustainable knowledge translation approach (36). This was also followed in the research of this thesis as the evidence from the Ottawa Panel CPGs was used to develop the PGrip program (research knowledge infrastructure). The content of the educational material of the PGrip program included didactic videos presented by arthritis health professionals themselves, a technique that was used to enhance credibility of the self-management program.

Though there are numerous trusted online resources for health information including government sponsored (e.g., Canadian Health Network, Medline Plus) and commercial (e.g., WebMD) health portals, patients typically use search engines to find relevant health information (37). Facebook, which oftentimes can include user-generated content, can influence information seekers' subjective credibility judgments of evidence-based health and medical information (33). For example, Facebook specifically has the potential to enhance credibility as it includes tools, such as the comment feature and the "like" button, which allows users to express their opinion about the information (33).

The increasing amount of user-generated content found online highlights the need for greater patient education by health professionals about evidence-based medicine and approaches for avoiding poor quality health information. Having arthritis health professionals take the time to inform their patients about the evidence behind PGrip (Ottawa Panel CPGs) would improve the credibility of the program. Arthritis health professionals would benefit from informing their patients about existing tools, such as the DISCERN instrument (www.discern.org.uk/), which helps users of consumer health information judge the quality of written information about treatment choices.

Conclusions and Future Implications

The overall objective of this thesis was to determine the feasibility of using Facebook as a dissemination strategy for an evidence-based patient education program by arthritis health professionals with their patients. The hypothesis of the feasibility study was that Facebook could be used a CPG dissemination strategy that arthritis health professionals would perceive as being both useful and easy to use to share information with their patients. The overall findings of this thesis indicate that Facebook may provide arthritis health professionals with an additional option of how to best share evidence-based information to allow their patients to successfully self-manage their arthritis. Specifically, the feasibility study suggests that a Facebook group page may be used as a dissemination strategy for the PGrip program by arthritis health professionals that was perceived to be usable with patients after two weeks and three months in regards its ease of use and high output quality. In addition to the findings of the feasibility study, the research of this thesis also identifies current knowledge and evidence gaps on ICTs as a CPG dissemination strategy for health professionals, and the perceived usability of social media by health professionals to facilitate chronic disease self-management with their patients.

In regards to potential implications of the research of this thesis, this research provides new knowledge on how a Facebook group page is perceived by arthritis health professionals as a dissemination strategy for an evidence-based self-management program for patients. This research also provides insight on how Facebook may provide arthritis health professionals with an additional choice of how to best share evidence-based information with their patients to promote the successfully self-manage their arthritis, while potentially reducing the amount of time needed during consultations for patient education and

behaviour change counselling.

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Part IV: Contributions

Chapter 8: Contribution of Collaborators

The following is a summary of the contribution of collaborators from the four manuscripts. Each has been categorized by the chapter for which they are found in this thesis.

Chapter 3: Gino De Angelis, Dr. Lucie Brosseau, Dr. George A. Wells, Dr. Barbara Davies, Dr. Judy King, and JM conceived and designed the systematic review. Analyzed the data: GD, SC. BD, JK, GAW, and LB contributed to the methods and review. GD, SC, LL performed the systematic review. GD wrote the paper.

Chapter 4: Gino De Angelis, Dr. Lucie Brosseau, Dr. George A. Wells, Dr. Barbara Davies, Dr. Judy King, and Jessica McEwan conceived and designed the systematic review. Jessica McEwan conducted the systematic literature search. Gino De Angelis and SMS collected and analyzed the data. Dr. Sabrina Cavallo, Dr. Barbara Davies, Dr. Judy King, Jessica McEwan, Dr. George A. Wells, and Dr. Lucie Brosseau contributed to the methods and review. Gino De Angelis wrote the paper.

Chapter 5: Gino De Angelis, Dr. Lucie Brosseau, Dr. George A. Wells, Dr. Barbara Davies, Dr. Judy King, and Jessica McEwan conceived and designed the feasibility study. Gino De Angelis collected and analyzed the data. Dr. Barbara Davies, Dr. Judy King, Dr. George A. Wells, and Dr. Lucie Brosseau contributed to the methods and review. Gino De Angelis wrote the paper.

Chapter 6: Gino De Angelis, Dr. Lucie Brosseau and Dr. George A. Wells conceived the study. Gino De Angelis is the principal investigator. Gino De Angelis, Dr. Lucie Brosseau and Dr. George A. Wells Dr. Judy King, and Dr. Barbara Davies contributed to the writing and revision of the protocol.

Part V: Appendices

Chapter 1 Appendices

Appendix 1.1 Publication #1

The following publication was published in 2016 in the JMIR Medical Education Journal and can be cited as: De Angelis G, Davies B, King J, McEwan J, Cavallo S, Loew L, Wells GA, Brosseau L

Information and Communication Technologies for the Dissemination of Clinical Practice Guidelines to Health Professionals: A Systematic Review. JMIR Med Educ 2016;2(2):e16

Review

Information and Communication Technologies for the Dissemination of Clinical Practice Guidelines to Health Professionals: A Systematic Review

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Abstract

Background: The transfer of research knowledge into clinical practice can be a continuous challenge for researchers. Information and communication technologies, such as websites and email, have emerged as popular tools for the dissemination of evidence to health professionals.

Objective: The objective of this systematic review was to identify research on health professionals' perceived usability and practice behavior change of information and communication technologies for the dissemination of clinical practice guidelines.

Methods: We used a systematic approach to retrieve and extract data about relevant studies. We identified 2248 citations, of which 21 studies met criteria for inclusion; 20 studies were randomized controlled trials, and 1 was a controlled clinical trial. The following information and communication technologies were evaluated: websites (5 studies), computer software (3 studies), Web-based workshops (2 studies), computerized decision support systems (2 studies), electronic educational game (1 study), email (2 studies), and multifaceted interventions that consisted of at least one information and communication technology component (6 studies).

Results: Website studies demonstrated significant improvements in perceived usefulness and perceived ease of use, but not for knowledge, reducing barriers, and intention to use clinical practice guidelines. Computer software studies demonstrated significant improvements in perceived usefulness, but not for knowledge and skills. Web-based workshop and email studies demonstrated significant improvements in knowledge, perceived usefulness, and skills. An electronic educational game intervention demonstrated a significant improvement from baseline in knowledge after 12 and 24 weeks. Computerized decision support system studies demonstrated variable findings for improvement in skills. Multifaceted interventions demonstrated significant improvements in beliefs about capabilities, perceived usefulness, and intention to use clinical practice guidelines, but variable findings for improvements in skills. Most multifaceted studies demonstrated significant improvements in knowledge.

Conclusions: The findings suggest that health professionals' perceived usability and practice behavior change vary by type of information and communication technology. Heterogeneity and the paucity of properly conducted studies did not allow for a clear comparison between studies and a conclusion on the effectiveness of information and communication technologies as a knowledge translation strategy for the dissemination of clinical practice guidelines.

(JMIR Med Educ 2016;2(2):e16) doi:10.2196/mededu.6288

KEYWORDS

health information technologies; electronic mail; email; Web 2.0; practice guidelines; health professions; information dissemination

Introduction

Success in regularly transferring research knowledge into clinical practice has been limited [1]. Evidence-based clinical practice guidelines (CPGs) are often not implemented effectively, resulting in the failure to achieve optimal health outcomes for patients [2]. Thus, efforts to reduce the knowledge-to-action gap remain a constant challenge among researchers and health professionals.

Knowledge translation (KT), the process of implementing knowledge into action, can provide methods for closing the knowledge-to-action gap [3]. With the emerging appeal of Web-based KT resources that allow for potential widespread reach through self-paced, self-directed learning, the Internet has become an important platform for KT initiatives such as CPG dissemination [4]. Information and communication technologies (ICTs) are defined as "technologies that provide access to information through telecommunications... [focusing] primarily on communication technologies. This includes the Internet, wireless networks, cell phones, and other communication mediums" [5]. ICTs have the potential to improve accessibility to CPGs. For example, digital CPGs can be continuously reviewed and updated with new evidence, while having the potential to be widely disseminated [6]. Furthermore, these Web-based tools provide both clinicians and consumers with a convenient method to access evidence-based CPGs [6].

Teaching modalities for medical education, including CPG dissemination, have evolved [7]. The development and implementation of novel teaching and dissemination strategies was prompted by research findings showing that traditional didactic seminars do not always modify behavior and learning competency [7]. Grimshaw et al [8] concluded that the evidence to guide choice of KT strategies targeting health professionals is incomplete. While the evidence of traditional KT strategies, such as printed educational materials [9], educational meetings [10], educational outreach [11], local opinion leaders [12], and audit and feedback [13], focusing on practice behavior change targeting health care professionals has been summarized [8], we have limited knowledge of the perceived usability and practice behavior among health professionals when using novel KT strategies such as ICTs for the dissemination of CPGs.

The objective of this systematic review was to summarize the evidence pertaining to the use of ICTs for the dissemination of CPGs to health professionals. Specifically, with this review we sought to provide new knowledge on health professionals' perceived usability and change in practice behavior when using ICTs to disseminate CPGs.

Methods

We conducted this systematic review using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [14]. To summarize the evidence, we used a systematic approach to retrieve relevant articles from the literature. Articles were selected for this review using the following predefined selection criteria guided by the population, intervention, comparison, outcome, and study design (PICOS) process.

We excluded studies if they did not meet the selection criteria (Table 1). We also excluded duplicate publications, narrative reviews, case series, case reports, data presented in abstract form only, conference proceedings, study protocols, and publications not written in English.

Table 1. Study selection criteria.

Criterion	Definition
Population	Health professionals (eg, physicians including medical residents, nurses, and physiotherapists)
Intervention	Information and communication technologies for disseminating clinical practice guidelines
Comparator	Information and communication technologies compared with each other or control (eg, no intervention)
Outcomes	Usability (eg, perceived usefulness and perceived ease of use)
	Practice behavior (eg, barriers, knowledge, skills, social/professional role and identity, optimism, beliefs about capabilities, beliefs about consequences, intentions, memory/attention/decision, environmental context and resources, social influences, and emotion)
Study design	Randomized controlled trials
	Nonrandomized comparative controlled trials

The literature search was performed by an information specialist. Published literature was identified by searching the following bibliographic databases up to the end of December 2015: MEDLINE, Cochrane Central Register of Controlled Trials, EMBASE, CINAHL, ERIC, and PsycINFO. The search was performed using terms to identify peer reviewed research in which ICTs and CPG dissemination were important features (Multimedia Appendix 1). A search of gray literature (literature that is not commercially published) was conducted by searching Google and other Internet search engines for additional Web-based publications. In addition, the searches were supplemented by hand searching the bibliographies of key articles. To ensure all ICTs would be captured in the literature search, including those that are older and established (eg, email), we did not place any date limits.

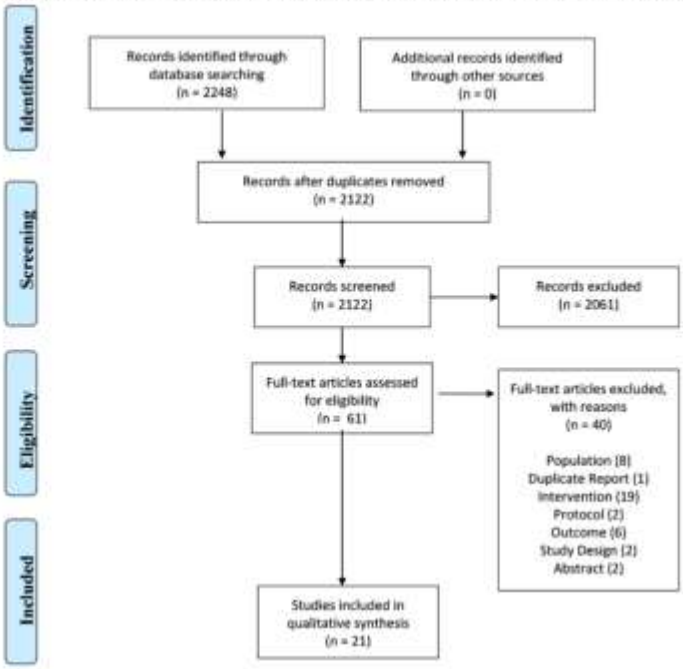
Titles and abstracts of all citations retrieved from the literature search were independently screened by 2 reviewers using Covidence (Veritas Health Innovation Ltd), a Web-based systematic review software. Full-text articles were then independently reviewed based on the selection criteria. Disagreements were resolved through discussion until consensus was reached. Figure 1 presents the study selection process in a PRISMA flow diagram.

Both descriptive data and results were extracted by 1 reviewer from each eligible article. The extraction was subsequently verified by a second reviewer. Data extraction forms were designed a priori to document and tabulate relevant study and patient characteristics, study findings, and authors' conclusions. We did not use data from figures if the data were not explicit. Studies were categorized by the type of ICT intervention used.

One reviewer independently assessed the quality of each study using the Cochrane risk of bias tool [15], which was subsequently checked for accuracy by a second reviewer. Disagreements were resolved through consensus. Risk of bias was assessed at the study level.

Given the broad inclusion criteria and heterogeneity of the interventions and methodological characteristics of included studies (guided by PICOS), we deemed a meta-analysis to be inappropriate, and we therefore conducted a narrative synthesis and summary of study findings. The outcomes of interest were the usability of the ICT intervention and practice behavior change.

Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram of included studies.



Usability

The usability outcomes were guided by the technology acceptance model (TAM2) [16], which illustrates that behavior intention to use a system is determined by perceived usefulness and perceived ease of use. Perceived usefulness is defined by Venkatesh and Davis [16] as "the extent to which a person believes that using the system will enhance his/her job performance" (pg 187), and perceived ease of use is defined as "the extent to which a person believes that using the system will be free of effort" (pg 187).

Practice Behavior

The theoretical domains framework (TDF) guided the practice behavior change outcomes [2]. The TDF identifies numerous behavior constructs and consists of 12 domains: (1) knowledge, (2) skills, (3) social or professional role and identity, (4) beliefs about capabilities, (5) beliefs about consequences, (6) motivation and goals, (7) memory, attention, and decision processes, (8) environmental context and resources, (9) social influences, (10) emotion regulation, (11) behavioral regulation, and (12) nature of the behavior. We categorized practice behavior outcomes by the domains listed above.

Results

We identified a total of 2248 citations through the initial search. After removing duplicates, we screened 2122 publication abstracts and titles. We assessed the full texts of 61 articles; of these, we excluded 40 for the following reasons: irrelevant

population (8 studies), duplicate report (1 study), irrelevant intervention (19 studies), study protocol (2 studies), irrelevant outcome (6 studies), inappropriate study design (2 studies), and presented as abstract only (2 studies). The excluded studies are listed in Multimedia Appendix 2. Figure 1 shows the PRISMA flow diagram.

Of the 21 studies that we included in our systematic review, 20 were randomized controlled trials (95%) and 1 was a controlled clinical trial (5%) [17-37] (Table 2). There were 7 primary ICT interventions that were used to disseminate CPGs: websites [17,22-25], computer software [26-28], Web-based workshops [20,29], computerized decision support systems (CDSSs) [30,31], electronic educational game [21], email [19,32], and multifaceted interventions that consisted of at least one ICT component [18,33-37].

Table 2. Type of information and communication technology (ICT) used in each included study.

ICT intervention	Number of studies	Studies
Website	5	Balamuth et al [22]; Bell et al [23]; Schroter et al [17]; Sassen et al [24]; Wolpin et al [25]
Computer software	3	Bullard et al [26]; Butzlaff et al [27]; Jousimaa et al [28]
Web-based workshops	2	Epstein et al [20]; Fordis et al [29]
Computerized decision support system	2	Gill et al [30]; Peremans et al [31]
Electronic educational game	1	Kerfoot et al [21]
Email	2	Lobach [19]; Stewart et al [32]
Multifaceted[a]	6	Bernhardsson et al [33]; Chan et al [34]; Desimone et al [35]; McDonald et al [36]; Fretheim et al [18]; Shenoy [37]

[a]Multifaceted intervention that consisted of at least one ICT component.

Multimedia Appendix 3 presents the study characteristics. Of the included studies, 11 (52%) involved only physicians [20-24,27-30,32,37], 3 (14%) involved only medicine residents and fellows (family or internal) [23,25,35], 3 (14%) involved only nurses [31,34,36], and 1 (5%) involved physiotherapists [33]. A total of 2 studies (10%) assessed both nurses and physicians [17,18], and another study (5%) assessed the combination of physicians, nurses, and medical residents [19].

In 8 studies, there was no comparison with an intervention [19,27,30,31,33,34], usual care [36], or usual education [35]. Another 2 studies were compared with a waiting list [24,32]. 10 studies were compared with active interventions [17,18,21-23,25,26,28,29,37], and 1 study was a pre-post design where assessments were conducted before and after the ICT intervention [20]. In terms of location, 10 studies were conducted in the United States [19,20,22,23,25,29,30,35-37], 3 were in Canada [26,32,34], 7 were in Europe [17,18,24,27,28,31,33], and 1 was an international study conducted in 63 countries [21]. Study durations and follow-up ranged from immediate posttest to 1 year postintervention.

Websites

The use of a website for the dissemination of CPGs to health professionals was assessed in 5 studies [17,22-25] (Table 3). Balamuth et al [22] compared a Web-based 1-page summary sheet of guidelines (n=128) with a weblink to guidelines (n=109) among physicians after 6 weeks. Schroter et al [17] compared an interactive Web-based tool combined with Web-based didactic material (n=527) with Web-based didactic material alone (n=527) among physicians and nurses after 4 months. Sassen et al [24] compared a website with educational modules (n=48) with a waiting list group (n=33) among orthopedic surgeons after 12 months. A further 2 studies involved only medicine residents and fellows [23,25]. Bell et al [23] compared self-study Web-based guidelines (n=79) with print-based guidelines (n=83) among family and internal medicine residents at immediate posttest and at 4 to 6 months postintervention. Wolpin et al [25] compared a website with enhanced learning modules (n=33) with a website containing usual care instructions (n=36) among medicine residents and fellows at 12 weeks postintervention.

Table 3. Summary of findings of included studies by primary information and communication technology (ICT) intervention.

ICT intervention	Study	Interventions	Outcome(s)	Effect size	Conclusion
Website					
	Balamuth, 2010 [22]	Web-based 1-page summary sheet of guidelines (n=128) Weblink to guidelines (n=109)	*Knowledge*: correctly diagnosed patients OR[a] (95% CI)	0.82 (0.49-1.4)	No statically significant difference between 2 groups in correctly diagnosing patients according to guidelines. Participants using the Web-based 1-page summary reported that the supplemental materials were more simple to use when compared with the weblink group.
			Perceived ease of use: simplicity of supplemental materials OR (95% CI)	6.1 (2.8-13.6)	
	Bell, 2000 [23]	Self-study Web-based guidelines (n=79) Print-based guidelines (n=83)	*Knowledge*: median (95% CI) score (out of 20) after immediate posttest	Web-based: 15.0 (14.0-15.0) Print based: 14.5 (14.0-15.0) *P*=.20	No statistically significant difference in knowledge at immediate posttest or after 4-6 months. Web-based guideline users were more satisfied with learning.
			Knowledge: median (95% CI) score (out of 20) after 4-6 months	Web-based: 12.0 (11.0-13.0) Print based: 11.0 (10.0-12.0); *P*=.12)	
			Perceived ease of use: median (95% CI) learner satisfaction scores (range 5-20, higher = better)	Web-based: 17.0 (16.0-18.0) Print-based: 15.0 (15.0-16.0); *P*<.001	
	Schroter, 2011 [17]	Website with educational modules (n=48) Waiting list (n=33)	*Knowledge*: mean % change (SD) from baseline knowledge at 4 months	Web-based plus Web material: 47.4% (12.6) to 66.8% (11.5) Web-based material only: 47.3% (12.9) to 67.8% (10.8); *P*=.19	No statistically significant differences in knowledge change or usability between the 2 groups. Participants in Web-based tool plus Web material group found it to be useful. Usefulness was not measured in the other group.
			Perceived usefulness: % of participants who reported the tool to be very useful/useful	Web-based plus Web material: 77% Web-based material only: NR[b]	
	Sassen, 2014 [24]	Website with educational modules (n=48) Waiting list (n=33)	*Intention* to use material to educate patients: mean (SD) score out of 7 (higher = easier) at baseline and 12 months	Website: 6.25 (1.00), 6.06 (1.11) Waiting list: 5.87 (1.15), 6.02 (0.91), *P*=.12	No statistically significant differences in intention to use and barriers between interventions groups at 12 months.
			Barriers to using the material to educate patients: mean (SD) score out of 7 (higher = easier) at baseline and 12 months	Website: 3.11 (1.17), 3.18 (1.12) Waiting list: 2.78 (1.01), 2.63 (0.96), *P*=.46	
	Wolpin, 2011 [25]	Website enhanced learning (additional case studies) (n=33) Website with usual care instructions (same content, without case studies) (n=36)	*Knowledge*: mean (SD) score % on knowledge content of CPGs[c] pretest and immediate posttest	Overall (pooled both groups): 79.28% (12.17), 82.32% (13.84), *P*=.10 Website (enhanced) 78.18% (11.1), 79.39% (15.0) Website (usual): 80.28% (13.2), 85.0% (12.3)	No statistically significant difference in knowledge or satisfaction at posttest between intervention groups. No statistically significant differences were seen between interventions groups for both outcomes.

ICT intervention	Study	Interventions	Outcome(s)	Effect size	Conclusion
			Perceived ease of use: overall satisfaction with learning experience, mean (SD) score (1-5, higher = very satisfied), pretest and immediate posttest	Overall (pooled both groups): 4.08 (0.860) Website (enhanced) 78.18 (11.1), 79.39 (15.0) Website (usual): 80.28 (13.2), 85.0 (12.3), *P*=.13	
Computer software					
	Bullard, 2004 [26]	Wirelessly networked mobile computer program (n=10)[d] Desktop computer program (n=10)[d]	*Perceived usefulness*: "impact on efficiency" mean (95% CI) score out of 7	Wireless: 3.2 (2.6-3.8) Desktop: 4.3 (4.0-4.6), *P*=.02	Statistically significant greater satisfaction for several items ("impact on efficiency," "increase use of CPGs," and "saving time") when using the wireless computer compared with the desktop computer. Other satisfaction items such as "configuration," "availability," "reduced communication with staff and patients," and "accessibility" did not show statistically significant differences (results not shown). Participants appeared to be indifferent regarding the usability of the wireless computer for their efficiency.
			Perceived usefulness: "increased use of CPGs" mean (95% CI) score out of 7 (7 = excellent)	Wireless: 4.1 (3.6-4.6) Desktop: 3.5 (2.9-4.0), *P*=.03	
			Perceived usefulness: "wireless computer program made participant more efficient," mean (95% CI) score out of 7 (7 = strongly agree)	Wireless: 3.30 (2.33-4.27) Desktop: NR	
	Butzlaff, 2004 [27]	CPGs via CD-ROM/Internet (n=53) No intervention (n=66)	*Knowledge*: median (IQR[e]) score out of 25 at baseline	CD/Internet: 13 (12-16) No intervention: 13 (10-15.25), *P*=.40	There was no statistically significant difference between intervention groups at baseline and ~70 postintervention in knowledge scores.
			Knowledge: median (IQR) score out of 25 at ~70 days posttest	CD/Internet: 15 (12-17) No intervention: 13 (11-15.25), *P*=.10	
	Jousimaa, 2002 [28]	CD-ROM computer-based guidelines (n=72) Textbook-based guidelines (n=67)	*Skills*: compliance with CPGs, "laboratory examinations," OR (95% CI)	1.07 (0.79-1.44)	There was no statistically significant difference between intervention groups for compliance with CPGs for laboratory, radiological, or physical examinations.
			Skills: compliance with CPGs, "radiological examinations," OR (95% CI)	1.09 (0.81-1.46)	
			Skills: compliance with CPGs, "physical examinations," OR (95% CI)	0.74 (0.51-1.06)	

ICT intervention	Study	Interventions	Outcome(s)	Effect size	Conclusion
Web-based workshops					
	Epstein, 2011 [20]	Web-based didactic education session/workshop (n=27) No intervention (received intervention after 6 months) (n=22)	*Skills*: compliance with CPGs, "use of parent ratings of ADHD[f] during assessment," mean % change from baseline at 6 months	Web: 23.8% No intervention: 5.7%, *P*=.03	Statistically significant changes from baseline to 6 months were seen among participants complying with CPG-recommended ADHD care practices, with the exception of 1 recommendation, "Use of parent ratings of ADHD to monitor treatment responses" (results not shown).
			Skills: compliance with CPGs, "use of teacher ratings of ADHD during assessment," mean % change from baseline at 6 months	Web: 22.6% No intervention: 6.0%, *P*=.04	
			Skills: compliance with CPGs, "use of [*Diagnostic and Statistical Manual of Mental Disorders* (Fourth Edition)] ADHD criteria during assessment," mean % change from baseline at 6 months	Web: 47.3% No intervention: 17.9%, *P*=.03	
			Skills: compliance with CPGs, "use of outside provider for ADHD diagnosis," mean % change from baseline at 6 months	Web: −60.7% No intervention: −10.7%, *P*<.001	
			Skills: compliance with CPGs, "use of teacher ratings of ADHD to monitor treatment responses," mean % change from baseline at 6 months	Web: 38.7% No intervention: 6.3%, *P*=.003	
	Fordis, 2005 [29]	Live Web-based CME[g] workshop (n=51) Web-based CME workshop (n=52) No intervention (n=20)	*Knowledge*: the 2 active CME interventions combined: mean % change (95% CI) from baseline to immediate posttest	31.0% (95% CI 27.0%-35.0%), *P*<.001	A statistically significant improvement in knowledge was seen over time for both Web-based interventions groups. A statistically significant decrease in appropriately screening patients was seen in the live Web-based CME group at 12 weeks posttest compared with baseline. No statistically significant differences were seen for screening patients between interventions groups. There was a statistically significant increase in the proportion of patients appropriately treated by the Web-based CME group compared with the live CME and control groups. Participants in the Web-based interventions were satisfied with the learning experience.
			Knowledge: the 2 active CME interventions combined: mean % change (95% CI) from baseline to 12 weeks posttest	36.4% (95% CI 32.2%-40.6%), *P*<.001	

ICT intervention	Study	Interventions	Outcome(s)	Effect size	Conclusion
			Knowledge: the 2 active CME interventions combined: mean % change (95 CI) from immediate posttest to 12 weeks posttest	5.4% (95% CI 2.6%-8.2%)	
			Skills: patients appropriately screened for dyslipidemia, mean % change (95% CI) from baseline to 12 weeks postintervention	Live Web-based: −3.3 (−5.9 to −0.7) Web-based: −0.1 (−2.9 to 2.6) No intervention: −0.8 (−3.5 to 1.8), *P*=.24	
			Skills: patients appropriately treated for dyslipidemia, mean % change from baseline to 12 weeks postintervention	Live Web-based: −1.1 (−4.9 to 2.7) Web-based: 5.0 (1.0-9.1) No intervention: 1.2 (−2.8 to 5.1), *P*=.04	
			Perceived usefulness: % of participants satisfied with the learning experience	Live Web-based: 100% (49/49) Web-based: 94% (44/47) No intervention: NR	
Computerized decision support system					
	Gill, 2011 [30]	EHR[h]-based clinical decision support (n=53) No intervention (n=66)	*Skills*: % of patients receiving guideline-concordant care, OR (95% CI)	EHR: 25.4% No intervention: 22.4%, OR 1.19 (1.01-1.42)	There was a statistically significant difference favoring the EHR intervention compared with no intervention for the proportion of patients receiving guideline-concordant care.
	Peremans, 2010 [31]	EHR-based clinical decision support (n=15) Empowered patient group (n=15) No intervention (n=13)	*Skills*: consultation and prescribing skills based on a 48-item checklist, mean difference (95% CI) from baseline to 5 months postintervention	EHR: −1.79 (−4.97 to 1.65) Empowered: 4.92 (1.96-7.89) No intervention: −0.91 (−3.37 to 1.92)	The empowered patient group was the only group that had improved consultation and prescribing skills scores after 5 months postintervention and the only intervention that demonstrated a statistically significant difference compared with no intervention.
Electronic educations game					
	Kerfoot, 2009 [21]	Electronic game/survey 2 questions every 2 days (n=735) Electronic game/survey 4 questions every 4 days (n=735)	*Knowledge*: median % (IQR) scores for knowledge test baseline	Electronic game 2 questions every 2 days: 48% (18) Electronic game 4 questions every 4 days: 45% (15)	Both electronic game cohorts demonstrated statistically significant improvements in knowledge compared with baseline.
			Knowledge: median % (IQR) scores for knowledge test postintervention (12 or 24 weeks), *P* value	Electronic game 2 questions every 2 days: 100% (3) Electronic game 4 questions every 4 days: 98% (8), *P*<.001	

ICT intervention	Study	Interventions	Outcome(s)	Effect size	Conclusion
Email					
	Lobach, 1996 [19]	Biweekly emails of computer-based audit/feedback program (n=22) No intervention (n=23)	*Skills*: median % (IQR) participant compliance with guidelines, *P* value	Email: 35.3% (NR[1]) No intervention: 6.1% (NR[1]), *P*=.01	The email intervention demonstrated statistical significance in greater compliance with guidelines compared with no intervention.
	Stewart, 2005 [32]	Email Web-based learning for 2 evidence-based modules (type 2 diabetes, prevention) (n=27) Waiting list (n=31)	*Knowledge*: mean (SD) score (out of 100) at baseline	Email (diabetes): 66.8 (14.1) Email (prevention): 53.8 (12.8) Waiting list (diabetes): 68.6 (10.4) Waiting list (prevention): 51.9 (9.5)	The intervention group (prevention module) demonstrated statistically significant improvements compared with the control group for knowledge at 2 and 6 months, as well as compliance at 6 months. There was no statistically significant difference with the diabetes modules.
			Knowledge: mean (SD) score (out of 100) at 2 months postintervention, *P* value	Email (diabetes): 72.7 (14.1) Email (prevention): 63.8 (17.6) Waiting list (diabetes): 67.7 (16.8), *P*=.57 Waiting list (prevention): 50.5 (13.8), *P*=.002	
			Knowledge: mean (SD) score (out of 100) at 6 months postintervention, *P* value	Email (diabetes): 73.2 (7.7) Email (prevention): 65.7 (15.2) Waiting list (diabetes): 68.6 (11.4), *P*=.14 Waiting list (prevention): 53.3 (10.5), *P*=.004	
			Skills: mean (SD) score for compliance with guidelines (out of 100) at baseline	Email (diabetes): 53.8 (12.5) Email (prevention): 52.2 (11.1) Waiting list (diabetes): 51.2 (11.6) Waiting list (prevention): 51.1 (14.4)	
			Skills: mean (SD) score for compliance with guidelines (out of 100) at 2 months postintervention, *P* value	Email (diabetes): 51.7 (12.9) Email (prevention): 52.2 (11.7) Waiting list (diabetes): 51.6 (9.5), *P*=.90 Waiting list (prevention): 47.7 (13.8), *P*=.11	
			Skills: mean (SD) score for compliance with guidelines (out of 100) at 6 months postintervention, *P* value	Email (diabetes): 47.1 (9.2) Email (prevention): 55.0 (10.0) Waiting list (diabetes): 50.8 (9.1), *P*=.14 Waiting list (prevention): 50.0 (14.4), *P*=.03	

ICT intervention	Study	Interventions	Outcome(s)	Effect size	Conclusion
Multifaceted					
	Bernhardsson, 2014 [33]	Multifaceted: implementation seminar/group discussion, website, and email reminders (n=168) No intervention (n=88)	*Knowledge*: change in % of participants who were aware that guidelines exist from baseline to 1-year follow-up, *P* value	Intervention: 27.9% No intervention: 7.3%, *P*=.02	There was a statistically significant difference favoring the intervention group for change in awareness, knowledge of where to find guidelines, and accessibility of guidelines at 1-year follow-up. There were no significant differences in frequent use of CPGs.
			Knowledge: change in % of participants who knew where to find guidelines from baseline to 1-year follow-up, *P* value	Intervention: 25.2% No intervention: 4.8%, *P*=.007	
			Perceived ease of use: change in % of participants who felt guidelines were easy to access from baseline to 1-year follow-up, *P* value	Intervention: 17.4% No intervention: −4.3%, *P*<.001	
			Skills: change in % compliance with use of CPGs (frequently or almost always)	Intervention: 9.2% No intervention: −0.2%, *P*=.30	
	Chan, 2013 [34]	Multifaceted: in-person education session and Web-based support (n=31) No intervention (n=22)	*Beliefs about capabilities*: change in % (95% CI) of participants who were self-confident in following CPGs at 2 weeks postintervention	Intervention: 25.9% (4.2 to 45.5) No intervention: 6.3% (−2.0 to 32.1)	There were statistically significant improvements in self-confidence to use, satisfaction in following, and willingness to follow CPGs among the intervention group at 2 weeks postintervention. There were no significant improvements among the control group.
			Perceived usefulness: change in % (95% CI) of participants who were satisfied in following CPGs at 2 weeks postintervention	Intervention: 40.7% (16.1-59.6) No intervention: −12.5 (−37.3 to 12.7)	
			Intention: willingness to use new CPGs, mean score change (95% CI) (out of 4, 4=all CPGs) at 2 weeks postintervention	Intervention: 0.74 (0.36-1.1) No intervention: 0.19 (−0.10 to 0.48)	
	Desimone, 2012 [35]	Multifaceted: in-person education, Web-based support, printed materials (n=11) Usual education (n=11)	*Knowledge*: mean % (SD) of correct responses (11 items) at baseline	Multifaceted: 69% (1.7) Usual education: 76% (1.2)	There was a statistically significant improvement in knowledge in both groups at 1 month postintervention. There were no observable differences between groups (between-group statistical analyses not performed).
			Knowledge: mean % (SD) of correct responses (11 items) at 1 month postintervention, *P* value	Multifaceted: 83% (2.1), *P*=.003 Usual education: 84% (1.4), *P*=.02	

ICT intervention	Study	Interventions	Outcome(s)	Effect size	Conclusion
	McDonald, 2005 [36]	Multifaceted: email reminder with provider prompts, patient education material, and clinical nurse specialist outreach (n=97) Email reminder of recommendations (n=121) Usual care (n=118)	*Skills*: adjusted mean difference in probability that participant assessed bowel movement based on CPG compared with usual care, *P* value	Email reminder: −5.7, *P*=.02 Multifaceted: −2.7, *P*=.26	In the email reminder intervention group, there was a decrease in performance, as the probability of nurses completing bowel movement assessments was statistically significantly lower compared with usual care. There was no statistically significant difference compared with the multifaceted group. Other nurse assessment and instruction practices did not reach statistical significance when the email reminder and multifaceted interventions were compared with usual care (results not shown).
	Fretheim, 2006 [18]	Multifaceted: educational outreach visit, audit and feedback at outreach visit, computerized reminders, risk assessment tools, patient information material, telephone follow-up (n=257) Passive guideline dissemination (no additional active promotion or encouragement for use of guidelines) (n=244)	*Skills*: mean change in % participants prescribing in concordance to CPGs from baseline to 12 months, between-group difference RR[i] (95% CI)	Multifaceted: 11.5% Passive dissemination: 2.2%, 1.94 (1.49-2.49)	There was a statistically significant difference in participants prescribing in concordance to CPGs from baseline to 12 months favoring the multifaceted group compared with passive guidelines dissemination. No statistically significant differences were demonstrated for differences in participants performing risk assessments at 12 months.
			Skills: between-group difference in mean % participants performing risk assessments according to CPGs at 12 months, RR (95% CI)	1.04 (0.60-1.71)	
	Shenoy, 2013 [37]	Multifaceted: Web-based education, audit, feedback (n=24) Mailed guidelines (n=21)	*Knowledge*: mean change (95% CI) in total score (18 clinical vignettes) from baseline to 12 weeks postintervention	0.04 (1.22-1.31)	There was no statistically significant change in knowledge between intervention groups from baseline to 12 weeks postintervention. There was no statistically significant difference between intervention groups for the proportion of patients receiving CPG-adherent care at 12 weeks postintervention (results not shown).

[a]OR: odds ratio.

[b]NR: not reported.

[c]CPG: clinical practice guideline.

[d]Crossover design with same participants in both groups.

[e]IQR: interquartile range (25th to 75th percentile).

[f]ADHD: attention-deficit/hyperactivity disorder.

[g]CME: continuing medical education.

[h]EHR: electronic health record.

[i]IQR values illustrated in a diagram; however, values are not explicit.

[j]RR: relative risk.

Usability

Perceived usefulness was assessed in 1 study [17]. There was no statistically significant difference between intervention groups in regard to the proportion of physicians and nurses finding the intervention to be usable for integrating the learning into clinical practice. However, 76.7% (218/284) of physicians and nurses in the interactive Web-based tool plus Web-based didactic material found the intervention to be "very useful/useful." Usability was not measured in the Web-based

didactic material-alone group and no comparative statistical analyses were performed.

Perceived ease of use was assessed in 3 studies [22,23,25]. Balamuth et al [22] found that physicians using the Web-based 1-page summary reported that the supplemental materials were "simpler" to use than did the group using a weblink to guidelines (odds ratio, OR 6.1, 95% CI 2.8-13.6). In 1 of the studies involving only medicine residents and fellows by Bell et al [23], the median (95% CI) learner satisfaction scale score (out of 20) was statistically significantly greater (P<.001) in the self-study Web-based guidelines group (OR 17.0, 95% CI 16.0-18.0) than in the print-based guidelines group (OR 15.0, 95% CI 15.0-16.0). In Wolpin et al [25], the other study involving only medicine residents and fellows, there was no statistically significant difference in overall satisfaction with learning experience between the intervention groups.

Practice Behavior

Knowledge was assessed in 4 studies [17,22,23,25]. In all 4 studies, there was no statistically significant improvement in knowledge when compared with respective comparators.

Intention to use CPGs and reduction in barriers were assessed in 1 study [24]. There was no statistically significant difference between groups for intention to use material to educate patients, and no statistically significant difference in reduced barriers to using the material to educate patients.

Computer Software

The use of computer software for the dissemination of CPGs among health professionals was assessed in 3 studies [26-28] (Table 3). Bullard et al [26] used a crossover design to compare a wirelessly networked mobile computer program with a desktop computer program among physicians (n=10) after 8-hour shifts. Butzlaff et al [27] compared CPGs provided by CD-ROM and Internet (n=53) with no intervention (n=66) among physicians after approximately 70 days. Jousimaa et al [28] compared CD-ROM computer-based guidelines (n=72) with textbook-based guidelines (n=67) among physicians after 1 month.

Usability

Perceived usefulness was assessed in 1 study [26]. Statistically significant mean (95% CI) satisfaction scores (out of 7, with 7 representing excellent) favored the wireless network mobile computer program group compared with the desktop computer program group for several items such as "impact on efficiency" (OR 3.2, 95% CI 2.6-3.8 vs OR 4.3, 95% CI 4.0-4.6, P=.02), "increased use of CPGs" (OR 4.1, 95% CI 3.6-4.6 vs OR 3.5, 95% CI 2.9-4.0, P=.03), and "saving time" (OR 3.1, 95% CI 2.3-3.9 vs OR 4.2, 95% CI 3.6-4.7, P=.05). Other satisfaction items such as "configuration," "availability," "reduced communication with staff and patients," and "accessibility" did not show statistically significant differences between intervention groups. Physicians appeared to be indifferent regarding the usability of the wireless computer with respect to their efficiency, with a mean (95% CI) score (out of 7, with 7 representing strongly agree) of 3.30 (2.33-4.27). Usability of the desktop computer program was not assessed.

Practice Behavior

Knowledge was assessed in 1 study [27]. There was no statistically significant difference in knowledge scores between intervention groups.

Skills were assessed in 1 study [28]. There was no statistically significant difference between intervention groups for compliance skills with CPGs for laboratory, radiological, or physical examinations.

Web-Based Workshops

The use of Web-based workshops for the dissemination of CPGs among health professionals was assessed in 2 studies [20,29] (Table 3). Epstein et al [20] compared a Web-based didactic education session or workshop (n=27) with no intervention (n=22) among pediatricians after 6 months. Participants in the Web-based didactic education workshop group received four 1-hour training sessions with instructions to use an Internet portal to assess attention-deficit/hyperactivity disorder (ADHD), titrate and monitor responses to medications, and communicate with patients and their parents and teachers using a Web-based report card. Fordis et al [29] compared a live Web-based continuing medical education (CME) workshop (n=51) with a Web-based (nonlive) CME workshop (n=52) and with no intervention (n=20) among physicians after 12 weeks.

Usability

Perceived usefulness was assessed in 1 study [29]. The proportion of physicians satisfied with the learning experience was 100% (49/49) for the live CME group and 94% (44/47) for the Web-based CME group. No comparative statistical analyses were performed for the perceived usefulness outcome.

Practice Behavior

Skills were assessed in both studies [20,29]. In Epstein et al [20], the Web-based didactic education workshop group demonstrated statistically significant improvements (mean percentage change from baseline) in ADHD care practices when compared with no intervention for the following CPG recommendations: "use of parent ratings of ADHD during assessment" (23.8% vs 5.7%, P=.03), "use of teacher ratings of ADHD during assessment" (22.6% vs 6.0%, P=.04), "use of DSM-IV [*Diagnostic and Statistical Manual of Mental Disorders* (Fourth Edition)] ADHD criteria during assessment" (47.3% vs 17.9%, P=.03), "use of outside provider for ADHD diagnosis" (–60.7% vs –10.7%, P<.001), and "use of teacher ratings of ADHD to monitor treatment responses" (38.7% vs 6.3%, P=.003). In Fordis et al [29], among the 3 intervention groups, there was no change from baseline screening levels following the intervention and no statistically significant differences between interventions groups. There was a statistically significant (P=.04) increase in the mean proportion (95% CI) of patients appropriately treated by the Web-based CME group (5.0%, 1.0%-9.1%) when compared with the live CME (−1.1%, −4.9% to 2.7%) and control groups (1.2%, −2.8% to 5.1%).

Knowledge was assessed in 1 study [29]. There was a statistically significant (P<.001) improvement in knowledge for both Web-based interventions groups combined, with a mean

(95% CI) change of 31.0% (27.0%-35.0%) from baseline to immediate posttest, and 36.4% (32.2%-40.6%) to 12 weeks posttest.

Computer Decision Support System

The use of CDSSs for the dissemination of CPGs among health professionals was assessed in 2 studies [30,31] (Table 3). According to Peremans et al [31], a CDSS is defined as "any software designed to directly aid clinical decision making, whereby individual patient records are matched with a computer database of guidelines" (pg 281). Peremans et al [31] compared an electronic health record (EHR)-based CDSS intervention (n=15) with a group receiving a visit by a simulated "empowered" patient (n=15) and with no intervention (n=13). Gill et al [30] compared an EHR-based CDSS intervention (n=53) with no intervention (n=66) among physicians and clinicians in ambulatory practices after 12 months.

Usability

Usability was not assessed in any of the included studies that used CDSSs for the dissemination of CPGs.

Practice Behavior

Skills were assessed in both studies [30,31]. In Peremans et al [31], the role of the simulated patient was to ask the physician specific clinical questions (a clinical scenario that was agreed upon by a panel of authors and researchers) regarding the prescribed pills she had received. The empowered-patient group was the only group that had statistically significant improved mean scores (out of 48 points) for consultation and prescribing skills after 5 months postintervention when compared with no intervention, with a mean (95% CI) difference of 4.92 (1.96-7.89). In Gill et al [30], there was a statistically significant difference favoring the EHR-based CDSS intervention compared with no intervention for delivering guideline-concordant care (OR 1.19, 95% CI 1.01-1.42).

Electronic Educational Game

The use of an electronic educational game for the dissemination of CPGs among health professionals was assessed in 1 study [21] (Table 3). Kerfoot et al [21] compared an electronic educational game with a survey containing 2 questions distributed every 2 days (n=735) with a group receiving the same game, but with a survey containing 4 questions distributed every 4 days (n=735) among urologists after 34 weeks.

Usability

Usability was not assessed in Kerfoot et al [21].

Practice Behavior

Both game groups demonstrated statistically significant ($P<.001$) improvements in knowledge compared with baseline, with median scores of 48.0% (interquartile range, IQR 18) versus 100.0% (IQR 3) for the electronic game cohort answering 2 questions every 2 days, and 45.0% (IQR 15) versus 98.0% (IQR 8) for the cohort answering 4 questions every 4 days.

Email

The use of email for the dissemination of CPGs among health professionals was assessed in 2 studies [19,32] (Table 3). Lobach [19] compared biweekly emails of a computer-based audit and feedback program (n=22) with no intervention (n=23) among physicians, general internists, nurses, physician assistants, and family medicine residents after 12 weeks. Stewart et al [32] examined the use of email to disseminate 2 separate evidence-based modules on diabetes and prevention (n=27) compared with a waiting list (n=31) among physicians after 6 months.

Usability

Usability was not assessed in any of the included studies that used email for the dissemination of CPGs.

Practice Behavior

Skills were assessed in both studies [19,32]. In Lobach [19], there was a statistically significant difference favoring the email intervention compared with no intervention for median rate of compliance with CPGs (35.3% vs 6.1%, $P=.01$). In Stewart et al [32], there was a statistically significant difference ($P=.03$) in skills favoring the email intervention compared with the waiting list, with mean (SD) compliance scores (out of 100) of 55.0 (10.0) versus 50.0 (14.4) for the prevention modules at 6 months. There was no statistically significant difference in compliance scores between intervention groups for the diabetes modules at 6 months and for both modules at 2 months.

Knowledge was assessed in 1 study [32]. There was a statistically significant difference ($P=.002$) favoring the email intervention compared with the waiting list, with mean (SD) knowledge scores (out of 100) of 63.8 (17.6) versus 50.5 (13.8), and 65.7 (15.2) versus 53.3 (10.5) for the prevention modules at 2 months and 6 months, respectively. There was no statistically significant difference in knowledge scores between intervention groups for the diabetes modules at 2 and 6 months.

Multifaceted ICT Interventions

The use of a multifaceted intervention including an ICT with more than one CPG dissemination strategy among health professionals was assessed in 6 studies [18,33-37] (Table 3). Bernhardsson et al [33] compared the combination of an implementation seminar with group discussion, a website, and email with no intervention (n=88) among physiotherapists after 12 months. Shenoy [37] compared the combination of Web-based education and audit and feedback (n=24) with mailed CPGs (n=21) among physicians after 5 months. Fretheim et al [18] compared the combination of an educational outreach visit, audit and feedback at the outreach visit, computerized reminders, risk assessment tools, patient information material, and telephone follow-up (n=257) with passive guideline dissemination (no additional active promotion or encouragement for the use of guidelines) (n=244) among physicians and practice nurses after 45 days. Chan et al [34] compared the combination of an in-person education session and Web-based support (n=31) with no intervention (n=22) among nurses after 2 weeks. Desimone et al [35] compared the combination of in-person education, Web-based support, and printed materials (n=11) with usual education (n=11) among internal medicine residents after 4 weeks. McDonald et al [36] compared the combination of email reminders with provider prompts, patient education material, and clinical nurse specialist outreach (n=97) with email

reminders of recommendations only (n=121) and usual care (n=118) among primary care and family medicine residents after 24 months.

Usability

Usability was assessed in 1 study [33]. There was no statistically significant difference between intervention groups for the change in proportion of physiotherapists who felt the CPGs were easy to access and the proportion of those who used the CPGs frequently.

Perceived usefulness was assessed in 1 study [34]. There was a statistically significant improvement in the proportion of nurses who were satisfied in following the CPGs at 2 weeks postintervention compared with baseline among the multifaceted intervention group, with a mean (95% CI) of 40.7% (16.1%-59.6%).

Practice Behavior

Knowledge was assessed in 3 studies [33,35,37]. In Bernhardsson et al [33], there were statistically significant improvements from baseline favoring the intervention group compared with no intervention for the proportion of physiotherapists who were aware that guidelines exist (27.9% vs 7.3%, P=.02) and the proportion of physiotherapists who were aware of where to find guidelines (25.2% vs 4.8%, P=.007). In Shenoy [37], there was no statistically significant improvement in knowledge among either the multifaceted intervention or the mailed guidelines groups. In the study involving only medicine residents and fellows by Desimone et al [35], there was a statistically significant improvement in correct responses (out of 11 items) from baseline in both intervention groups, with mean (SD) proportions for the multifaceted intervention group (83%, SD 2.1% vs 69%, SD 1.7%, P=.003) and the usual education group (84%, SD 1.4% vs 76%, SD 1.2%, P=.02).

Skills were assessed in 3 studies [18,33,36]. In McDonald et al [36], the probability of nurses completing bowel movement assessments was statistically significantly lower in the email reminder intervention group (P=.02) than in the usual care group, with an adjusted mean difference of −5.7% (89.0% vs 94.7%), representing a decrease in performance. There was no statistically significant difference compared with the multifaceted intervention group. Other nurse assessment and instruction practices did not reach statistical significance when the email reminder and multifaceted interventions were compared with usual care. In Fretheim et al [18], there was a statistically significant difference in the proportion of physicians and practice nurses prescribing in concordance to CPGs from baseline to 12 months favoring the multifaceted group (11.5%) compared with the passive guidelines dissemination group (2.2%), with a relative risk (95% CI) of 1.94 (1.49-2.49). There was no statistically significant difference between intervention groups for physicians and practice nurses performing risk assessments at 12 months. In Bernhardsson et al [33], there was no statistically significant difference between intervention groups for change in the proportion of physiotherapists who "frequently or almost always" used the CPGs.

Beliefs about capabilities and intention to use CPGs were assessed in 1 study [34]. There was a statistically significant improvement in the proportion of nurses who were self-confident in following the CPGs at 2 weeks postintervention compared with baseline among the multifaceted intervention group, with a mean (95% CI) of 25.9% (4.2%-45.5%). There was a statistically significant improvement in intention to use the new CPGs when compared with baseline among the multifaceted intervention group, with a mean (95% CI) change in score (out of 4, with 4 representing willingness to use all CPGs) of 0.74 (0.36-1.1). There was no statistically significant improvement among the control group for each of the outcomes listed above.

Discussion

The aim of this review was to identify research on health professionals' perceived usability and practice behavior with ICTs for the dissemination of CPGs. In summary, results varied by the type of ICT used. While rapidly changing technologies may pose challenges for the development, implementation, and evaluation of ICT-based interventions, as they may be associated with greater barriers for adoption by health professionals [38], there were no apparent trends when comparing established and older ICTs (eg, email and computer software) versus newer emerging ICT interventions (eg, electronic educational games, Web-based workshops, and the multifaceted ICT interventions). Studies using websites to disseminate CPGs [17,22-25] demonstrated no improvements in knowledge [17,22,23,25], reduced barriers [25], or intentions to use CPGs [25]. There were positive effects for perceived usefulness [17] and perceived ease of use [22,23] (2 of 3 studies). Studies using computer software [26-28] demonstrated no improvements in knowledge [27] or skills [28], but an effect on perceived usefulness [26]. We found that 2 studies using Web-based workshops [20,29] demonstrated improvements in knowledge [29] and perceived usefulness [29] and skills [20,29]. Studies using CDSSs demonstrated variable results for skills, as 1 study [30] demonstrated a positive effect, while the other did not [31]. While both studies were compared with no intervention, it should be noted that in the latter study [31], the non-ICT intervention (empowered patient group) was the only group that demonstrated a positive effect when compared with no intervention. The 1 study that used an electronic educational game [21] demonstrated an improvement in knowledge. Studies using email [19,32] demonstrated improvements in knowledge [32] and skills [19,32]. Studies using multifaceted ICT interventions [18,33-37] demonstrated improvements in knowledge [33,35] (2 of 3 studies), perceived usefulness [34], perceived ease of use [33], intention to use CPGs [34], beliefs about capabilities [33], and skills [37] (1 of 2 studies). While the multifaceted interventions in this review mostly demonstrated positive findings for improvements in usability and practice behavior, it remains unclear whether they are in fact superior to single interventions. Grimshaw et al [8] revealed that effect sizes in multifaceted interventions do not necessarily increase with increasing number of components, and these types of interventions appear to be more costly than single interventions. Similarly, a review by Squires et al [39] concluded that there is a lack of compelling evidence to demonstrate that

multifaceted interventions are more effective than single interventions.

Outcome selection was guided by both the TAM2 [16] and the TDF [2]. We chose the TAM2 because it was originally designed to predict ICT acceptance and usage in the workplace and has been widely used for diverse sets of ICT users [40]; we chose the TDF because it simplifies and integrates many behavior change theories, including social cognitive theory, learning theory, and diffusion theory [2]. The TAM2 is a validated and robust theoretical framework that has been used for predicting and explaining behavior related to ICTs [16]. In addition to cognitive instrumental processes, the TAM2 encompasses social influence processes, including subjective norms, which have shown to explain the perceived usefulness of ICTs [41]. Developed from a synthesis of psychological theories, the TDF is an integrative framework that has been shown to be useful and flexible for the assessment of behavior change and barriers among a diverse group of health professionals working in various clinical settings [42]. Together, both theoretical frameworks provided a comprehensive list of outcomes to measure health professionals' usability and practice behavior change of ICTs for the dissemination of CPGs.

The variable findings in knowledge improvement are supported by a recent systematic review [7] of educational strategies for teaching medical trainees, which found no difference in learner outcomes when comparing lecture-based versus Web-based strategies. While previous reviews have assessed interventions for promoting ICT adoption [43] and KT dissemination strategies focusing on practice behavior change among health professionals [8] distinctly, this systematic review adds to the body of literature by summarizing current evidence pertaining to health professionals' perceived usability and practice behavior change with ICTs, specifically for the dissemination of CPGs. A systematic review by Gagnon et al [43] concluded that there is very limited evidence on effective interventions promoting the adoption of ICTs by health care professionals, while a systematic review by Grimshaw et al [8] concluded that the evidence to guide the choice of KT strategies targeting health professionals is incomplete. Understanding how health professionals engage with and use ICTs to access CPGs will enable health care provider organizations to create content that is more Web friendly [44]. While the evidence is limited, studies of ICTs included in this review have shown promising findings. ICTs are novel ways of disseminating CPGs, compared with more traditional methods such as printed educational materials [9], educational meetings [10], educational outreach [11], local opinion leaders [12], and audit and feedback [13]. This review highlights which ICTs have been successfully used as a dissemination strategy for CPGs; however, it remains unclear whether one ICT is more effective than another. It is also unclear whether other ICTs not captured in this review, such as social media, can be used as effective dissemination strategies for CPGs. Further research, by conducting well-designed randomized controlled trials, is necessary to determine whether the use of ICTs is an effective strategy to disseminate evidence-based medicine to health professionals. There were differences in study durations and measurements among the included studies. As none of the studies measured sustainability, researchers should consider what is an appropriate time frame to expect meaningful differences in behavior change. Future studies, designed to compare these strategies head-to-head, would provide further guidance. While the scope of the review focused on the dissemination of CPGs to health professionals, future research should also assess how ICT dissemination strategies can be used as a tool to share information between health professionals and patients. As only 1 of the included studies [24] assessed barriers, future research should consider barriers as a crucial outcome of interest.

Strengths and Limitations

The strengths of this systematic review include the broad eligibility criteria that we used, allowing for numerous types of ICTs and various health professional populations (ie, physicians including medical residents, nurses, and physiotherapists) to be included and summarized in this review. Additionally, we used a systematic approach to review the literature and assessed the methodological quality of each included study. This systematic review was conducted following the PRISMA checklist [14].

Nevertheless, there are limitations of this review that should be considered. We did not include information published in languages other than English; thus, we may have excluded some relevant findings. The small number of included studies per ICT and the heterogeneity between studies in regard to the included health professional populations, definitions of outcomes assessed, selected comparators (some compared interventions against no intervention, while others used active comparators), and duration of studies did not allow for comparisons between studies. As a result, we were not able to calculate pooled effect sizes or perform meta-analyses. The terminology of outcomes in the included studies sometimes differed from the identified concepts in the TAM2 and domains of the TDF that we used to define the usability and practice behavior change outcomes, respectively. Several studies measured numerous outcomes, and it remains uncertain whether these studies were adequately powered to detect meaningful differences. Furthermore, the overall findings were limited by the high loss to follow-up in numerous studies [17,21,23,25,30,32,34,36]. While reasons for loss to follow-up remain unclear, one potential cause as suggested by study authors may be professional or organizational barriers related to the use of these ICTs. CPG dissemination and KT strategies should be tailored and driven by barriers to improve adherence in practice [44].

The authors of the included studies did not always assess the quality of information being presented or quality of ICT. The quality of information being presented was previously assessed and deemed appropriate by authors in 4 of 5 (80%) studies using websites [17,23-25], 1 of the 2 (50%) studies using Web-based workshops [29], the study using an electronic educational game [21], 1 of 3 (33%) studies using computer software [26], both studies using email [19,32], both studies using CDSSs [30,31], and 4 of 6 studies (67%) using a multifaceted intervention including an ICT [33,35-37]. It was unclear whether the quality of information was assessed and deemed appropriate in the remaining studies. The quality of the ICT was assessed and deemed appropriate in 2 of 5 studies (40%) using websites [24,25], 1 of the 2 (50%) studies using Web-based workshops

[29], the study using an electronic educational game [21], 1 of 3 (33%) studies using computer software [26], 1 of 2 (50%) studies using email [19], and 1 of 6 studies [35] using a multifaceted intervention including an ICT. In studies using CDSSs, the quality of the ICT was assessed in 1 of 2 studies (50%) [30] but was not generally accepted by users. It was unclear whether the quality of the ICTs was assessed and deemed appropriate in the remaining studies.

The overall methodological quality of included studies was strong for the website studies, while it was uncertain for the electronic education game, email, and multifaceted studies (Multimedia Appendix 4). Studies using computer software, Web-based workshops, and CDSSs were of variable methodological quality, as some studies were predominantly strong, while others were of uncertain quality. Several studies were conducted more than 10 years ago; thus, these ICTs may not reflect current technology and may no longer be relevant. The goal of this systematic review was to transparently present the current state of knowledge about ICT use among health professionals and to allow readers to make informed decisions regarding their relevance.

Conclusion

The findings of this systematic review suggest that health professionals' perceived usability and practice behavior change vary by type of ICT. Website studies demonstrated improvements in perceived usefulness and perceived ease of use, but not for knowledge usability, barriers, and intentions. Computer software studies demonstrated improvements in perceived usefulness, but not in knowledge and skills. Web-based workshop and email studies demonstrated improvements in knowledge, perceived usefulness, and skills. An electronic educational game intervention demonstrated an improvement in knowledge from baseline to 12 or 24 weeks. CDSS studies demonstrated variable findings for improvement in skills. Multifaceted ICT interventions demonstrated improvements in beliefs about capabilities, but not in usability. Most multifaceted ICT studies demonstrated improvements in knowledge, perceived usefulness, perceived ease of use, and beliefs about capabilities. In summary, heterogeneity and the paucity of properly conducted studies did not allow for a clear comparison between studies and a conclusion on the effectiveness of ICTs as a KT strategy for the dissemination of CPGs.

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Conflicts of Interest

None declared.

Multimedia Appendix 1

Search strategy.

[PDF File (Adobe PDF File), 40KB - mededu_v2i2e16_app1.pdf]

Multimedia Appendix 2

List of excluded studies.

[PDF File (Adobe PDF File), 84KB - mededu_v2i2e16_app2.pdf]

Multimedia Appendix 3

Included study characteristics.

[PDF File (Adobe PDF File), 78KB - mededu_v2i2e16_app3.pdf]

Multimedia Appendix 4

Methodological assessment of included studies.

[PDF File (Adobe PDF File), 75KB - mededu_v2i2e16_app4.pdf]

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Abbreviations

ADHD: attention-deficit/hyperactivity disorder
CDSS: computerized decision support system
CME: continuing medical education
CPG: clinical practice guideline
EHR: electronic health record
ICT: information and communication technologies
IQR: interquartile range
KT: knowledge translation
PICOS: population, intervention, comparison, outcome, and study design
PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses
OR: odds ratio
TAM2: technology acceptance model
TDF: theoretical domains framework

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Appendix 1.2: Publication #2

The following publication was published in 2018 in the Digital Health Journal and can be cited as: De Angelis G, Wells GA , Davies B, King J, Shallwani SM, McEwan J, Cavallo S, Brosseau L. The use of social media among health professionals to facilitate chronic disease self-management with their patients: A systematic review. Digital Health 2018; 4.

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Review Article

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The use of social media among health professionals to facilitate chronic disease self-management with their patients: A systematic review

Gino De Angelis[1], George A Wells[2], Barbara Davies[3], Judy King[1], Shirin M Shallwani[1], Jessica McEwan[4], Sabrina Cavallo[5] and Lucie Brosseau[1,2]

Abstract

Objective: The objective of this systematic review was to summarize the evidence pertaining to the use of social media by health professionals to facilitate chronic disease self-management with their patients.

Methods: A systematic approach was used to retrieve and extract relevant data. A total of 5163 citations were identified, of which seven unique studies met criteria for inclusion; one was a randomized controlled trial, two were prospective cohort studies, and four were qualitative studies. The following social media platforms were evaluated: discussion forums (6 studies) and collaborative project (1 study).

Results: The available evidence suggests that health professionals perceived discussion forums and collaborative projects to be useful social media platforms to facilitate chronic disease self-management with patients. No relevant evidence was found regarding the use of other social media platforms. Most studies indicated positive findings regarding health professionals' intention to use discussion forums, while the one study that used a collaborative project also indicated positive findings with its perceived ease of use as health professionals felt that it was useful to facilitate chronic disease self-management with patients. Mixed findings were seen in regards to health professionals' perceived ease of use of discussion forums. The most common barrier to using social media platforms was the lack of time in health professionals' schedules.

Conclusions: Discussion forums and collaborative projects appear to be promising resources for health professionals to assist their patients in self-managing their chronic conditions; however, further research comparing various social media platforms is needed.

Keywords

Social media, chronic disease, self-management, dissemination, evidence-based practice, patient education

Submission date: 12 August 2017; Acceptance date: 21 March 2018

Introduction

The prevalence rates of major chronic diseases among Canadian adults continue to increase, and the population over 65 years of age is growing almost four times greater than the overall population.[1] Chronic disease has also resulted in significant use of health care services as adults with multiple chronic diseases account for over two-thirds of health care spending.[2] Given that

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more Canadians are living longer with chronic diseases,[1] there is a need for health professionals to promote evidence-based self-management support to their patients.

In an effort to improve joint partnerships between health professionals and patients for the collaborative care of chronic diseases, health professionals are supplementing traditional patient education by providing technical skills and information allowing their patients to self-manage their chronic conditions.[3]

Self-management support, such as the provision of personalized feedback, creation of small action plans and goal setting, enlisting social support, and determining goal achievement,[4] allows health professionals to complement traditional patient education.[3] Self-management support may allow patients to make appropriate decisions and manage their conditions through the use of technical skills and information to identify problems.[3]

There remains a lack of clarity on how health professionals can optimally enhance self-management support[5] while addressing many challenges associated with provision including limited time and difficulties with ensuring patients are willing and able to understand instructions.[6] New methods to provide successful self-management support to patients are therefore needed to minimize resource demand and improve patient education.

Self-management support can be enhanced by online information and communication technologies (ICTs) as chronic disease patients are increasingly using them to access health information[7] and these tools appear to be a promising resource allowing new strategies for patients and health professionals to communicate with one another and to educate themselves.[8,9] Online ICTs, such as social media, have the potential to reach a broad population,[10] and allow for improved social support and knowledge acquisition.[10,11] Furthermore, online self-management interventions have been associated with improvements in health behaviors and health status among older patients with chronic diseases.[7]

Social media have been defined as "a group of online applications that allow for the creation and exchange of content generated by users" (p. 1376)[12] and have been categorized into the following groups: collaborative projects, content communities, blogs or microblogs, social networking sites, virtual gaming or social worlds,[13] and online discussion forums.[12] Collaborative projects (e.g., Wikipedia) are "websites which allow users to add, remove, and change text-based content" and "enable the joint and simultaneous creation of content by many end-users" (p. 62).[13] Content communities (e.g., YouTube) allow users to share media content such as videos, text, photographs, and presentations.[13] Blogs and microblogs (i.e., Twitter) are specific websites that come in different formats such as reviews of relevant information in one content area, to personal memoirs.[13] These forms of social media are typically managed by one individual[13] and are usually displayed by date-stamped entries.[14] Social networking sites (e.g., Facebook) are "applications that enable users to connect by creating personal information profiles, inviting friends and colleagues to have access to those profiles, and sending e-mails and instant messages between each other" (p. 63).[13] Virtual game worlds (e.g., Second Life) are "platforms that replicate a three dimensional environment in which users can appear in the form of personalized avatars and interact with each other as they would in real life" (p. 64), while virtual social worlds "allow inhabitants to choose their behavior more freely and essentially live a virtual life similar to their real life" (p. 64).[13] Online discussion forums, sometimes referred to as bulletin boards, allow users to have conversations using posted messages, and have been considered a form of social media as they incorporate user-generated content.[12]

Social media have demonstrated to be a potentially successful resource tool for patients to self-manage their chronic conditions as it has provided them with empowerment,[15] improved health indicators,[9] and enhanced patient knowledge and confidence.[16] Social media use among health professionals has also increasingly become popular[17,18] and has engaged learners and disseminated accurate information to enhance education.[17,19,20] Social media allows for multimedia-sharing (e.g., disease management videos, podcasts and wikis) and has also shown to facilitate public health promotion[21] and respond to public health concerns.[22]

While evidence shows that health professionals are using social media more regularly,[17,18] and with a growing need to improve self-management strategies for patients, there is a lack of clarity regarding its use for chronic disease management and the role played by health professionals.[9]

This systematic review was designed to address this knowledge gap. The objective of this systematic review was to summarize the evidence pertaining to the use of social media by health professionals to facilitate chronic disease self-management with their patients. Specifically, the aim of this systematic review was to provide new knowledge on health professionals' perceived usability and change in practice behavior when using social media to assist patients in self-managing their chronic conditions.

Methods

This systematic review was conducted using the Preferred Reporting Items for Systematic Reviews

and Meta-Analyses (PRISMA) guidelines.[23] To summarize the evidence, a systematic approach was adopted to retrieve relevant papers from the literature. Articles were selected for this review using the predefined selection criteria guided by population, intervention, comparison, outcome, and study design (PICOS) in Table 1.

Studies were excluded if they did not meet the selection criteria (Table 1). Duplicate publications, narrative reviews, case series, case reports, data presented in abstract form only, conference proceedings, study protocols, and publications not written in English were also excluded.

Search strategy

The literature search was performed by an information specialist. Published literature was identified by searching the following bibliographic databases up to April 2016: Medline, Cochrane Central Register of Controlled Trials, Embase, CINAHL, ERIC, and PsycINFO. The search was performed using terms to identify peer-reviewed research in which social media and chronic disease self-management were important features (see Supplementary Appendix 1). Gray literature (literature that is not commercially published) was conducted by searching Google and other internet search engines to identify any additional web-based publications. In addition, the searches were supplemented by hand searching the bibliographies of key papers. A date limit of 2004 onwards was placed to ensure the most relevant social media technologies were included.

Two reviewers independently screened the titles and abstracts of all citations retrieved from the literature search using Covidence (www.covidence.org), an online systematic review tool. Independent reviews of the full-text articles were then performed based on the selection criteria. Disagreements were resolved through discussion until consensus was reached. The study selection process is presented in a PRISMA flow diagram (Figure 1).

Descriptive data were extracted by one reviewer for each eligible article. The extraction was subsequently verified by a second reviewer. Data extraction forms were designed a priori to document and tabulate relevant study and patient characteristics, study findings and authors' conclusions. Data from figures were not used if they were not explicit. Studies were categorized by the type of social media intervention used as categorized by Hamm et al.[12] (Table 2).

Given the broad inclusion criteria and heterogeneity of the interventions and methodological characteristics of included studies (PICOS), a meta-analysis was deemed inappropriate, and a narrative synthesis and summary of study findings was therefore conducted. The outcomes of interest included the usability of social media platforms for chronic disease self-management and practice behavior change among health professionals (Table 1).

Table 1. Selection criteria for systematic review.

Population	Health professionals (e.g., physicians, nurses, dieticians)
Intervention	Chronic disease self-management programs disseminated using social media platforms (i.e., collaborative project, blog or microblog, content community, social networking site, virtual world, discussion forum)
Comparator	• Other social media platforms • Information and communication technologies (e.g., email, websites) • No comparator
Outcome	• Usability (e.g., perceived usefulness and ease of use) • Practice behavior change (e.g. barriers, knowledge, skills, social/professional role and identity, optimism, beliefs about capabilities, beliefs about consequences, intentions, memory/attention/decision, environmental context and resources, social influences, and emotion)
Study Design	Randomized controlled trials (RCTs), non-randomized comparative controlled trials (CCTs), observational studies, qualitative studies

Quality appraisal of the selected literature

One reviewer independently assessed the quality of each study using the Scottish Intercollegiate Guidelines Network (SIGN 50) tool for cohort studies and randomized controlled trials (RCTs),[24] and the Critical Appraisal Skills Programme (CASP) tool[25] for qualitative studies, which was subsequently checked for accuracy by a second reviewer. Disagreements were resolved through consensus. Risk of bias was assessed at the study level. Summary scores were not calculated, rather the strengths and limitations of each included study were described (see Supplementary Appendix 3).

Usability

The usability outcomes were guided by the Technology Acceptance Model (TAM2)[26] which illustrates that behavior intention to use a system is determined by perceived usefulness and perceived ease of use. Perceived usefulness is defined by Venkatesh and Davis[26] as "the extent to which a person believes that

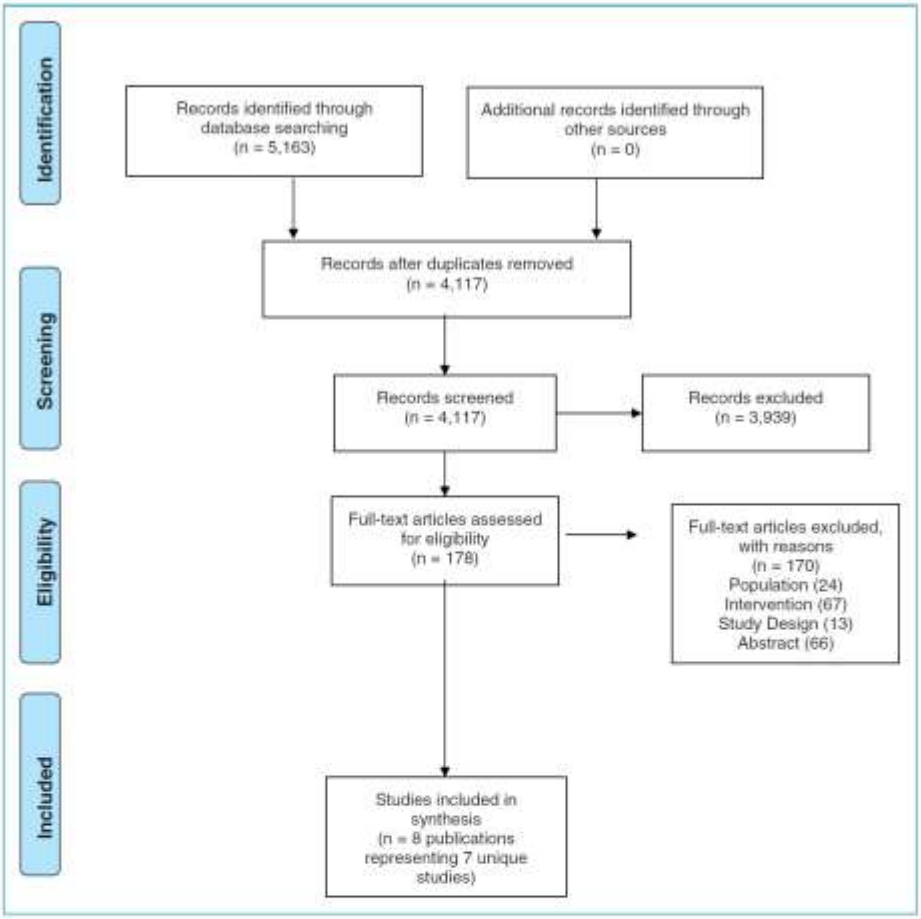

Figure 1. PRISMA flow diagram of included studies.

using the system will enhance his/her job performance" (p. 187), and perceived ease of use is defined as "the extent to which a person believes that using the system will be free of effort" (p. 187).

Practice behavior

Practice behavior change outcomes were guided by the Theoretical Domains Framework (TDF).[27] The TDF identifies numerous behavior constructs and consists of 12 domains: (a) knowledge; (b) skills; (c) social/professional role and identity; (d) beliefs about capabilities; (e) beliefs about consequences; (f) motivation and goals; (g) memory, attention and decision processes; (h) environmental context and resources; (i) social influences; (j) emotion regulation; (k) behavioral regulation; and (l) nature of the behavior. Practice behavior outcomes were categorized by the domains listed above.

Results

Included studies

A total of 5163 citations were identified through the initial database search. After removing duplicates, 4117 publication abstracts and titles were screened. The full texts of 178 articles were assessed; of these, 170 were excluded for the following reasons: irrelevant population (24 studies), irrelevant intervention (67 studies), inappropriate study design (13 studies), and presented as abstract only (66 studies). Two publications[28,29] present on findings from one unique study.

Table 2. Characteristics of included studies.

Author (year), country	Study design	Data collection	Chronic disease	Participants (sample)	Social media intervention	Duration/follow-up
Anhøj J (2004), Denmark	Prospective cohort	Online survey, mailed survey and interviews (location not specified)	Asthma	Health care providers that according to the manufacturer's (AstraZeneca) customer database had received a user name and password for LinkMedica. Survey: $n = 131$; interview: $n = 5$	Discussion forum	1 month
Anttila M (2008), Finland	Qualitative	Online survey, multi-center	Chronic mental illness (psychiatric care)	Nurses working on nine acute wards in two psychiatric hospitals $n = 56$	Discussion forum	1 month (duration) 1-year follow-up post intervention
Gupta S (2011) and Gupta (2012), Canada, United States, Australia	Prospective cohort	Online survey, multi-center	Asthma	Pulmonologists, primary care physicians, and certified asthma educators from academic and community clinics. Development stage: $n = 16$; wiki stage: $n = 35$	Collaborative project	3 weeks
Nordfeldt S (2012), Sweden	Qualitative	Online survey/essay (setting/location not specified)	Diabetes	Members of two pediatric diabetes care teams, including physicians, nurses, dieticians, and a social welfare officer $n = 18$	Discussion forum	Not specified
Nordqvist C (2009), Sweden	Qualitative	Telephone interview, single-center (clinic)	Diabetes	Members of two diabetes teams, including seven physicians, eight nurse specialists in diabetes, one nurse, two dieticians, and two social welfare officers $n = 20$	Discussion forum	~1 year
Oh H (2011), Republic of South Korea	Qualitative	Face-to-face or telephone interview, or email communication, single-center	Gout	An expert panel consisting of four physicians, one out-patient nurse, and 20 in-patient nurses $n = 25$	Discussion forum	Not specified
Wiecha J (2015), United States		Survey, multi-center	Asthma	Primary care providers from community health centers, a medical center, and other practices $n = 14$	Discussion forum	6 months

The excluded studies are listed in Supplementary Appendix 2. The PRISMA flow diagram is shown in (Figure 1).

Of the seven unique studies that were included in our systematic review, one was an RCT,[30] two were prospective cohort studies,[28,29,31] and four were qualitative studies.[9,32–34] In regards to the types of social media platforms, six studies[9,30–34] assessed discussion forums while one study assessed a collaborative project.[28,29] The included studies were conducted in Denmark,[31] Finland,[32] Canada,[28,29] United States,[28–30] Australia,[28,29] Republic of Korea,[34] and Sweden.[9,33] The following chronic conditions were assessed: asthma,[28–31] chronic mental illness,[32] diabetes,[9,33] and gout.[34] The following health professionals were represented in the included studies: nurses working in acute psychiatric wards,[32] diabetes nurses,[9,33] out-patient arthritis nurses,[34] in-patient arthritis nurses,[34] >asthma nurse,[30] pulmonologists,[28–30] primary care physicians,[9,28–31,33,34] certified asthma educators,[28,29] and dieticians.[9,33] Further details regarding the included study characteristics can be found in Table 2.

Methodological quality

The strengths and limitations of each included study are summarized in Supplementary Appendix 3. The RCT by Wiecha et al.[30] addressed an appropriate and focused question and the assignment of subjects to intervention groups was randomized. However, there was no mention on how randomization was concealed. While a RCT design was used allowing patients and health professionals to be randomized to their respective interventions, comparative analyses were not conducted among the health professional sample. A self-reported survey was used to measure health care professionals' experience with the discussion forum. The authors indicated the use of validated tools to assess patient outcomes (population and outcomes outside the scope of this review); however, the reliability and validity of the survey used among the health professional sample is uncertain. Limited information regarding the health professional sample was provided. Blinding of study subjects was not relevant given the nature of the study design. The study was also limited to a single site.

Both prospective cohort studies[28,29,31] addressed appropriate and focused questions and indicated the number of subjects who were invited to participate. Outcomes were clearly defined in both studies and blinding was not feasible given the nature of the interventions. Gupta et al.[28,29] used a validated tool (System Usability Scale) and assessed participants at multiple time points, while it was unclear whether the study by Anhøj et al.[31] used a validated measurement tool and assessments were only conducted at one time point. While no effort was made to minimize confounding or risk of bias in Anhøj et al.,[31] focus groups and development testing was used to identify barriers and analyses were stratified by type of health professional in Gupta et al.[28,29]

There was a clear statement of the aim of the research in all four qualitative studies.[9,32–34] The qualitative methodology was appropriate in three studies[9,32,33]; however, it was unclear whether the methodology used in the study by Oh et al.[34] was appropriate as it was based on a structured interview with only one open-ended question. While Nordqvist et al.[9] clearly described their reasoning why qualitative methods were used, the other study authors opted to use surveys rather than focus groups or open-ended interviews to collect information.[32–34] Only the study by Anttila et al.[32] provided details on how participants were recruited and whether ethical issues were taken into consideration. Data analyses appeared to be rigorous in three studies,[9,32,33] but were unclear in the study by Oh et al.[34] All studies provided a clear statement of findings.

Social media interventions, measures, and results

Of the seven included studies, six used a discussion forum[9,30–34] while one used a collaborative project.[28,29] All studies assessed health professionals' perceived usefulness (TAM2), four studies assessed perceived ease of use (corresponding to similar concepts used by TAM2),[28,29,32–34] four studies assessed environmental context and resources (TDF),[9,28,29,32,33] three studies assessed intention to use (TAM2),[28,29,33,34] and one study assessed knowledge (TDF),[28,29] social influences (TDF),[28,29] beliefs about capabilities (TDF),[28,29] output quality (TAM2),[33] beliefs about consequences (TDF),[9] social/professional role (TDF)[9] and job relevance (TAM2).[9] Further details on the reported baseline characteristics of included study participants (health professionals) can be found in Supplementary Appendix 4 in the supplementary material. A summary of findings of the included studies can be found in Supplementary Appendix 5.

Discussion forum

Anttila et al.[32] assessed nurses' ($n = 56$) experiences of an online portal (Mieli.Net) developed for patients with schizophrenia spectrum psychosis. The portal is intended to support patient self-management skills in mental health services and includes processes to support knowledge, develop patient problem-solving skills, and improve self-efficacy. Specifically, the interactive internet-based portal included patient-centered,

tailored information using multimedia material (text, sound, figures, photographs), a channel for peer support for patients (i.e., discussion forum, chat room, open internet diary), and an e-support tool for counseling and support between patients and nurses. While the study was designed to compare the portal intervention with standardized patient education using leaflets, only findings from the portal intervention were presented. Surveys were distributed to the nurses following one year of using the online portal. The questionnaires also included open-ended items that allowed them to describe their experiences in their own words. Qualitative data from the surveys indicated that nurses experienced the online portal as a broad information source and a "self-help" aid for patients, and felt that it was useful for patients when their mental state was healthy (Perceived usefulness, TAM2). Additionally, they felt that the portal supported patients' self-management abilities as it enabled autonomous access to information and could be used independently, separate from education sessions (Perceived usefulness, TAM2). Nurses felt that the absence of ICT skills was an obstacle in patients' use of the portal and felt it was difficult to use themselves (Perceived ease of use, TAM2). Nurses also felt that there were inadequate resources (e.g., lack of space or quiet room with available computer and internet connection) as it took too much time away from their basic work (Environmental context and resources, TDF). Another common theme from the surveys was nurses' hesitancy to use the portal with patients because of their lack of experience with it (Intention to use, TAM2)

Anhøj et al.[31] assessed physicians' and nurses' ($n = 136$) use of the LinkMedica website, an asthma self-management tool which includes an electronic asthma diary for patients, a knowledge center which includes over 100 articles about asthma and allergies, and an unmoderated discussion forum that allows users to engage in discussion and pose questions with experts. A mailed questionnaire was sent to 131 physicians and nurses. Surveys were evaluated five to seven months following the launch of the website. Findings from the survey revealed that 73% of participants felt that there is a need for internet tools like LinkMedica in medical practice (Perceived usefulness, TAM2). Additionally, 22% did not use the tool, but wanted to try it (Intention to use, TAM2), and only 3% had looked at it, but did not find it useful (Perceived usefulness, TAM2). Based on the results of the questionnaires, different types of LinkMedica users (n = 5) (i.e., level of familiarity with tool and experience as a general practitioner (GP)) were selected for semi-structured interviews. Findings from the interviews concluded that the GPs were not confident "PC" users and found it difficult to instruct patients in the system (Beliefs about capabilities, TDF). Although the GPs had a positive attitude towards the tool, they felt it was difficult to use (Perceived ease of use, TAM2). They also indicated that their use of the tool is influenced by external factors such as time and economy (Environmental context and resources, TDF).

Nordfeldt et al.[33] assessed the perceptions of physicians, nurses, dieticians, and a social welfare officer ($n = 18$) in pediatric diabetes care teams of using an open-access interactive online portal (Diabit List) tailored to young diabetes type 1 patients and their guardians or significant others. In addition to providing access to general and local diabetes-related information, the online portal also provided peer-mediated information and dialogues through open-access forums and blogs. A local news feed, including staff presentations, was integrated in the portal and was managed by a member of each clinical diabetes team. Approximately 18 months following the launch of the portal, the health professionals were each asked to write an essay on their experience using the portal, focusing on both positive and negative user experiences. Each survey was then analyzed using qualitative content analysis. Overall, the survey respondents felt that the online portal functioned well, its design was easy to understand, and felt it was a manageable tool for seeking information (Perceived usefulness, TAM2). Respondents also believed that the online portal was a source of scientifically sound information (Output quality, TAM2), and the information was easily accessible to primary care and other hospital staff (Perceived ease of use, TAM2). They also felt comfortable recommending the online portal as the source of information came from a reputable source, produced by a multiprofessional community of practitioners (Intention to use, TAM2). Some respondents identified barriers and difficulties with the online portal including lack of time and computer access, and inadequate computer experience (Environmental context and resources, TDF).

Nordqvist et al.[9] also assessed the Diabit List open-access interactive online portal among physicians, nurses, dieticians, and social welfare officers ($n = 20$) from two pediatric diabetes teams. The objective of this study was to assess pediatric health professionals' attitudes towards the use of the online portal, and determine barriers and facilitators to introducing such systems into clinical practice. The assessments took place approximately over a one-year duration (between the creation of the piloted prototype in 2005 to the launch in the spring of 2006). The investigators conducted semi-structured interviews and analyzed data using qualitative (phenomenological) methods. Overall findings from the interviews suggested that health professionals were confident that in addition to

being part of the internal routine of the clinics, the online portal's use could extend beyond the clinics (Beliefs about consequence, TDF). Health professionals also felt that the portal was useful for providing families with newly updated diabetes information and provided a closer interaction between diabetes teams and families (Perceived usefulness, TAM2). Several health professionals believed that the shared information provided on the online portal, including references to verified websites and assuming it is regularly updated, would be a great tool to support their practice with patients (Job relevance, TAM2). Some of the interviewees shared their concerns regarding privacy, whether the current legislation permitted email contact with patients, and whether email communication would be safe (Social/professional role and identity, TDF). Another barrier that was noted was the lack of time and determining how to incorporate the online tool into routine practice, while other health professionals expected the online portal to save time during consultations when providing general information to patients (Environmental context and resources, TDF).

Oh et al.[34] assessed an interactive website that consisted of a discussion forum for posting patients' gout-related experiences, as well as an expert section to introduce recent gout-related scientific information among an expert panel consisting of physicians, in-patient and out-patient nurses ($n = 25$). The content of the gout-related information was based on a systematic review of the literature and the website was structured into the following sections: overview, causes, risk factors, symptoms, diagnosis, progress, treatments and complications. The website was placed on a web server and was implemented to the expert panel. One week after its implementation, face-to-face or telephone interviews or email communication were used to assess content access, satisfaction of the program contents, and ease of site navigation. When asked about the information content of the website, most experts (between 80–88%) felt that the causes, symptoms, diagnosis, treatments and prognosis of gout sections were useful to understand gout, and 84% were satisfied with the self-management techniques (Perceived usefulness, TAM2). The majority of experts indicated that the website was useful in understanding patients' gout-related experiences; however, only 44% stated that the website was of interest to them (Perceived usefulness, TAM2). Additionally, 60% of the experts suggested that further information on diet and gout progress/medications were needed (Perceived usefulness, TAM2). Findings from the evaluation on ease of site navigation and content access indicated that experts were highly satisfied (Perceived ease of use, TAM2) and all respondents indicated a willingness to use the website frequently (Intention to use, TAM2).

Wiecha et al.[30] assessed an interactive website (BostonBreathes) for patients and primary care providers (physicians and nurses) to promote asthma self-management. The website allows primary care providers to participate in a private discussion forum with patients and/or asthma nurses, while also allowing for the review of patient-level data on symptoms, medication usages, emergency room visits and patient graphical data of peak flow. Children with persistent-level asthma and their primary care providers were randomized to either usual care ($n = 21$) or monitoring and self-management using the interactive website ($n = 37$). Some of the primary care providers in the intervention arm ($n = 14$) completed a survey on their experience with the website during the six-month study period. The primary care providers used a separate interface to monitor their patients' website use and were able to communicate online via the discussion board with patients. Findings from the primary care provider survey using a Likert scale (0 = strongly disagree to 10 = strongly agree) indicated a neutral response in that the discussion board was an effective way to communicate with patients (mean score of 5.6) and marginally agreed that the website provided useful information about their patients that they would not have had otherwise (mean score of 6.5) (Perceived usefulness, TAM2). Overall, there was agreement that the website was easy to use (mean score of 6.9) (Perceived ease of use, TAM2) and agreement that they would recommend the website for their asthmatic patients (mean score of 6.2) (Intention to use, TAM2). There was overall disagreement that the primary care providers had enough time in their schedules to use the website (mean score of 4.6) (Environmental context and resources, TDF).

Collaborative project

Gupta et al.[28,29] used a wiki-based system to develop an asthma action plan (AAP) by multiple stakeholders including pulmonologists and primary care physicians, asthma educators, and patients ($n = 51$). The intervention was described by the authors as "a system that allows multiple users to collaboratively design an AAP by inputting preferences for the content and format (visual layout and design) of the AAP plan through a Web-based wiki-inspired platform" (p. 2).[29] The AAP underwent a development phase ($n = 16$) where the investigators established the AAP content, tested the tool among stakeholders, and revised the tool based on stakeholder feedback. The tool then underwent three separate one-week "wiki" periods where the content was collaboratively compiled by stakeholders ($n = 35$). The visual design features of the AAP were then optimized, and underwent face

validity testing in three one-hour focus groups consisting of two pulmonologists, two asthma educators, two patients and two primary care physicians who were not involved in the development process. During the wiki stage, the mean System Usability Scale score (range from 0 to 100, with higher scores representing greater usability) improved to 75.9 (SD 19.6) compared to 72.2 (SD 10.2) in the development stage. Pooled results from 35 participants (including 19 patients) indicated that 80% were satisfied with the overall AAP that was created, and 77% felt that the wiki tool was an effective way to design an AAP (Perceived usefulness, TAM2). The majority (91%) of respondents indicated they would be able to use the wiki tool and AAP that was created (Perceived ease of use, TAM2). Almost half (49%) of respondents indicated if their schedules permitted, they would have used the site more often (Environmental context and resources, TDF). Most respondents (86%) indicated they would be willing to use a wiki tool to design visual media in the future (Intention to use, TAM2). Most respondents (67%) felt that the chat room feature allowed them to understand the preferences of other participants (Knowledge, TDF). The wiki tool did not appear to be impacted by social influences as only 26% of respondents indicated that there were certain participants whose opinions were more influential than others (Social/professional role and identity, TDF), and only 37% felt that they were able to make more changes and suggestions through the web-based process than they would have been able to in a face-to-face group discussion (Beliefs about capabilities, TDF). See Supplementary Appendix 5 for further details on findings from Gupta et al.[28,29]

Discussion

This review contributes to the growing literature on social media used by health professionals. To our knowledge, there has been no other synthesis of evidence pertaining to the use of social media by health professionals to facilitate chronic disease self-management with their patients. In summary, the available evidence suggests that health professionals perceived discussion forums to be a useful social media platform in the majority of included studies,[9,31–34] while the one study that used a collaborative project (wiki)[28,29] also indicated that it was useful to facilitate chronic disease self-management in patients.

Research has revealed that social media can be used among health professionals as a useful and dynamic tool to access up-to-date information, maintain professional connections,[18,35] and to share knowledge and health promotion.[18,36] Additionally, social media have shown to enable professional networking, community outreach, and building social capital.[37]

The collaborative project in Gupta et al.[28,29] had positive findings in regards to its perceived ease of use. Mixed findings were seen in regards to health professionals' perceived ease of use as three studies demonstrated positive findings,[30,33,34] while two studies noted difficulties with using the discussion forum interventions.[31,32] The interventions in Anttila et al.[32] and Anhøj et al.[31] included multiple components in addition to the discussion forums such as online patient diaries, e-support tools and chat rooms; thus it remains unseen whether the complexity of these interventions led to health professionals' perceived difficulties. Similarly, there appeared to be an observed pattern between health professionals' perceived ease of use and their intention to use the discussion forum interventions as the studies by Anttila et al.[32] and Anhøj et al.[31] also noted that most respondents were hesitant to use the tool.

Nordqvist et al.[9] demonstrated that health professionals anticipated positive outcomes (beliefs about consequences) for using discussion forums, indicating that its use could extend beyond internal use in clinics. Health professionals felt that discussion forums were a great tool to support their practice.[9]

Findings from Gupta et al.[28,29] indicate that there remains uncertainty about the benefits of using a web-based process versus face-to-face group discussion. Other research comparing social media-based outreach dissemination of clinical practice guidelines to traditional methods concluded no difference in awareness and knowledge of the guideline recommendations.[38] Conversely, in comparison to traditional face-to-face methods, online chronic disease self-management interventions have the potential to reach a broader population of chronic disease patients,[10] while online communities may allow for improved social support.[10,11]

The included studies noted several barriers to using social media to facilitate chronic disease self-management with their patients. The most common barrier identified was the lack of time in their schedules to use these tools.[9,28–30,32,33] Online ICTs, such as social media, can enhance self-management support, providing a potential demand-reducing and time-saving opportunity for health professionals.[3,7,10] For example, encouraging patients to use social media platforms to access educational material and to engage in discussion with other patients may provide health professionals with an additional option to improve self-management support, while potentially allocating less time for patient education and behavior change counseling during consultations.[39]

Previous research has shown that although perceived barriers to using social media are high, health professionals still frequently use them.[34] While the findings of this review suggest that health professionals believe

they do not have enough time to engage in social media interventions, research has shown that disseminating evidence and educational programs through social media may in fact be a time-saving and a potential demand-reducing option for patient care.[3,7,10]

Another barrier noted in the included studies was lack of space or computer access within the work place.[32,33] The need for access to internet and online technologies is necessary as clinics and hospital settings continue to evolve, and technology can enable health professional and patient shared decision making.[3]

Health professionals also noted a lack of computer skills and unfamiliarity using these types of interventions resulting in hesitancy in instructing patients to use these types of interventions.[31] The promotion of using and incorporating social media in chronic disease care requires adequate training. Research has indicated that most health professionals have basic knowledge of how to use some social media platforms such as social networking sites, yet there remains uncertainty for other types of social media use as evidence is lacking.[18]

As seen in the study by Nordqvist et al.[9], another concern that health professionals and workplaces should consider are policies on patient privacy. Concerns over confidentiality and privacy when using social media are a common concern among health professionals.[39] With the evolution of professional interactions and communications, there is a need to establish and inform health professionals about guidelines of social media use in the workplace.[38,40] Guidelines would provide direction on how to use such technologies while maintaining professionalism.[40] Some work settings and environments may have a negative perception of using social media as it may be seen as inappropriate and unprofessional because of the risk of mixing personal and professional limits and the potential for confidentiality breaches.[37] It is important to note that not all clinical settings and practices may support the use of social media in the work setting. For example, a policy statement by the American College of Physicians has recommended health professionals not to contact patients through social networking sites (i.e., Facebook) and to use high privacy settings.[41]

To our knowledge, no other systematic reviews have been conducted on health professionals' use of social media in chronic disease self-management. Hamm et al. conducted a scoping review of the literature on social media use by health care professionals and trainees.[12] Similar to the present review, the most common social media platform used in general by health professionals was discussion forums. The objectives of most social media platforms were to facilitate communication (61.5% of studies) or improve knowledge (42.7% of studies) of health professionals. The scoping review concluded that social media use among health professionals is common, particularly in education settings, and the versatility of these tools suggest that they may be appropriate for use in a wide variety of professional activities.[12] While the scoping review did not evaluate the effectiveness of the social media platforms, it was suggested that further research on their effectiveness could inform future practice. The decision to include discussion forums as an additional social media category of interest in this systematic review was decided a priori, and is in agreement with the review by Hamm et al.[12] While discussion forums do not fall within one of the social media categories identified by Kaplan and Haenlein,[13] Hamm et al.[12] indicated that discussion forums incorporate user-generated online content, and should be considered precursors to modern social media platforms.

A recent systematic review of the literature was conducted on health professionals' perceived usability and practice behavior change of ICTs for the dissemination of clinical practice guidelines.[42] The review looked at comparative evidence of various ICTs such as websites, web-based workshops, email and computer software; however, no research was found on social media use. The review concluded that health professionals' perceived usability and practice behavior change varied by type of ICT. Websites, computer software and web-based workshops all demonstrated improvements in perceived usefulness.[42] Smailhodzic et al.[15] conducted a systematic review on empirical research regarding the effects of social media use by patients for health related reasons. While the review focused on patients' rather than health professionals' use of social media, the authors concluded that social media use by patients was found to affect the health professional and patient relationship by stimulating more equal communication between them, and that social media can lead to greater confidence in their relationships with health professionals.

The selection of outcomes for this review were guided by the TDF[27] and TAM2.[26] The TDF was chosen as it integrates and clarifies several behavior change theories including learning theory, diffusion theory and social cognitive theory.[27] The TAM2, a validated and robust theoretical framework, was chosen as it was originally designed to predict the acceptance and usage of ICTs, such as social media, among various users and settings.[43] The TAM2 also considers social influence processes which have shown to explain the perceived usefulness of technologies.[44] The TDF was developed from a synthesis of psychological theories, and has shown to be useful for assessing barriers and behavior change among health professionals from various clinical disciplines and settings.[45] Together, both theoretical frameworks provided a comprehensive list of outcomes to measure health professionals' usability and practice behavior change for the use of social media to facilitate chronic disease self-management with their patients.

The strengths of this systematic review include the broad eligibility criteria that were used, allowing for numerous types of social media platforms, various health professional populations, and study designs (including qualitative) to be considered for inclusion in this systematic review. Furthermore, a systematic approach was used to select the relevant articles in the literature and to assess the methodological quality of each included study. This systematic review was conducted following the PRISMA checklist.[23]

There are several limitations of this review that should be considered. Information published in languages other than English were not included; thus, it is possible that some relevant findings may have been excluded. Given the paucity of included studies with quantitative study designs and heterogeneous populations, interventions and outcomes, meta-analyses were not feasible. Interpretation of study findings is limited by the methodological concerns noted in the Methodological quality section. Other key methodological limitations include small sample sizes ($n < 100$) in most studies, the lack of subgroup analyses to compare differences between types of health professionals (e.g., physicians versus social welfare officers), the pooling of patients with health professionals in the analyses,[28,29] and potential industry funding bias.[31] The assessment of health professionals was not always the population of interest, but rather a subgroup that was considered.[30] It remains unclear whether social media platforms are appropriate self-management resources for all chronic conditions as only a select few were assessed in this review. The terminology of outcomes in the included studies sometimes differed from the identified concepts in the TAM2 and domains of the TDF that were used to define the usability and practice behavior change outcomes, respectively. None of the included studies were designed to perform direct comparisons between different social media platforms. Overall, there was a paucity of evidence for the use of collaborative projects, and no evidence for other social media platforms met the selection criteria for this review. Lastly, it remains uncertain whether study findings are generalizable as clinical practice may vary by geographic region.

The potential implications of this review are twofold. First, this research provides a summary of the current evidence pertaining to health professionals' perception of social media use to assist patients to self-manage their chronic conditions, while identifying common barriers and knowledge gaps for future research. Knowledge gaps include the lack of evidence regarding other social media platforms not captured in this review, and the absence of studies comparing social media platforms with each other. Future research of well-conducted and properly designed studies is therefore needed. Second, the findings of this review suggest that discussion forums and collaborative projects may supplement traditional care as additional resources for sharing evidence-based self-management information and facilitating communication with patients.

Conclusion

The findings of this systematic review suggest that health professionals perceived discussion forums and collaborative projects appear to be useful social media platforms to facilitate chronic disease self-management with patients. No evidence was found regarding the use of other social media platforms. Most studies suggested positive findings regarding health professionals' intention to use discussion forums. Mixed findings were seen in regards to health professionals' perceived ease of use of discussion forums. The most common barrier to using social media platforms was the lack of time in health professionals' schedules. Other notable barriers included lack of space or computer access within the work place, and computer competency. Paucity of evidence and lack of high quality studies limited the interpretation of evidence. In summary, discussion forums and collaborative projects appear to be promising resources for health professionals to assist their patients to self-manage their chronic conditions; however, further research comparing various social media platforms is needed.

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Appendix 1.3 Publication #3

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Feasibility Study

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The use of social media by arthritis health professionals to disseminate a self-management program to patients: A feasibility study

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Abstract

Objective: The objective of this study was to determine the feasibility of Facebook as a dissemination strategy for the People Getting a Grip on Arthritis self-management program by arthritis health professionals to their patients.

Methods: The feasibility study comprised a single arm, pre-post design that included a convenience sample of 78 arthritis health professionals across Canada. Assessments were performed at baseline, two-weeks post-intervention, and at three-months follow-up using online questionnaires. The primary outcome measure was change in perceived usability of Facebook as a dissemination strategy for the People Getting a Grip on Arthritis program with patients at two-weeks post-intervention using an instrument based on an extended version of the Technology Acceptance Model 2. Comparisons with baseline were assessed using *t*-test analyses.

Results: Statistically significant improvements from baseline were seen for all items of the Technology Acceptance Model 2 domains: *perceived ease of use* (four items), *intention to use* (two items) and *output quality* (two items) domains. Variable results were seen for the *job relevance*, *perceived usefulness*, *voluntariness*, and *result demonstrability* domains of the Technology Acceptance Model 2. There were no statistically significant improvements for the *subjective norm* and *image* domains.

Conclusions: Facebook may provide arthritis health professionals with an additional option of how to best share evidence-based information to allow their patients to successfully self-manage their arthritis.

Keywords

Social media, Facebook, osteoarthritis, rheumatoid arthritis, self-management, dissemination, evidence-based practice, clinical practice guidelines, patient education

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Introduction

With an increasing aging Canadian population with chronic diseases such as arthritis,[1] there is an urgent need for health professionals to promote evidence-based arthritis self-management support to their patients. As we continue to move towards a paradigm of patient and health professional partnerships for the collaborative care of chronic diseases involving self-management support, health professionals are complementing traditional patient education by providing patients with technical skills and information to identify problems, allowing them to make appropriate decisions, and take action to manage their conditions.[2] Self-management support refers to the systematic provision by healthcare professionals to provide education,

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coaching, and other interventions to help patients gain confidence, knowledge, skills, and motivation to manage the physical, social, and emotional impacts of their disease.[3] Self-management begins with patient education, the process of learning technical skills related to patients' specific conditions.[3] Self-management support can involve a variety of techniques including the creation of small actions plans and goal setting, providing personalized feedback, enlisting social support, and determining goal achievement.[4]

While the effective self-management of chronic diseases among patients continues to be essential in optimizing health outcomes, there is uncertainty as to how health professionals can enhance self-management support among their patients.[5] Lack of time and resources have also been identified as barriers to the delivery of evidence-based patient education and behavior change counseling.[6,7] Furthermore, ensuring that patients are willing and able to understand instructions can be challenging for health professionals.[8] Increasing the use and discovering new methods of providing successful self-management support may facilitate patient education and help reduce the demand for more human health resources to care for chronic diseases.

Web 2.0 refers to the next generation of the Internet allowing individuals to share information and collaborate online.[9] Web 2.0 technologies, such as social media, continue to rise in popularity, as they allow users to add or change content on the Web.[10] eHealth interventions, which may include Web 2.0 technologies, provide health information from electronic resources[10] and is defined by Health Canada as "the application of information and communication technologies within the health sector."[11] eHealth interventions and Web 2.0 technologies can enhance self-management support as they provide a time-saving and a potential demand-reducing option for health professionals,[2,12,13] and have increasingly become more popular among chronic disease patients to access health information.[12] Online chronic disease self-management interventions have shown to reach a broad population of chronically ill patients,[13] and online communities have allowed for improved social support and knowledge acquisition.[13,14] A systematic review by Stellefson et al.[12] concluded that older adults with chronic disease may be associated with improvements in health behaviors and health status when using Web 2.0 self-management interventions. The increasing popularity of social media and social networking applications offers health professionals with a communication tool to share health education information with patients. Positive uses of social media among health professionals include disseminating accurate information to enhance education, countering inaccuracies, and engaging learners.[15] With its capabilities to allow for multimedia-sharing such as disease management videos, podcasts, and wikis, social media has shown to be successful in public health promotion and advocacy,[16] disseminating evidence-based health information,[17] responding to public concerns during outbreaks,[18] and as an effective medical teaching tool.[19]

Different types of social media include collaborative projects, blogs, content communities, and social networking sites.[20] Facebook, one of the most popular social networking sites with more than a billion active users,[21] allows for the sharing of opinions and information through pictures, texts, and links,[22] allowing for new forms of interaction between health professionals and their patients.[23] While current research has been undertaken to measure the effectiveness of Web 2.0 and online interventions for the self-management of chronic disease among patients,[13,14] there is limited research on how health professionals, specifically working in arthritis care, perceive the usability of Facebook to disseminate self-management programs to their patients. A recent scoping review of the literature on social media use by health professionals and trainees[24] included 96 studies of which, only 16 (17%) included a social networking site. The most common types of social media use were discussion forums (45%), blogs or micro blogs (28%), and collaborative projects (21%). The most common medical specialties as categorized by the authors were the combination of administration, critical appraisal and research (11/96, 11.5%), public health (9/96, 9.4%), and mental health (6/94, 6.3%). The most common outcomes measured in the included studies were clinicians' peer-to-peer communication (43/96, 44.8%), clinicians' satisfaction (36/96, 37.5%), and clinicians' knowledge of conditions and complications (22/96, 22.8%). Only two of 16 studies (12.5%) that used a social networking site intervention measured clinicians' perceived usability of social media tools. The scoping review concluded a paucity of studies using a randomized controlled trial (RCT) design (five of 96 studies (5.2%)) and few studies assessed a social networking site (16 of 96 (16.7%)).[24] Furthermore, only three studies (3.1%) and two studies (2.1%) consisted of allied health professionals and nurses in a practice setting respectively.

Among health professionals, Facebook has shown to be a useful tool for sharing knowledge and health promotion with patients,[23,25] to obtain up-to-date information and maintain professional connections,[23,26] and to facilitate networking, building social capital and community outreach.[27] Among arthritis patients, Facebook has shown to be a useful tool for accessing evidence-based educational information to improve their knowledge of non-pharmacological arthritis treatment.[28]

Web-based arthritis self-management programs, such as The Arthritis Society's People Getting a Grip

on Arthritis (PGrip)[29] and the Stanford School of Medicine's Better Choices Better Health – Arthritis,[30] have been shown to improve patients' health status,[31] health literacy,[32,33] and self-efficacy.[31,32,34] The use of Web 2.0 technologies in arthritis self-management, including interactive web-based educational modules and online discussion boards, have been used for arthritis self-management programs, and allow for social support and interactivity among patients.[31–33] While the effectiveness of Web 2.0 technologies for arthritis self-management has been studied among patients,[31–34] there is a need for further research to measure the perceived usability of these technologies, such as Facebook, as a dissemination strategy among arthritis health professionals. This feasibility study was designed to address this knowledge gap and further explore Facebook as an innovative dissemination strategy for self-management programs.

Objectives

The objective of this study was to determine the feasibility of using Facebook as a dissemination strategy for the PGrip program by arthritis health professionals to patients. We refer to a dissemination strategy as a method to distribute evidence-based information and materials to arthritis health professionals. We defined arthritis health professionals as individuals who are involved with the care of people with rheumatic disease. The hypothesis of the proposed feasibility study was that arthritis health professionals would demonstrate improvements in the perceived usability of Facebook to share information from the PGrip program with patients after two weeks and three months. We refer to usability as the behavior intention to use a system as determined by its perceived usefulness and perceived ease of use.[35] In addition, we hypothesized that the Facebook group page could improve practice behavior change among arthritis health professionals as a strategy to disseminate PGrip after two weeks and three months. We refer to practice behavior change as an improvement in the adoption and implementation of evidence based interventions into routine practice behaviors that may be influenced by a range of individual, organizational, and social factors.[36]

Methods

Arthritis self-management program

PGrip[29] is a bilingual (English/French), educational, evidence-based online self-management program for patients with osteoarthritis (OA) and rheumatoid arthritis (RA). The PGrip program is based on results of comparative controlled trials which investigated the efficacy of various self-management interventions for people living with arthritis and the findings were synthesized and graded by the Ottawa Panel.[37–42] Through knowledge synthesis, systematic reviews were performed and rigorous methods were used to develop the Ottawa Panel clinical practice guidelines (CPGs) for the self-management of arthritis. The self-management interventions presented in PGrip were those that achieved positive recommendations (Grades A, B and C+) in the Ottawa Panel CPGs.[37–42] According to the Ottawa Panel grading recommendations, a Grade C+ is considered positive and acceptable as it signifies ≥20% in clinical importance although the finding may not be statistically significant ($p < 0.05$). The Ottawa Panel CPGs for OA and RA[43–47] are recognized as high quality CPGs according to several systematic reviews using the Appraisal of Guidelines Research and Evaluation (AGREE I & II)[48] criteria. Knowledge from the Ottawa Panel CPGs has been translated into lay terms and tailored into a set of didactic videos for the PGrip program. The Ottawa Panel self-management interventions for OA included: ice massage, hand exercises, aquatic therapy exercises, weight management, and a stationary bicycling program. The RA self-management interventions included: insoles and footwear, yoga, Tai Chi, aquatic jogging, wrist orthotics, and transcutaneous electrical nerve stimulation. For each self-management intervention identified in the Ottawa Panel CPGs, two video presentations were created: (a) a narrated PowerPoint presentation of simplified instructions on how to perform/apply the self-management intervention with case scenarios illustrating the appropriateness and relevance of each; and (b) practical sessions with an arthritis health professional providing step by step instructions while performing/applying the self-management intervention with a patient.

For the current study, a PGrip Facebook group page was created and videos of the presentations and practical sessions for various PGrip self-management interventions were posted on the page. To simplify access, the videos were clearly labeled and categorized by type of arthritis (i.e. OA or RA) and type of video (i.e. narrated presentation or practical session). Other information on the page was provided, including the "About" section which provides a brief description of the PGrip program, and a web link to The Arthritis Society's PGrip website. Additionally, instructions on how to access the videos and how to post comments or questions were also provided on the page.

Advisory Committee

To engage potential knowledge users in the research process, an Advisory Committee consisting of six

arthritis health professional users (two registered nurses, two physiotherapists, and two occupational therapists) was convened to identify barriers of using and accessing Facebook as a dissemination strategy for the PGrip program and to identify how the PGrip Facebook group page can be tailored to improve usability among arthritis health professionals.

To be eligible to participate, Advisory Committee members must have been: (a) trained as a nurse, or physical/occupational therapist; (b) registered with their provincial professional regulatory body; (c) currently practicing clinically which was defined as spending a minimum of 50% of their time (work week) in direct arthritis patient care; (d) had Internet access; (e) able to communicate in English. Additionally, to ensure that measured barriers were solely reflective of the Facebook intervention, and not the content of the PGrip program, Advisory Committee members were previous PGrip users who were familiar with the content of the program. Advisory Committee members were often reminded of this throughout the discussion by the facilitator to prevent response bias. The Advisory Committee members were recruited from local hospitals (The Ottawa Hospital and Children's Hospital of Eastern Ontario) and The Arthritis Society (Ottawa branch) by poster, e-mail or social media sites of their respective institutions. The Advisory Committee met on three separate occasions that were facilitated by the principal investigator (GD).

The timeline and purpose of each Advisory Committee meeting is presented in Figure 1. The purpose of the first meeting, which took place three months prior to commencing the feasibility study, was to obtain detailed feedback regarding various barriers to engaging in a Facebook group page to disseminate educational material (such as the PGrip program) to patients and to provide recommendations of how the Facebook group page could be tailored to improve usability. Advisory Committee members were provided with instructions on how to access the Facebook group page prior to the first meeting. The Advisory Committee was asked to provide feedback on the usability of the Facebook intervention using the Technology Acceptance Model 2 (TAM2) questionnaire,[35] an extension of the original model.[49] A discussion to obtain feedback on barriers took place with an interview guide based on the theoretical domains framework (TDF).[36] Results were analyzed by two assessors and differences were resolved by consensus.

The purpose of the second meeting, one month before the commencement of the feasibility study, was to provide an opportunity for the Advisory Committee members to comment and provide insight on the design and methodology of the feasibility study. Specifically, Advisory Committee members discussed the findings from the first meeting and how the Facebook group page could be tailored to address the identified barriers and facilitators discussed. Based on results from the usability questionnaire in the first meeting, the Facebook group page was to be deemed "usable" if the majority of participants (at least four of the six respondents) achieved an overall mean item score of five (*somewhat agree*) or greater out of a possible seven points on a tailored 24-item TAM2 questionnaire (Appendix 1). The threshold score of five out of seven was chosen a priori and was considered to be the minimum score representing a positive response regarding usability. In the event that the Facebook intervention was not found to be "usable", the Advisory Committee would have reconvened at a later date following the second meeting to complete the usability questionnaire once again after the Facebook intervention had been tailored. This process was to be followed until the Committee came to a consensus that the Facebook intervention was deemed to be "usable" and ready for the feasibility study.

Figure 1. Timeline and purpose of Advisory Committee meetings.

The purpose of the third and final meeting, one month after the completion of the feasibility study, was to allow the Advisory Committee members an opportunity to contribute to the interpretation of findings, and brainstorm ideas on how the feasibility study results could be disseminated. They were also asked to provide guidance on the methodology for a future RCT.

Feasibility study

A single arm, pre-post design was used for the feasibility study. Arthritis health professionals were recruited and provided with instructions on how to access the Facebook group page.

Participants. A convenience sample of 78 arthritis health professionals was recruited across Canada by online advertisements using email or online newsletters from the following organizations: Arthritis Health Professions Association, The Arthritis Society, Canadian Physiotherapy Association, Vancouver Coastal Health, St Elizabeth Health Care, Ontario Physiotherapy Association, and Montfort Hospital. A representative from each organization either forwarded the email advertisement to their colleagues or had the advertisement published in their respective organization's online newsletter. New PGrip users and those already familiar with the PGrip program were invited to participate. In order to be eligible for the feasibility study, participants must have been: (a) trained as a nurse, or physical/occupational therapist; (b) registered with their provincial professional regulatory body; (c) currently practicing clinically which was defined as spending a minimum of 50% of their time (work week) in direct arthritis patient care; (d) had Internet access; (e) communicate in English; and (f) did not participate in the Advisory Committee. Individuals not meeting all inclusion criteria were excluded and were not deemed eligible for the study. Prior to being enrolled in the study, participants were assessed for eligibility through the use of an online admission questionnaire. If deemed eligible, participants registered to the study by contacting the research coordinator by email who later responded and provided further instructions to accessing the Facebook group page. All participants completed an electronic consent form approved by the University of Ottawa Research Ethics Board (H11-12-10).

Measures. Participants completed three assessments using the Fluid Survey online platform.[50] The survey links were sent to participants by email. The first assessment included baseline measurements prior to participating in the Facebook group page. The second assessment was performed immediately after posting the material on the Facebook group page (two weeks after baseline). The third and final assessment was at three-months post-intervention.

The primary outcome measure was change in perceived usability of Facebook as a dissemination strategy for the PGrip program with patients at two-weeks post-intervention, measured using an instrument based on the TAM2 questionnaire, a validated tool showing internal consistency reliability and construct validity.[35] Change in perceived usability at three-months post-intervention was also assessed. The TAM2 is a 26-item questionnaire consisting of nine domains: *intention to use* (two items), *perceived usefulness* (four items), *perceived ease of use* (four items), *subjective norm* (two items), *voluntariness* (three items), *image* (three items), *job relevance* (two items), *output quality* (two items), and *result demonstrability* (four items). The TAM2 questionnaire is measured on a seven-point Likert scale (1 = *strongly disagree* to 7 = *strongly agree*). Given that Facebook may not be accessible due to firewalls in the workplace for all study participants, two items from the *image* domain were removed. Thus a tailored 24-item TAM2 questionnaire was used (Appendix 1). Definitions for each domain of the TAM2 questionnaire can be found in Appendix 2.

Other outcomes included: (a) change in perceptions of barriers to using Facebook as a dissemination strategy for the PGrip program with patients at two-weeks post-intervention and three-months follow-up; (b) practice behavior change in using Facebook as a dissemination strategy for the PGrip with patients at two-weeks post-intervention and three-months follow-up; and (c) changes in Facebook use and impact measures at two-weeks post-intervention and three-months follow-up

To measure change in perceptions of barriers, participants were asked to identify their top three barriers to engaging in the Facebook group page. Each identified barrier was coded and categorized according to constructs of the TDF and was analyzed descriptively. For example, a lack of experience or skill was categorized as a "skill" barrier, while a lack of Internet access at the workplace was categorized as an "environmental context and resources" barrier.

Practice behavior change was measured using an instrument based on the TDF questionnaire.[36] The TDF questionnaire is a validated tool that has shown high internal consistency reliability and discriminant validity.[36] As identified by Huijg et al.,[36] the TDF questionnaire is generic and can be used to measure TDF-based determinants of healthcare professionals' specific implementation behaviors. The TDF questionnaire is a 32-item tool that allows for application within a range of different contexts in which implementation research takes place. Each domain contains a different amount

of items: *knowledge* (four items), *skills* (three items), *social/professional role and identity* domain (four items), *optimism* (two items), *beliefs about capabilities* (three items), *beliefs about consequences* (two items), *intentions* (four items), *memory/attention /decision* (four items), *environmental context and resources* (two items), *social influences* (two items), and *emotion* (two items). The TDF questionnaire is scored by a five-point Likert scale (1 = strongly disagree to 5 = strongly agree) for most domains, though not all 32 items use the same five-point Likert scale. For example, one item in the tailored questionnaire asks "For how many of the next 10 patients do you intend to use the Facebook group page to disseminate PGrip?" Options for this question consisted of a five-point Likert scale ranging from no patients to >4 patients. Another question asked "How strong is your intention to use Facebook to implement (share/discuss) PGrip with patients?" Options for this question consisted of a five-point Likert scale ranging from 5 = very strong to 1 = very weak. Four items (one from the *skills* domain, one from the *beliefs about capabilities* domain, and two from the *emotions* domain) were removed, as they were not deemed to be appropriate for the nature of the Facebook intervention in the health professional workplace. As a result, the *emotion* domain was not evaluated. Thus, a tailored 28-item TDF questionnaire was used (Appendix 3). Definitions for each domain of the TDF questionnaire can be found in Appendix 4.

Facebook impact measures were assessed by asking participants to rank the number of times they used the following Facebook tools using a five-point Likert scale ranging from one (>8 times) to five (0 times): (a) posted a comment on the "Wall" of the Facebook page; (b) posted a comment on a video on the Facebook page; (c) used the "Like" feature on a comment and/or video on the Facebook page; and (d) shared a link to a video or other website on the Facebook page.

Statistical analyses. For the Advisory Committee, the discussion was digitally recorded and field notes were taken by a non-participant observer. Following the first meeting, results from the usability questionnaire were analyzed descriptively using means and standard deviations (SDs) for items and domains. Discussion responses surrounding perceived barriers were analyzed and coded following the constructs of the TDF (Appendix 4).

For the feasibility study, data analyses were performed using SPSS v. 22. Descriptive statistics such as proportions, mean and SD were used to summarize baseline characteristics. For the primary outcome of usability, a paired *t*-test was conducted to compare changes from baseline scores to two-weeks post-intervention for each item of the TAM2 questionnaire. Additional paired *t*-test analyses were conducted comparing baseline scores to the three-month follow-up period. Adjustments for multiple comparisons were not made to the statistical testing. To facilitate the interpretation of findings, mean scores and SDs were calculated for each TAM2 domain. The data was deemed to be normally distributed. For the secondary outcome of TDF domain item scores, the same analysis strategy using paired *t*-tests to compare changes from baseline to two-weeks post-intervention and baseline to three-month follow-up was considered. Mean scores and SDs were also calculated for each TDF domain. Descriptive statistics were used to summarize the perceived barriers and Facebook impact measures. For perceived barriers, the proportion of all responses was calculated for each identified barrier according to TDF construct, while for Facebook impact measurement, the proportion of participants using Facebook was calculated for each question. For the analyses of the TAM2 and TDF scores, missing values were imputed using the last observation carried forward approach. Additionally, complete case analyses, in which missing data were omitted, were performed for all outcomes.

Results

Advisory Committee

During the first Advisory Committee meeting, several common barriers and facilitators to using Facebook as a dissemination strategy were discussed. The Advisory Committee felt that the Internet is an easier method for accessing clinical practice guidelines and evidence-based material using printed articles and materials. Ultimately, Committee members would not have initially thought to use Facebook as a dissemination strategy but, if they were aware that the information was there, they would refer it to their patients. Generally, the Committee members were not familiar with Facebook. However, after using the group page, it was deemed more straightforward than what was previously believed. Several barriers to using the Facebook group page with patients were brought forward including privacy concerns using social media platforms. Initially, one Committee member stated "I wouldn't join a page made specifically for patients because of personal confidentiality." While there was a consensus and hesitancy for both clinicians and patients to use personal accounts to interact and post comments, this concern was mitigated after it was identified that personal accounts were not needed to access the content of the group page. Another common theme identified as a barrier was access to the Internet, computer, and mobile devices. One Committee member stated "Computers with access to high speed Internet may be hard to find at times." The Advisory Committee

members felt that their patients' general computer skills may be another potential barrier. One Committee member stated that "Certain clients may have issues with using social media platforms." Committee members felt that Facebook was useful for patients in clinical settings indicating that "patients in the waiting room can scroll through the page." They also felt that the group page was appropriate and liked the idea of providing patients with a web link, as opposed to a pamphlet. In order to tailor and improve the PGrip Facebook group page for the feasibility study, each Advisory Committee member provided feedback, such as minor glitches in some of the videos, and suggestions on page accessibility (e.g. instructions on navigating the site, and improved ordering of videos) were provided. These comments were addressed prior to commencing the feasibility study. Results from the TAM2 questionnaire revealed that all Advisory Committee members believed that the Facebook group page was "usable" as four of six respondents achieved an overall mean item score of five (*somewhat agree*) or greater out of a possible seven points. Total mean (SD) item scores ranged from 4.8 (1.6) (*neutral*) to 5.8 (1.0) (*somewhat agree*). Consensus on the usability was further confirmed after discussing these findings with all Advisory Committee members at the second meeting. The consensus agreed upon by all committee members was that the Facebook group page was a "usable" tool that warranted further investigation in a feasibility study.

During the second Advisory Committee meeting, members brainstormed and discussed the methodology for the proposed feasibility study. In addition to Facebook being a dissemination strategy for arthritis health professionals to use with patients, the original scope of the proposed feasibility study was to also examine the use of Facebook as a tool for health professionals to access evidence-based material, such as the PGrip program, to improve their own knowledge. The Committee members came to a consensus and decided that the usability questionnaire (TAM2) should only focus on Facebook as a dissemination tool for health professionals with patients. The Committee felt that questions pertaining to the use of Facebook as an information source for health professionals could be omitted. While the Committee was enthusiastic about Facebook as a dissemination tool that health professionals can use with their patients, they did not believe that Facebook would be as useful as an information source for health professionals. The main reasoning for this was that according to one of the inclusion criterion "spending a minimum 50% of the time in direct patient care," health professionals should already have the knowledge of the material presented in PGrip. This important feedback was considered and implemented in the feasibility study.

During the third Advisory Committee meeting, results from the feasibility study (presented below), were presented. The Committee also provided ideas for disseminating the results of this study which included publishing the findings in a peer-reviewed journal and providing an electronic information brief to patient organization groups who could then include them in their newsletters, websites, or social media pages. The Committee also brainstormed ideas for a future full-scale RCT that would compare the Facebook group page with other information and communication technologies such as websites, YouTube channels, or device applications ("apps").

Feasibility study

A summary of baseline demographic information can be found in Table 1. A total of 78 arthritis health professionals, comprising 14 (17.9%) occupational therapists, 53 (67.9%) physiotherapists, and 11 (14.1%) registered nurses participated in the study. The mean age of participants was 40.0 years and the majority resided in Ontario (65.4%) and were female (93.4%). While the majority had a Facebook account (93.6%), only 39.7% had access to Facebook at the workplace, though 89.7% stated they would use Facebook outside work hours. In regards to work setting, 54.1% worked in group practice, seeing on average approximately nine patients per day. Most (29.5%) worked in a hospital, 23.0% worked in private practice, 16.4% in a community health center, 9.8% in a rehabilitation facility, and 21.3% in other settings (e.g. home or outpatient). Most had greater than 20 years of clinical experience (31.1%) and were not familiar with the PGrip program (88.5%). All 78 participants completed the baseline questionnaire, 76 (97.4%) completed the second questionnaire at two-weeks post-intervention and 75 (96.2%) completed the final questionnaire at three-months post-intervention. A study flowchart of feasibility study participants is presented in Figure 2.

Change in perceived usability. For the primary outcome of usability based on the TAM2 questionnaire at two-weeks post-intervention, the mean absolute changes from baseline for each item, is presented in Appendix 5. Figure 3 presents the mean usability scores for each domain at baseline, two-weeks post-intervention, and three-months follow-up. At two-weeks post-intervention, the mean (SD) score numerically improved, though responses remained categorized as *neutral* for the *intention to use* domain from 4.46 (0.07) to 4.96 (0.01) (both items statistically significant), the perceived *usefulness* domain from 4.56 (0.43) to 4.81 (0.39) (two of four items statistically significant), and the output quality domain from 4.02 (0.06) to 4.87 (0.15) (both items

Table 1. Baseline characteristics and Facebook use ($n = 78$).

	n	%
Province of residence		
Ontario	51	65.4
Quebec	6	7.7
British Columbia	17	21.8
Other	4	5.1
Profession		
OT	14	17.9
PT	53	67.9
RN	11	14.1
Age[a]		
Mean (SD)[a]	40.0 (10.3)	
Sex[a]		
Male	4	6.6
Female	57	93.4
Practice location[a]		
Urban	37	60.7
Rural	11	18.0
Suburban	13	21.3
In which of the following settings do you usually work?[a]		
Private practice	14	23.0
Hospital	18	29.5
Rehabilitation facility	6	9.8
Community health center	10	16.4
Other (home, outpatient, community care)	13	21.3
What is your primary employment role?[a]		
Clinician	57	93.4
Other	4	5.1
On average, how many clients do you see per day?[a]		
Mean (SD)	8.64 (4.68)	
In regards to your work setting, do you work in[a]		
Solo practice	28	45.9
Group practice	33	54.1
Group practice role:		
Primary therapist	23	37.7
Educator	3	4.9
Multidisciplinary	2	3.3
Interdisciplinary	2	3.3
Manager/chair of team	1	1.6
Did not state	2	3.3
Level of education (as practitioner degree)[a]		
Diploma	4	6.6
Bachelor's degree	35	57.4
Master's degree	22	36.1
How many years of clinical experience do you have as a PT/OT/RN[a]		
0–4	8	13.1
5–9	14	23.0
10–14	8	13.1
15–19	10	16.4
>20	19	31.1
Familiar with Facebook		
Yes	72	92.3
No	5	6.4
Did not respond	1	1.3
Has a Facebook account		
Yes	73	93.6
No	5	6.4
Has access to Facebook at the workplace		
Yes	31	39.7
No	46	59.0
Did not respond	1	1.3
Would use Facebook outside work hours		
Yes	70	89.7
No	3	3.8
Did not respond	5	6.4

OT: occupational therapist; PT: physiotherapist; RN: registered nurse; SD: standard deviation.
[a]Based on responses from 61 participants.

statistically significant). The mean score improved from *somewhat disagree to neutral* for the *job relevance* domain from 3.78 (0.69) to 4.18 (0.91) (one of two items statistically significant). The mean scores improved from *neutral to somewhat agree* for the *perceived ease of use* domain from 4.41 (0.41) to 5.22 (0.46) (all four items statistically significant) and *result demonstrability* domain from 4.84 (0.45) to 5.07 (0.42) (one of four items statistically significant). The mean score numerically improved, but the response remained categorized as *moderately agree for* the *voluntariness* domain from 6.27 (0.38) to 6.54 (0.04) (one of three items statistically significant). There were no statistically significant improvements for the *subjective norm* or *image* domains.

At three months, the mean score numerically improved from baseline, though responses remained categorized as *neutral* for the *perceived ease of use* domain from 4.41 (0.41) to 4.97 (0.45) (three of four items statistically significant), and the *output quality* domain from 4.02 (0.06) to 4.98 (0.28) (both items statistically significant). The mean score improved from *somewhat disagree to neutral* for the *job relevance* domain from 3.78 (0.69) to 4.17 (0.67) (one of two items statistically significant). The mean score numerically improved, but remained categorized as *moderately agree* for the *voluntariness* domain from 6.27 (0.38) to 6.59 (0.04) (one of three items statistically significant). There were no statistically significant improvements for the *intention to use*, *perceived usefulness*, *subjective norm* or *result demonstrability* domains. There was a numeric decrease in mean score from baseline for the *image* domain from 2.79 (1.41) to 2.28 (1.51), however the response remained categorized as *moderately disagree*

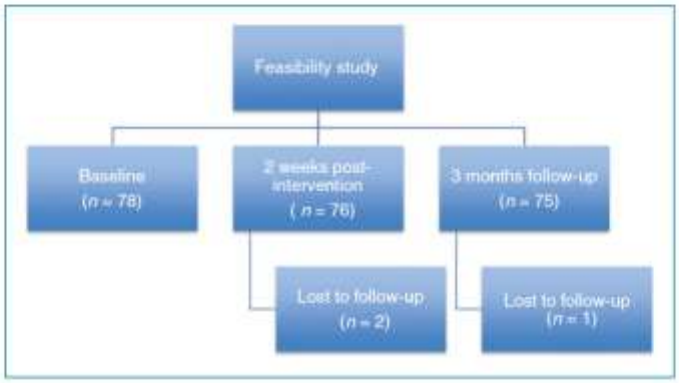

Figure 2. Feasibility study flowchart.

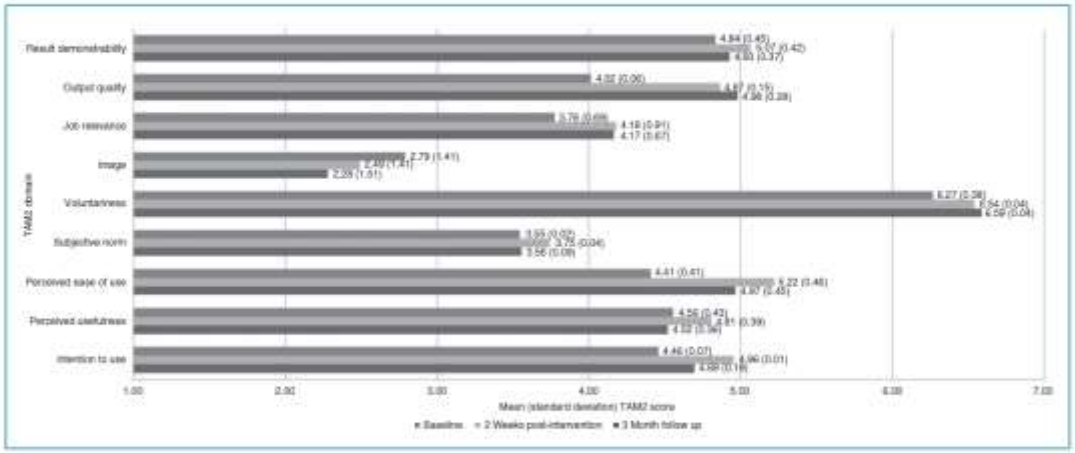

Figure 3. Mean usability scores by Technology Acceptance Model 2 (TAM2) domain.

Table 2. Perceived barriers to engaging in Facebook group page.

Barrier (based on TDF)*	Baseline (n = 226)	2 Weeks (n = 219)	3 Months (n = 207)
Knowledge	9.3%	10.1%	7.3%
Skills	9.7%	11.0%	10.1%
Social/professional role and identity	16.4%	10.1%	5.3%
Beliefs about capabilities (self-efficacy)	7.1%	7.7%	10.6%
Beliefs about consequences (anticipated outcomes/ attitude)	9.7%	10.1%	7.3%
Motivation and goals (intention)	0.4%	0.0%	0.0%
Memory, attention and decision processes	0.4%	0.0%	0.0%
Environmental context and resources (environmental constraints)	45.6%	50.2%	56.5%
Emotion	1.3%	0.5%	0.5%
Nature of behaviors (habits)	0.0%	0.5%	2.4%

TDF: theoretical domains framework.
*Participants provided multiple responses as they were instructed to list their top three barriers.

(the one item was statistically significant). There were no differences between the complete case analysis and last observation carried forward analysis at two weeks and three months.

Change in perceptions of barriers. Prior to receiving the Facebook intervention at baseline, the most common barriers to using Facebook as a dissemination strategy for the PGrip with patients, as categorized by the TDF, were *environmental context and resources* (environmental constraints) (45.6%). Other common barriers included *social/professional role and identity* (16.4%) and *beliefs about consequences* (anticipated outcomes/ attitude) (9.7%) (Table 2). Following the intervention after two weeks, the most common barriers were *environmental context and resources* (50.2%), *skills* with using the Facebook group page (11.0%) and *knowledge* about Facebook (10.1%). After three months, the most common barriers were *environmental context and resources* (56.5%), *beliefs about capabilities* (self-efficacy) in using Facebook (10.6%), and *skills* with using the Facebook group page (10.1%).

Practice behavior change. For the outcome of practice behavior change based on the TDF questionnaire at two weeks post-intervention, the mean absolute change from baseline for each item is presented in Appendix 6. Figure 4 presents the mean practice behavior change scores for each domain at baseline, two-weeks post-intervention, and three-months follow-up.

At two-weeks post-intervention, the mean (SD) score numerically improved, though responses remained categorized as *neutral* for the *optimism* domain from 3.37 (0.26) to 3.55 (0.32) (three of four items statistically significant), *beliefs about capabilities* domain from 3.55 (0.18) to 3.76 (0.21) (one of two items statistically significant), and the *intentions* domain from 3.05 (0.29) to 3.20 (0.36) (one of four items statistically significant). The mean score improved from *somewhat disagree* to *neutral* for the *knowledge* domain from 2.35 (0.16) to 3.96 (0.14) (four of four items statistically significant), *skills* domain from 2.56 (1.18) to 3.40 (1.05) (two of two items statistically significant), and *memory/attention/decision* domain from 2.91 (0.66) to 3.27 (0.55) (three of four items statistically significant). There was a numerical improvement in mean score for the *social/professional role identity* domain from 2.53 (0.32) to 2.59 (0.09) (two of four items statistically significant), however the responses remained categorized as *somewhat disagree*. Items of the *social/professional role and identity* domain demonstrated variable findings as there was a statistically significant improvement for one of the four items, and a statistically significant decrease for another item. There were no statistically significant improvements for the *environmental context and resources* and *social influences* domains.

At three months, the mean *knowledge* domain score improved from *somewhat disagree* to *agree* from 2.35 (0.16) to 4.03 (0.06) (four of four items statistically significant). The mean score numerically improved, though responses remained categorized as *neutral* for the *optimism* domain from 3.37 (0.26) to 3.55 (0.36) (one of four items statistically significant), and *beliefs about capabilities* domain from 3.55 (0.18) to 3.77 (0.12) (one of two items statistically significant). The mean

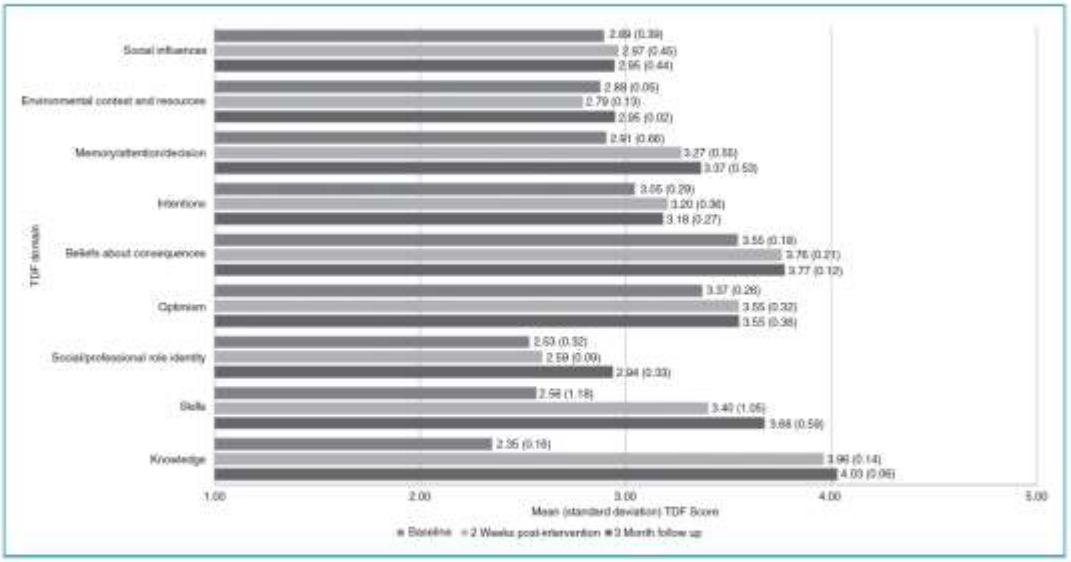

Figure 4. Mean practice behavior change scores by theoretical domains framework (TDF) domain.

domain score improved from *somewhat disagree* to *neutral* for *skills* domain from 2.56 (1.18) to 3.68 (0.59) (two of two items statistically significant), and *memory/attention/decision* domain from 2.91 (0.66) to 3.37 (0.53) (three of four items statistically significant). There were no statistically significant improvements for the *optimism, intentions, environmental context and resources* and *social influences* domain.

Facebook use and impact measures. Facebook use and impact measures at two-weeks post-intervention and three-months follow-up is presented in Table 3. After two weeks, the majority of participants (93.6%) did not post a comment on the "Wall" of the Facebook group page, while one participant (1.3%), and two participants (2.6%) posted a comment once and three times respectively. Similarly, the majority of participants (93.6%) did not post a comment on a video of the Facebook group page, while one participant (1.3%), and two participants (2.6%) posted a comment once and three times respectively. Most participants (64.1%) did not use the "like" feature on a comment and/or video on the Facebook group page, while 15 participants (19.2%) used the like feature once, six participants (7.7%) used the like feature three times, three participants (3.8%) used the like feature five times, and one participant (1.3%) used the like feature eight times or greater. Most participants (85.9%) did not share a link to a video or other websites on the Facebook group page, while six participants (7.7%), two participants (2.6%), and one participant (1.3%) shared a link once, three times, and eight times or greater, respectively. After three months, the number or participants who posted a comment on the "Wall", posted a comment on a video, used the "like" feature, and shared a link to a video or other website generally increased in comparison with the assessment at two weeks (Table 3).

Discussion

We hypothesized that arthritis health professionals would demonstrate improvements in the perceived usability of Facebook to share information from the PGrip program with patients after two weeks and three months. The sample of participants included a diversity of work settings. As nearly almost all participants (89%) were not previously familiar with the PGrip program, this study highlights the need for additional dissemination strategies. Two weeks after its introduction, the feasibility of the Facebook group page being an easy to use tool was confirmed as arthritis health professionals indicated a greater intention to use the group page, agreeing that they would share it with patients. Participants demonstrated improved ease of use as they agreed that the group page was clear and understandable, did not require a significant amount of mental effort, was easy to use with patients, and easy to accomplish what they intended to do with the page. There were also improvements in output quality as participants agreed that the output they got from the group page was high, and that they had no problem with the quality of group page. There remains uncertainty with improvements regarding the perceived

Table 3. Facebook use ($n = 78$).

	2 Weeks		3 Months		Absolute mean change
	n	%	n	%	%
Posted a comment on the "Wall" of the Facebook group page					
>8 times	0	0.0%	0	0.0%	0.0%
5 times	0	0.0%	1	1.3%	1.3%
3 times	1	1.3%	0	0.0%	−1.3%
1 time	2	2.6%	6	7.7%	5.1%
0 times	73	93.6%	68	87.2%	−6.4%
No response	2	2.6%	3	3.8%	1.3%
Posted a comment on a video on the Facebook group page					
>8 times	0	0.0%	1	1.3%	1.3%
5 times	0	0.0%	0	0.0%	0.0%
3 times	2	2.6%	2	2.6%	0.0%
1 time	1	1.3%	6	7.7%	6.4%
0 times	72	92.3%	66	84.6%	−7.7%
No response	3	3.8%	3	3.8%	0.0%
Used the "Like" feature on a comment and/or video on the Facebook group page					
>8 times	1	1.3%	3	3.8%	2.6%
5 times	3	3.8%	5	6.4%	2.6%
3 times	6	7.7%	3	3.8%	−3.8%
1 time	15	19.2%	16	20.5%	1.3%
0 times	50	64.1%	48	61.5%	−2.6%
No response	3	3.8%	3	3.8%	0.0%
Shared a link to a video or other website on the Facebook group page					
>8 times	1	1.3%	2	2.6%	1.3%
5 times	0	0.0%	0	0.0%	0.0%
3 times	2	2.6%	3	3.8%	1.3%
1 time	6	7.7%	7	9.0%	1.3%
0 times	67	85.9%	63	80.8%	−5.1%
No response	2	2.6%	3	3.8%	1.3%

usefulness of the group page (*perceived usefulness* domain) and relevance of the group page in relation to participants' jobs (*job relevance* domain). While numerical improvements were seen for all items of these domains, not all items demonstrated statistically significant changes from baseline. Both the perceived usefulness and job relevance domains included multiple items. While all domain items pertain to a common theoretical construct (domain), each item was intended to capture various components of their respective domains. For example, the perceived usefulness domain asked patients whether the Facebook group page improved their job performance, increased their productivity, enhanced their job effectiveness, and whether they perceived the tool to be useful in their job. Only items pertaining to increased productivity and usefulness of the tool in their job demonstrated statistically significant differences, while the remaining items did not. The statistically significant findings are in line with the discussion of the Advisory Committee, which concluded that the Facebook group page was a useful tool to refer the PGrip program to their patients and that it provides clinicians with another resource or tool to teach their patients about RA and OA self-management. Another study that surveyed 485 primary care physicians and oncologists in the USA concluded that social media was perceived as being a useful and efficient method to share medical knowledge.[25] Similar to our study, the Technology Acceptance Model was used to explore physician's attitudes towards social media, and their perceptions on its usefulness and ease of use. Approximately 46.0% of respondents used social media on a weekly basis to scan or explore medical information, 57.5% perceived social media to be beneficial and engaging as a method to access high-quality information, 57.9% felt it was useful and enabled them to care for patients more effectively, and 60% felt it improved the quality of the care that they delivered. In our feasibility study, the *job relevance* domain asked patients whether the use of the Facebook group page was both important and relevant in their job; only the latter item was statistically significant. Although unclear, non-significant findings may be explained by the lack of a clear definition of what is considered 'important'. These findings were also consistent with discussions among the Advisory Committee who commented that the use of a Facebook group page was relevant to their jobs as most hospitals, rehabilitation facilities and community health centers have similar social media pages to share information with patients and clients; there were no comments or indications on the importance of using the Facebook page in their jobs.

With variable findings (i.e. some items showing improvements and others showing declines from baseline), further uncertainty remains in relation to the voluntariness of using the group page (*voluntariness* domain), and difficulties in communicating the findings, benefits, and consequences of the group page with others (*result demonstrability* domain). The variable results of the *voluntariness* and *image* domains may be explained by the nature of the intervention, in which the introduction of a Facebook page would likely not have an impact on change in voluntariness (i.e. organization policies would not change because of the intervention), and image (i.e. difficult to change perception of one's image or status in a social system in such a short period of time); however, reasoning for the variable results of the *result demonstrability* domain remains unclear. Furthermore, the variable results of the *voluntariness* and *image* domains may be explained by the baseline mean scores, which were numerically higher for the *voluntariness* domain, and lower for the *image* domain, in comparison to other domains scores, suggesting that participants had strong beliefs about these two domains prior to the study, which may not have allowed for a large margin of change. The Facebook group page did not appear to have an impact on *image*, as participants did not agree that using the group page would enhance how they would be viewed by their organizations for using the group page. Additionally, it remains unclear exactly how long it takes to change the perception of one's image or status in a social system. Thus, this study may not have been of sufficient duration to measure and assess whether the Facebook group page can have a positive effect on *image*. As seen in other research that has used the TAM2, the impact of image on perceived usefulness is not significant when the usage of a technology or system is optional.[35,51] Peluchette et al. found that while the use of social media in the work setting can elicit positive reactions such as improving job satisfaction and strengthening relationships, social media use may be seen as unprofessional or inappropriate, creating possibilities for confidentiality breaches.[27] Similar privacy and patient confidentiality concerns were also identified in this feasibility study, which may explain the health professionals' negative implication on image. There is also uncertainty regarding the perception that that most people believe they should be using Facebook as a dissemination strategy as there were no statistically significant improvements in the *subjective norm* domain. While social media continues to grow in popularity, its use in a work environment is not always accepted as it is sometimes seen as mixing professional and personal boundaries.[27]

Findings at three months suggest that the overall perceived usability of the Facebook group page appeared to marginally decline over time as changes from baseline were generally similar though inferior to measurements at two weeks for the *intention to use*,

perceived ease of use, *subjective norm*, *job relevance* and *result demonstrability* domains. However, changes in the *intention to use* and *perceived usefulness* domains no longer remained statistically significant at three months. In contrast, improvements in output quality were superior after three months, which may be a result of participants having more time to explore the content and videos of the group page. The findings from the use of the group page suggest that the majority of participants did not use it regularly in their everyday practice, which may explain the marginal decline in item scores after three months.

The successful implementation of evidence-based practice in arthritis care requires an interprofessional approach to identify barriers.[47] This study included physiotherapists, occupational therapists and nurses who work in arthritis care. Numerous barriers to engaging in the Facebook group page to disseminate the PGrip program to patients were identified. The most common barriers identified were those related to *environmental context and resources*. Most participants were concerned about Internet access or not having access to a computer or mobile devices in the workplace. Similarly, they were concerned whether their patients had Internet access, or access to computers and mobile devices. In addition, several participants also felt that they did not have a sufficient amount of time in their work environment to go through the Facebook group page with patients as timing is limited to performing comprehensive assessments. As clinics and hospital settings continue to evolve, there is a need for access to Internet and technologies by health professionals in these institutions. Technology in the work setting has shown to facilitate clinical and patient shared decision making.[2] If health professionals have limited time to go through the PGrip content, they can simply provide patients with the link to the Facebook group page to allow them to access the content on their own, and perhaps answer any questions at a future visit. Another common concern of participants was the *social/professional role and identity*. Some institutions prohibit the use of social media while working and some identified that it is perceived "unprofessional" to use Facebook at work. Additionally, participants were hesitant of whether the group page would allow for theirs and their patients' privacy and confidentiality to be maintained. While these were common barriers identified at baseline, after three months, there was a decrease in the proportion of participants who identified barriers relating to *social/professional role and identity*. After engaging in the PGrip Facebook group page, health professionals may have realized that the group page can be used in a professional manner to assist patients to self-manage their arthritis. In recent years, social media in the workplace has evolved,[15] and more and more organizations are creating organizational Facebook pages.[23] The PGrip Facebook group page does not require patients or health professionals to identify themselves. While the use of some tools such as posting comments or writing on the "Wall" requires individuals to create an account, the content and videos on the group page are accessible for everyone with or without a Facebook account. Other barriers identified were knowledge relating to Facebook as some participants and their patients were not familiar with the social networking website. Participants were also concerned about their patients not possessing the necessary general computer skills to navigate to the Facebook group page. Findings at three months suggest that barriers associated with knowledge and skills were marginally reduced after participants grew more familiar with the group page. This may suggest that this barrier may continue to be reduced after a longer period of time and greater exposure.

We also hypothesized that the Facebook group page can improve practice behavior change among arthritis health professionals as a strategy to disseminate PGrip after two weeks and three months. While improvements were seen after two weeks, participants overall did not feel that the Facebook group page had an impact on their practice behavior in regards to the dissemination of the PGrip program. Based on findings from the TDF questionnaire, baseline scores indicated that participants' had negative or neutral feelings regarding the various domains. Arthritis health professionals indicated improvements in understanding the content, objectives and how to use the Facebook group page (*knowledge* domain). Participants demonstrated improved skills (*skills* domain), agreeing that they had the skills to use the group page. While other improvements were seen across other domains, participants either remained neutral or in disagreement on whether the Facebook group page had an impact on their practice behavior. Though mostly similar to comparisons at two weeks, there were marginal improvements in several domains (e.g. *knowledge*, *social/professional role and identity*, *beliefs about capabilities*, *memory/attention/decision*, *and environmental context and resources*) after three months. Two weeks, and three months may not have been a sufficient amount of time to detect meaningful differences in practice behavior change. Change in practice can take several years, with some estimates even suggesting between one to two decades for original research to be incorporated into routine practice.[52]

Research has shown that most health professionals already have basic knowledge of how to use Facebook with colleagues and patients, and the implication of using it.[23] Another study similarly concluded that social media has a limited impact on change in practice as adding social media-based outreach dissemination methods to traditional methods did not improve awareness of the CPG and knowledge of CPG recommendations, nor did it affect implementation of the recommendations.[53]

The majority of participants did not use features of the Facebook group page such as the "Wall" or "Like" button, or posted comments on the videos. There were marginal increases in the use of these features over time, which may suggest that participants grew more comfortable or had more time to use them, however overall usage remained low. Although previous research has shown that health professionals frequently use social media even though the perceived barriers are high,[34] the barriers identified in this study by have impacted the overall use of the Facebook group page. One potential reason for the low rate of usage of these features may be related to concerns over confidentiality and privacy as noted in both the Advisory Committee discussion and the findings of barriers. Based on these concerns, there have been recommendations made to health professionals to not contact patients through Facebook and to use high privacy settings.[54] Laliberté et al. surveyed 322 physiotherapists and physical rehabilitation therapists practicing in Quebec, Canada to determine their knowledge and practice behavior of using Facebook.[23] While the majority (84.3%) had a personal Facebook account, only 3% of respondents reported having a professional profile. Several respondents (35.5%) stated that their workplace had a professional page, 27% had employers as online friends, while 21% had patients as online friends. A study that explored the attitudes and experiences of 682 health professional students using Facebook concluded that 44% of respondents had colleagues as online friends.[55] Health professional students were more cautions with Facebook use with patients as only less than 1% had current patients/clients as online friends and 40% felt it was unprofessional to post any information relating to a patient/client, even in the absence of identifying information. There was a consensus that posting material to Facebook was associated with risks to their current position and future prospects.[55]

Both perceived usability and practice behavior change are complex outcomes, influenced by various factors (domains).[35,56–59] The use of questionnaires based on theoretical frameworks (i.e. TDF and TAM2) allowed for the identification of change across various domains. As highlighted above, greater improvements were seen in certain domains for perceived usability (e.g. intention to use, ease of use, output quality) and certain practice behavior domains (e.g. knowledge and skills) compared to others. The TDF framework also allowed for the categorization of barriers, highlighting that *environmental context and resources* were by far the biggest concern for arthritis health professionals to using the Facebook group page.

From the overall findings of this feasibility study, we can infer that Facebook offers arthritis health professionals with another option as a dissemination strategy to share evidence-based information, such as the PGrip program, with their patients to successfully self-manage their arthritis. More patients are using the Internet to access health information.[12] Over a billion people around the world are currently on Facebook,[21] and approximately one in every three older adults who use the Internet access social networking sites such as Facebook, and approximately 20% contribute to these sites by commenting or sharing the health and medical information.[60,61] A study by Brosseau et al. used Facebook to disseminate the PGrip program to older patients with arthritis.[33] Overall, the Facebook group page successfully enhanced patients' knowledge and improved intention to use PGrip self-management strategies. Facebook may provide arthritis health professionals with an additional option to enhance self-management support among their patients. Furthermore, directing patients to explore the Facebook group page on their own may help reduce the amount of time needed during consultations for patient education and behavior change counseling.

While social media is increasingly becoming more popular among health professionals,[15,23] further research to determine its usability as a dissemination strategy to share evidence is needed. A RCT comparing Facebook with other information and communication technology dissemination strategies would provide further insight on whether it is more usable than other social media platforms or other technologies such as email or websites. Studies should be adequately powered and exploratory subgroup analyses should be performed to consider important factors noted above. Future studies should focus on the strengths of domains that demonstrated successful improvements in this study, as should strive to understand how other perceived usability domains can be improved. As noted in similar research,[23,55] there is a need to establish guidelines on social media use in the workplace as professional communications and interaction continue to evolve. Health professionals should be informed on whether current guidelines exist in their workplace[23] as guidance on the use of social networking software can help health professionals maintain professionalism while being able to share material and use these technologies.[55]

Limitations

There were limitations of this study that should be considered. Firstly, this feasibility study used a convenience sample and, as a result, it remains uncertain whether it was adequately powered to detect meaningful differences. Additionally, the study was not designed to assess specific subgroups to determine the effects of factors such as age, practice setting, and clinical experience. Though based on previously validated tools, the

questionnaires used were tailored specifically for the Facebook intervention and this study, thus they were not validated prior to this study. The study was also limited by the pre-post design with measurements at two-weeks post-intervention and three-month follow-up. Specifically, the design did not allow for a comparison group, randomization, and used a short time frame of three months. A longer period of six months or greater would provide useful insight on the long-term effects of the dissemination strategy. Given the nature of the survey-based assessments, response bias regarding whether participants felt obligated to provide socially desirable responses cannot be ruled out. As the majority of participants were female, physiotherapists, resided in Ontario, worked in a hospital and urban setting, it remains unclear whether the limited sample of participants was representative of all arthritis health professionals in Canada and may be subject to selection bias. The sample of participants was middle aged (mean age of 40 years), yet the majority possessed several years of clinical experience (>20 years). Previous research has shown that age and gender do not have a significant impact on the adoption or usage of social media among physicians and that practice-related characteristics do not appear to be associated with use of Internet-based communication technologies.[62] Another study showed that health professionals with a Facebook account were primarily clinicians, younger, with less work experience.[23] Whether older professionals, or those with fewer years of experience would yield similar results remains unclear. Furthermore, while the majority of participants were not familiar with the PGrip program prior to enrolling in the study, the majority were familiar with Facebook and had a registered account. It remains unseen whether familiarity of either the PGrip program or Facebook may have impacted the findings.

Conclusions

This feasibility study suggests that a Facebook group page may be used as a dissemination strategy for the PGrip program by arthritis health professionals, as it was perceived to be usable with patients after two weeks and three months in regards its ease of use and high output quality. There remains uncertainty in regards to the group page's perceived usefulness, relevance to arthritis health professionals' jobs, the perception of whether these individuals should be using Facebook as a dissemination strategy, the voluntariness of using the group page, and difficulties in communicating the findings, benefits, and consequences of the group page with others. The Facebook group page did not appear to have an impact on arthritis health professionals' image and how they would be viewed by their organizations for using the group page. The most common barriers to engaging in the Facebook group page to disseminate the PGrip program to patients included those related to *environmental context and resources* such as access to Internet and technology in the workplace, and patients having this same access at home. While participants' knowledge and skills improved over time, they did not feel that the Facebook group page had an impact on their practice behavior in regards to the dissemination of the PGrip program. The overall usage of features such as the "Wall", "Like" button, and posting of comments was low, though marginally increased over time.

The potential implications of this work are twofold. Firstly, this research provides new knowledge on how a Facebook group page as a dissemination strategy for an evidence-based self-management program for patients is perceived by arthritis health professionals. Secondly, social media, such as Facebook may provide arthritis health professionals with an additional option of how to best share evidence-based information to allow their patients to successfully self-manage their arthritis, while potentially reducing the amount of time needed during consultations for patient education and behavior change counseling.

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Appendix

Appendix 1. Tailored Technology Acceptance Model 2 (TAM2) questionnaire.

Domain	1	2	3	4	5	6	7
Item #	Strongly disagree	Moderately disagree	Somewhat disagree	Neutral (neither disagree or agree)	Somewhat agree	Moderately agree	Strongly agree
Intention to use							
1	Assuming I have access to the Facebook group page, I intend to use it with patients						
2	Given that I have access to the Facebook group page, I predict that I would use it with patients						
Perceived usefulness							
3	Using the Facebook group page may improve my performance in my job						
4	Using the Facebook group page in my job may increase my productivity						
5	Using the Facebook group page may enhance my effectiveness in my job						
6	I find the Facebook group page may be useful in my job						
Perceived ease of use							
7	My interaction with the Facebook group page is clear and understandable						
8	Interacting with the Facebook group page does not require a lot of my mental effort						
9	I find the Facebook group page easy to use with patients						
10	I find it easy to get to the Facebook group page to do what I want it to do						
Subjective norm							
11	People who influence my behavior think that I should use the Facebook group page with patients						
12	People who are important to me think that I should use the Facebook group page with patients						
Voluntariness							
13	My use of the Facebook group page with patients is voluntary						
14	My supervisor does not require me to use the Facebook group page with patients						
15	Although it might be helpful, using the Facebook group page with patients is certainly not compulsory in my job						
Image							
16	People in my organization who use the Facebook group page with patients have more prestige than those who do not						
Job relevance							
17	In my job, usage of the Facebook group page with patients is important						
18	In my job, usage of the Facebook group page with patients is relevant						
Output quality							
19	The quality of the output I get from the Facebook group page is high						
20	I have no problem with the quality of the Facebook group page output						

(continued)

Appendix 1. Continued.

Domain	1	2	3	4	5	6	7
Item #	Strongly disagree	Moderately disagree	Somewhat disagree	Neutral (neither disagree or agree)	Somewhat agree	Moderately agree	Strongly agree
Result demonstrability							
21	I have no difficulty telling others about the results of using the Facebook group page with patients						
22	I believe I could communicate to others the consequences of using the Facebook group page with patients						
23	The results of using the Facebook group page with patients are apparent to me						
24	I would have no difficulty explaining why using the Facebook group page with patients may or may not be beneficial						

Source: Adapted from Venkatesh and Davis.[35]

Appendix 2. Definitions of Technology Acceptance Model 2 (TAM2) domains.

Domain	Definition*
Intention to use	Determined by perceived usefulness and perceived ease of use
Perceived usefulness	The degree to which a person believes that a particular system would enhance his or her performance
Perceived ease of use	The degree to which a person believes that a particular system would be free from effort
Subjective norm	Perception that most people who are important think he should or should not perform the behavior in question
Voluntariness	The degree to which use of the innovation is perceived as being voluntary, or of free will
Image	The degree to which use of an innovation is perceived to enhance one's image or status in one's social system
Job relevance	Perception regarding the degree to which the target system is applicable to his or her job
Output quality	What tasks a system is capable of performing and the degree to which those tasks match their job goals (job relevance)
Result demonstrability	Tangibility of the results of using the innovation will directly influence perceived usefulness

*Source: Venkatesh and Davis.[35]

Appendix 3. Tailored theoretical domains framework questionnaire.

	1	2	3	4	5
Item #	Strongly disagree	Disagree	Neutral (neither disagree or agree)	Agree	Strongly agree
Knowledge					
1	I am aware of the content and objectives of the Facebook group page				
2	I know the content and objectives of the Facebook group page				
3	I am familiar with the content and objectives of the Facebook group page				
4	I am aware of how to use the Facebook group page to disseminate PGrip with patients				

(continued)

Appendix 3. Continued.

	1	2	3	4	5
Item #	Strongly disagree	Disagree	Neutral (neither disagree or agree)	Agree	Strongly agree
Skills					
5	I have the skills to use the Facebook group page to disseminate PGrip with patients				
6	I have practiced using the Facebook group page to disseminate PGrip with patients				
Social/professional role and identity					
7	Using the Facebook group page to disseminate PGrip with patients is part of my work as an arthritis health professional				
8	As an arthritis health professional, it is my job to use the Facebook group page to disseminate PGrip with patients				
9	It is my responsibility as an arthritis health professional to use the Facebook group to disseminate PGrip with patients				
10	Using the Facebook group page to disseminate PGrip with patients is consistent with my job as a health professional				
Optimism					
11	I am confident that I can use the Facebook group page to disseminate PGrip with patients even when there is little time				
12	I am confident that if I wanted I could use the Facebook group page to disseminate PGrip with patients				
13	With regard to using the Facebook page to disseminate PGrip with patients in uncertain times, I usually expect the best				
14	With regard to using the Facebook group page to disseminate PGrip with patients I'm always optimistic about the future				
Beliefs about consequences					
15	If I use the Facebook page to disseminate PGrip with patients, it will benefit public health				
16	If I use the Facebook group page to disseminate PGrip with patients, it will not have disadvantages for my relationship with them				
Intentions					
17[a]	For how many of the next 10 patients do you intend to use the Facebook group page to disseminate PGrip?				
18	I will definitely use the Facebook group page to disseminate PGrip with patients				
19	I intend to use the Facebook group page to disseminate PGrip with patients				
20[b]	How strong is your intention to use the Facebook group page to disseminate PGrip with patients?				
Memory/attention/decision					
21[c]	How often do you forget to use the Facebook group page to disseminate PGrip with patients?				
22	When I need to concentrate to use the Facebook group page to disseminate PGrip with patients, I have no trouble focusing my attention				
23	When trying to focus my attention on using the Facebook group page to disseminate PGrip with patients, I have no difficulty blocking out distracting thoughts				
24	When concentrating on using the Facebook group page to disseminate PGrip with patients, I can focus my attention so that I become unaware of what's going on around me				
Environmental context and resources					
25	Within the socio-political context (clinical unit) there is sufficient financial support (e.g. from local authorities, insurance companies) for using the Facebook group page to disseminate PGrip with patients				

(continued)

Appendix 3. Continued.

	1	2	3	4	5
Item #	Strongly disagree	Disagree	Neutral (neither disagree or agree)	Agree	Strongly agree
26	Within the socio-political context (clinical unit) there are good networks between parties involved in using the Facebook group page to disseminate PGrip with patients				
Social influences					
27	Most people who are important to me think that I should use the Facebook group page to disseminate PGrip with patients				
28	Most people whose opinion I value would approve me of using the Facebook group page to disseminate PGrip with patients				

PGrip: People Getting a Grip on Arthritis.
Source: Adapted from Huijg et al.[36]
[a]None = 1; one patient = 2; two patients = 3; three patients = 4; >4 patients = 5.
[b]Very weak = 1; weak = 2; neutral = 3; strong = 4; very strong = 5.
[c]Never = 1; almost never = 2; occasionally = 3; almost always = 4; always = 5.

Appendix 4. Definitions of theoretical domains framework domains.

Domain	Definition[a]
Knowledge	An awareness of the existence of something
Skills	An ability or proficiency acquired through practice
Social/professional role and identity	A coherent set of behaviors and displayed personal quality s of an individual in a social or work setting
Beliefs about capabilities (self-efficacy)	Acceptance of the trust, reality, validity about an ability, talent, or facility that a person can put to constructive us
Beliefs about consequences (anticipated outcomes/ attitude)	Acceptance of the truth, reality, or validity about outcomes of a behavior in a given situation
Motivation and goals (intention)	A conscious decision to perform a behavior or a resolve to act in a certain way/ mental representations of outcomes or end states that an individual wants to achieve
Memory, attention and decision processes	The ability to retain information, focus selectively on aspects of the environment and choose between two or more alternatives
Environmental context and resources (environmental constraints)	Any circumstance of a person's situation or environment that discourages or encourages the development of skills and abilities, independence, social competence, and adaptive behavior
Social influences (norms)	Those interpersonal processes that can cause individuals to change their thoughts, feelings, or behaviors
Emotions	A complex reaction pattern, involving experiential, behavioral, and physiological elements, by which the individual attempts to deal with a personally significant matter or event
Behavioral regulation	Anything aimed at managing or changing objectively observed or measured actions
Nature of behaviors (habits)[b]	Behaviors that are routine, automatic, or habits

[a]Source: Cane J, O'Connor D and Michie S. Validation of the theoretical domains framework for use in behavior change and implementation research. *Implement Sci* 2012; 7: 37.
[b]Source: Michie et al.[59]

Appendix 5. Usability (Technology Acceptance Model 2 (TAM2)), $n = 78$.

TAM2 domain		Baseline		Absolute change Baseline to 2 weeks					Absolute change Baseline to 3 months				
Question #		Mean	SD	Mean	SD	95% CI		p Value	Mean	SD	95% CI		p Value
Intention to use													
1	Assuming I have access to the Facebook group page, I intend to use it with patients	4.41	1.78	0.54	1.82	0.13	0.95	0.01	0.42	2.02	−0.03	0.88	0.07
2	Given that I have access to the Facebook group page, I predict that I would use it with patients	4.51	1.68	0.47	1.44	0.14	0.80	0.01	0.05	2.01	−0.40	0.51	0.82
Perceived usefulness													
3	Using the Facebook group page may improve my performance in my job	4.51	1.26	0.33	1.50	0.00	0.67	0.05	0.09	1.64	−0.28	0.46	0.63
4	Using the Facebook group page in my job may increase my productivity	4.06	1.42	0.21	1.32	−0.09	0.50	0.18	−0.04	1.56	−0.39	0.31	0.83
5	Using the Facebook group page may enhance my effectiveness in my job	4.56	1.25	0.36	1.39	0.05	0.67	0.03	−0.01	1.56	−0.36	0.34	0.94
6	I find the Facebook group page may be useful in my job	5.10	1.20	0.09	1.39	−0.22	0.40	0.57	−0.21	1.52	−0.55	0.14	0.24
Perceived ease of use													
7	My interaction with the Facebook group page is clear and understandable	4.08	1.41	1.21	1.72	0.82	1.59	0.00	1.10	1.60	0.74	1.46	0.00
8	Interacting with the Facebook group page does not require a lot of my mental effort	4.82	1.48	0.69	1.62	0.33	1.06	0.00	0.55	1.79	0.15	0.96	0.01
9	I find the Facebook group page easy to use with patients	4.03	1.06	0.53	1.45	0.20	0.85	0.00	0.34	1.43	0.02	0.67	0.04
10	I find it easy to get to the Facebook group page to do what I want it to do	4.71	1.42	0.83	1.78	0.43	1.24	0.00	0.28	1.90	−0.15	0.71	0.19

(continued)

Appendix 5. Continued.

TAM2 domain / Question #		Baseline		Absolute change Baseline to 2 weeks					Absolute change Baseline to 3 months				
		Mean	SD	Mean	SD	95% CI		p Value	Mean	SD	95% CI		p Value
Subjective norm													
11	People who influence my behavior think that I should use the Facebook group page with patients	3.56	1.29	0.15	1.60	−0.21	0.52	0.40	−0.08	1.55	−0.43	0.27	0.66
12	People who are important to me think that I should use the Facebook group page with patients	3.53	1.36	0.24	1.51	−0.10	0.58	0.16	0.09	1.56	−0.26	0.44	0.61
Voluntariness													
13	My use of the Facebook group page with patients is voluntary	5.85	1.41	0.69	1.45	0.36	1.02	0.00	0.73	1.48	0.40	1.07	0.00
14	My supervisor does not require me to use the Facebook group page with patients	6.35	1.30	0.23	1.29	−0.06	0.52	0.12	0.28	1.53	−0.06	0.63	0.11
15	Although it might be helpful, using the Facebook group page with patients is certainly not compulsory in my job	6.60	0.92	−0.09	1.07	−0.33	0.15	0.46	−0.05	1.32	−0.35	0.25	0.73
Image													
16	People in my organization who use the Facebook group page with patients have more prestige than those who do not	2.79	1.41	−0.31	1.78	−0.71	0.09	0.13	−0.51	1.74	−0.91	−0.12	0.01
Job relevance													
17	In my job, usage of the Facebook group page with patients is important	3.29	1.36	0.24	1.50	−0.10	0.58	0.16	0.40	1.73	0.01	0.79	0.05
18	In my job, usage of the Facebook group page with patients is relevant	4.26	1.44	0.56	1.68	0.19	0.94	0.00	0.38	1.77	−0.02	0.78	0.06

(continued)

Appendix 5. Continued.

TAM2 domain / Question #		Baseline		Absolute change Baseline to 2 weeks					Absolute change Baseline to 3 months				
		Mean	SD	Mean	SD	95% CI		p Value	Mean	SD	95% CI		p Value
Output quality													
19	The quality of the output I get from the Facebook group page is high	3.97	0.94	0.78	1.31	0.49	1.08	0.00	0.81	1.33	0.51	1.11	0.00
20	I have no problem with the quality of the Facebook group page output	4.06	1.06	0.91	1.39	0.60	1.22	0.00	1.12	1.46	0.79	1.44	0.00
Result demonstrability													
21	I have no difficulty telling others about the results of using the Facebook group page with patients	4.94	1.47	0.24	1.62	−0.12	0.61	0.19	0.18	1.66	−0.19	0.55	0.34
22	I believe I could communicate to others the consequences of using the Facebook group page with patients	5.19	1.46	−0.03	1.59	−0.38	0.33	0.89	−0.23	1.55	−0.58	0.12	0.19
23	The results of using the Facebook group page with patients are apparent to me	4.18	1.25	0.28	1.56	−0.07	0.63	0.12	0.22	1.54	−0.13	0.57	0.22
24	I would have no difficulty explaining why using the Facebook group page with patients may or may not be beneficial	5.03	1.40	0.41	1.42	0.09	0.73	0.01	0.21	1.66	−0.17	0.58	0.28

CI: confidence interval; SD: standard deviation.
Missing values were imputed using last observation carried forward method; Scores based on 1 = Strongly disagree to 7 = Strongly agree.

Appendix 6. Practice behavior (theoretical domains framework (TDF)), $n = 77$.[a]

TDF domain / Question #		Baseline		Absolute change Baseline to 2 weeks					Absolute change Baseline to 3 months				
		Mean	SD	Mean	SD	95% CI		p Value	Mean	SD	95% CI		p Value
Knowledge													
1	I am aware of the content and objectives of the Facebook group page	2.58	1.21	1.58	1.28	1.29	1.88	0.00	1.52	1.31	1.22	1.82	0.00

(continued)

Appendix 6. Continued.

TDF domain		Baseline		Absolute change Baseline to 2 weeks					Absolute change Baseline to 5 months				
Question #		Mean	SD	Mean	SD	95% CI		p Value	Mean	SD	95% CI		p Value
2	I know the content and objectives of the Facebook group page	2.26	1.07	1.69	1.23	1.41	1.97	0.00	1.74	1.23	1.46	2.02	0.00
3	I am familiar with the content and objectives of the Facebook group page	2.27	1.10	1.60	1.26	1.31	1.88	0.00	1.77	1.23	1.49	2.05	0.00
4	I am aware of how to use the Facebook group page to disseminate PGrip with patients	2.29	1.22	1.58	1.27	1.30	1.87	0.00	1.69	1.35	1.38	1.99	0.00
Skills													
5	I have the skills to use the Facebook group page to disseminate PGrip with patients	3.40	1.34	0.74	1.23	0.46	1.02	0.00	0.69	1.34	0.38	0.99	0.00
6	I have practiced using the Facebook group page to disseminate PGrip with patients	1.73	0.87	0.94	1.34	0.63	1.24	0.00	1.53	1.28	1.24	1.82	0.00
Social/professional role and identity													
7	Using the Facebook group page to disseminate PGrip with patients is part of my work as an arthritis health professional	2.34	0.94	0.36	1.01	0.13	0.59	0.00	0.56	1.01	0.33	0.79	0.00
8	As an arthritis health professional, it is my job to use the Facebook group page to disseminate PGrip with patients	2.34	1.05	0.14	1.16	−0.12	0.41	0.28	0.31	1.03	0.08	0.55	0.01
9	It is my responsibility as an arthritis health professional to use the Facebook group to disseminate PGrip with patients	2.45	1.06	0.14	1.43	−0.18	0.47	0.38	0.34	1.02	0.11	0.57	0.01

(continued)

Appendix 6. Continued.

TDF domain		Baseline		Absolute change Baseline to 2 weeks					Absolute change Baseline to 3 months				
Question #		Mean	SD	Mean	SD	95% CI		p Value	Mean	SD	95% CI		p Value
10	Using the Facebook group page to disseminate PGrip with patients is consistent with my job as a health professional	3.00	0.99	−0.40	1.44	−0.73	−0.07	0.02	0.42	1.13	0.16	0.67	0.00
Optimism													
11	I am confident that I can use the Facebook group page to disseminate PGrip with patients even when there is little time	3.10	0.94	0.05	1.00	−0.17	0.28	0.65	−0.04	1.19	−0.31	0.23	0.77
12	I am confident that if I wanted I could use the Facebook group page to disseminate PGrip with patients	3.64	1.00	0.27	1.06	0.03	0.51	0.03	0.21	1.10	−0.04	0.46	0.10
13	With regard to using the Facebook page to disseminate PGrip with patients in uncertain times, I usually expect the best	3.19	0.81	0.27	0.79	0.09	0.45	0.00	0.30	0.93	0.09	0.51	0.01
14	With regard to using the Facebook group page to disseminate PGrip with patients I'm always optimistic about the future	3.56	0.80	0.12	0.76	−0.06	0.29	0.18	0.25	0.89	0.04	0.45	0.02
Beliefs about consequences													
15	If I use the Facebook page to disseminate PGrip with patients, it will benefit public health	3.68	0.87	0.23	0.83	0.05	0.42	0.02	0.18	0.94	−0.03	0.40	0.09
16	If I use the Facebook group page to disseminate PGrip with patients, it will not have disadvantages for my relationship with them	3.42	0.91	0.19	0.96	−0.02	0.41	0.08	0.27	1.03	0.04	0.51	0.02

(continued)

Appendix 6. Continued.

TDF domain		Baseline		Absolute change Baseline to 2 weeks					Absolute change Baseline to 3 months				
Question #		Mean	SD	Mean	SD	95% CI		p Value	Mean	SD	95% CI		p Value
Intentions													
17	For how many of the next 10 patients do you intend to use the Facebook group page to disseminate PGrip?	2.64	1.51	0.09	1.23	−0.19	0.37	0.52	0.29	1.46	−0.05	0.62	0.09
18	I will definitely use the Facebook group page to disseminate PGrip with patients	3.12	0.84	0.14	0.94	−0.07	0.36	0.19	0.14	0.97	−0.08	0.36	0.20
19	I intend to use the Facebook group page to disseminate PGrip with patients	3.32	0.90	0.29	0.97	0.07	0.51	0.01	0.19	0.97	−0.03	0.42	0.08
20	How strong is your intention to use the Facebook group page to disseminate PGrip with patients?	3.10	1.02	0.12	1.09	−0.13	0.36	0.35	−0.08	1.16	−0.34	0.18	0.56
Memory/attention /decision													
21	How often do you forget to use the Facebook group page to disseminate PGrip with patients?	1.92	1.00	0.58	1.15	0.32	0.85	0.00	0.73	1.24	0.45	1.01	0.00
22	When I need to concentrate to use the Facebook group page to disseminate PGrip with patients, I have no trouble focusing my attention	3.26	0.75	0.36	0.89	0.16	0.57	0.00	0.44	0.88	0.24	0.64	0.00
23	When trying to focus my attention on using the Facebook group page to disseminate PGrip with patients, I have no difficulty blocking out distracting thoughts	3.29	0.84	0.44	0.85	0.25	0.63	0.00	0.55	0.93	0.34	0.76	0.00

[continued]

Appendix 6. Continued.

TDF domain		Baseline		Absolute change Baseline to 2 weeks					Absolute change Baseline to 3 months				
Question #		Mean	SD	Mean	SD	95% CI		p Value	Mean	SD	95% CI		p Value
24	When concentrating on using the Facebook group page to disseminate PGrip with patients, I can focus my attention so that I become unaware of what's going on around me	3.16	0.76	0.08	0.89	−0.12	0.28	0.44	0.13	0.98	−0.09	0.35	0.25
Environmental context and resources													
25	Within the socio-political context (clinical unit) there is sufficient financial support (e.g. from local authorities, insurance companies) for using the Facebook group page to disseminate PGrip with patients	2.91	0.81	−0.21	1.02	−0.44	0.02	0.08	0.03	0.86	−0.17	0.22	0.79
26	Within the socio-political context (clinical unit) there are good networks between parties involved in using the Facebook group page to disseminate PGrip with patients	2.84	0.76	0.04	0.98	−0.18	0.26	0.73	0.12	0.90	−0.09	0.32	0.26
Social influences													
27	Most people who are important to me think that I should use the Facebook group page to disseminate PGrip with patients	2.62	0.91	0.03	0.85	−0.17	0.22	0.79	0.01	0.82	−0.18	0.20	0.89
28	Most people whose opinion I value would approve me of using the Facebook group page to disseminate PGrip with patients	3.17	0.89	0.12	0.96	−0.10	0.33	0.29	0.09	1.00	−0.14	0.32	0.43

CI: confidence interval; PGrip: People Getting a Grip on Arthritis; SD: standard deviation.
[a]One participant did not complete the TDF questionnaire. Additionally one participant provided no responses for question #27 ($n = 76$).
Scores based on 1 = strongly disagree, 5 = strongly agree; missing values were imputed using last observation carried forward method.

Appendix 1.4 Ethics documents

Appendix 1.4.1 University of Ottawa REB Certificate for Advisory Committee

File Number: H12-14-07 **Date (mm/dd/yyyy):** 01/04/2016

Université d'Ottawa University of Ottawa
Bureau d'éthique et d'intégrité de la recherche Office of Research Ethics and Integrity

Ethics Approval Notice

Health Sciences and Science REB

Principal Investigator / Supervisor / Co-investigator(s) / Student(s)

First Name	Last Name	Affiliation	Role
Lucie	Brosseau	Health Sciences / Physiotherapy	Supervisor
George A.	Wells	Medicine / Medicine	Co-Supervisor
Gino	De Angelis	Health Sciences / Occupational Therapy	Student Researcher

File Number: H12-14-07

Type of Project: PhD Thesis

Title: An advisory committee determining the feasability of using social media as a guideline disseminatioon strategy for arthritis health professionals

Renewal Date (mm/dd/yyyy)	Expiry Date (mm/dd/yyyy)	Approval Type
12/22/2015	12/21/2016	Ia

(Ia: Approval, Ib: Approval for initial stage only)

Special Conditions / Comments:
N/A

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www.recherche.uottawa.ca/deontologie/ www.research.uottawa.ca/ethics/

File Number: H12-14-07 **Date (mm/dd/yyyy):** 01/04/2016

Université d'Ottawa
Bureau d'éthique et d'intégrité de la recherche

University of Ottawa
Office of Research Ethics and Integrity

This is to confirm that the University of Ottawa Research Ethics Board identified above, which operates in accordance with the Tri-Council Policy Statement (2010) and other applicable laws and regulations in Ontario, has examined and approved the ethics application for the above named research project. Ethics approval is valid for the period indicated above and subject to the conditions listed in the section entitled "Special Conditions / Comments".

During the course of the project, the protocol may not be modified without prior written approval from the REB except when necessary to remove participants from immediate endangerment or when the modification(s) pertain to only administrative or logistical components of the project (e.g., change of telephone number). Investigators must also promptly alert the REB of any changes which increase the risk to participant(s), any changes which considerably affect the conduct of the project, all unanticipated and harmful events that occur, and new information that may negatively affect the conduct of the project and safety of the participant(s). Modifications to the project, including consent and recruitment documentation, should be submitted to the Ethics Office for approval using the "Modification to research project" form available at: http://research.uottawa.ca/ethics/submissions-and-reviews.

Please submit an annual report to the Ethics Office four weeks before the above-referenced expiry date to request a renewal of this ethics approval. To close the file, a final report must be submitted. These documents can be found at: http://research.uottawa.ca/ethics/submissions-and-reviews.

If you have any questions, please do not hesitate to contact the Ethics Office at extension 5387 or by e-mail at: ethics@uOttawa.ca.

Appendix 1.4.2 Advisory committee letter of information and consent form

Advisory committee letter of information and consent form

People Getting a Grip on Arthritis (PGrip): Advisory Committee for using Facebook as a guideline dissemination strategy among arthritis health professionals

Investigators: Gino De Angelis (M.Sc.), Lucie Brosseau (Ph.D.)

Supported by: Canadian Institutes for Health Research Doctoral Research Award

Participant Information Letter & Consent Form

We are pleased to invite you to participate in the advisory committee for a proposed feasibility study that will determine the perceived usability of Facebook as a guideline dissemination strategy for an online arthritis educational program called People with Arthritis Getting a Grip on Arthritis (PGrip).

To take part in the advisory committee, you must be a 1) familiar with the content of the PGrip program; 2) trained as a nurse (RN), occupational therapist, or physical therapist; 2) registered with your professional regulatory body; 3) practicing clinically defined as spending a minimum of 50% of your time (work week) in direct patient care 4) have internet access, 5) must be able to communicate in English.

What Your Participation Involves:

Meeting on three separate occasions. Each meeting will be approximately 2 to 3 hours in duration.

Meeting 1: Barriers and facilitators of using Facebook as a guideline dissemination strategy.

Meeting 2: Discussion on the design and methodology of the feasibility study. This meeting will take place one month prior to commencing the feasibility study.

Meeting 3: Discussion on the findings from the first meeting and how the Facebook intervention can be tailored to address the identified barriers and facilitators. This meeting will take place nine months.

Roles:
In the first meeting, you will be asked to take part in a discussion regarding various barriers and facilitators to engaging in a Facebook intervention to disseminate guidelines with patients and to provide recommendations of how the Facebook intervention can be tailored to improve usability. Prior to this meeting, you will be provided with instructions on how to access the Facebook page and will be given copy of the interview questions.

You will also be asked to complete a usability questionnaire pertaining to the Facebook intervention. The questionnaire will take approximately between 5 to 10 minutes to complete.
In the second meeting, you will be asked to take part in a discussion regarding findings from the first meeting and how the Facebook intervention can be tailored to address the identified barriers and facilitators discussed. In the final meeting, you will be asked to contribute to the interpretation of findings of the feasibility study, and brainstorm ideas on how these results can be disseminated. You will also be asked to provide guidance on the methodology for a future RCT.

Privacy & Confidentiality

Your participation is voluntary; you can choose not to answer any of the questions asked. You can withdraw or dropout of the advisory committee at any time. If you wish, you may withdraw any data after it has been submitted by contacting the principal investigator. You will receive a $100.00 for taking part in each of the 3 meetings. Should you choose to withdraw from the advisory committee, you will still receive the compensation offered.

Please be advised that discussions during each meeting will be digitally recorded. All records and information will be kept confidential and protected. All data will be kept on a secure computer; access to the computer will be secured by use of specific passwords known only to the research team. All data (paper and electronic) will be destroyed 5 years after publication of study results. Personal matters will not be discussed.

How will the information from you and other participants be used?
The information collected will be used to improve arthritis education of health professionals and for scientific and academic papers. You may request a copy of the final report.
Risks and Benefits

There are no known risks to participating in the advisory committee. Your participation is expected to improve education of arthritis health professionals. The study may benefit you, as a participant, by allowing you to share your experiences treating patients with arthritis and allowing those experiences to suggest ways to improve arthritis education and care.
Consent

I agree to complete the attached arthritis questionnaire.

I understand that I will need to provide some personal information such as my name and address, however, all of the information collected during this study will be kept confidential. Information will be kept at the research unit on a secure computer only the study team will have access to.

I understand that if I have any questions or concerns regarding my participation in this study, I may contact the principal investigator, Gino De Angelis at (613) 562-5800 extension 8015
I understand that in no way does signing this form waive my legal rights nor relieve the investigators, sponsors, or involved institutions from their legal and professional responsibility. If I have any questions regarding my rights as a research participant in this study, I can call, Ethics Review Officer, University of Ottawa, at 550, Cumberland Street, room # 154, Ottawa ON K1N 6N5, (613) 562-5387 or ethics@uottawa.ca.

_____	_____	_____
Print Name of the researcher	Signature	Date
_____	_____	_____
Print Name of the participant	Signature	Date
_____	_____	_____
Print Name of the witness	Signature	Date

N.B. there are two copies of this consent form (one for the research team and one for your own records).

Eligibility Questionnaire

Are you familiar with the PGrip program and its contents?

Please identify your profession:

Nurse (RN): ___

Physical Therapist ____

Occupational Therapist ____

Other (please list) _____

Are you registered with your professional regulatory body?

Yes ____

No ____

Do you spend a minimum of 50% of your time (work week) in direct patient care?

Yes ____

No ____

Do you have internet access?

Yes ____

No ____

How many years of experience do you have working with arthritis patients?

___ years

Appendix 1.4.3 University of Ottawa REB Certificate for Advisory Committee

File Number: H11-12-10 **Date (mm/dd/yyyy):** 01/04/2016

Université d'Ottawa
Bureau d'éthique et d'intégrité de la recherche

University of Ottawa
Office of Research Ethics and Integrity

Ethics Approval Notice

Health Sciences and Science REB

Principal Investigator / Supervisor / Co-investigator(s) / Student(s)

First Name	Last Name	Affiliation	Role
Lucie	Brosseau	Health Sciences / Physiotherapy	Principal Investigator
Mary	Bell	Medicine / Medicine	Co-investigator
Lynn M.	Casimiro	Health Sciences / Human Kinetics	Co-investigator
Doug	Coyle	Medicine / Medicine	Co-investigator
Gino	De Angelis	Health Sciences / Occupational Therapy	Co-investigator
Mary	Egan	Health Sciences / Occupational Therapy	Co-investigator
Judy	King	Health Sciences / Physiotherapy	Co-investigator
Sydney	Lineker	Others / Others	Co-investigator
Stephane	Poitras	Health Sciences / Physiotherapy	Co-investigator
Roanne	Thomas	Health Sciences / Physiotherapy	Co-investigator
Peter	Tugwell	Medicine / Medicine	Co-investigator
George	Wells	Medicine / Medicine	Co-investigator

File Number: H11-12-10

Type of Project: Professor

Title: A randomized controlled trial evaluating the impact of an online knowledge translation strategy to implement the Ottawa Panel Guidelines on the self-management of osteoarthritis and rheumatoid

Renewal Date (mm/dd/yyyy)	Expiry Date (mm/dd/yyyy)	Approval Type
01/07/2016	01/06/2017	Ia

(Ia: Approval, Ib: Approval for initial stage only)

550, rue Cumberland, pièce 154
Ottawa (Ontario) K1N 6N5 Canada
550 Cumberland Street, room 154
Ottawa, Ontario K1N 6N5 Canada
(613) 562-5387 • Téléc./Fax (613) 562-5338
www.recherche.uottawa.ca/deontologie/ www.research.uottawa.ca/ethics/

File Number: H11-12-10 **Date (mm/dd/yyyy):** 01/04/2016

Université d'Ottawa University of Ottawa
Bureau d'éthique et d'intégrité de la recherche Office of Research Ethics and Integrity

This is to confirm that the University of Ottawa Research Ethics Board identified above, which operates in accordance with the Tri-Council Policy Statement (2010) and other applicable laws and regulations in Ontario, has examined and approved the ethics application for the above named research project. Ethics approval is valid for the period indicated above and subject to the conditions listed in the section entitled "Special Conditions / Comments".

During the course of the project, the protocol may not be modified without prior written approval from the REB except when necessary to remove participants from immediate endangerment or when the modification(s) pertain to only administrative or logistical components of the project (e.g., change of telephone number). Investigators must also promptly alert the REB of any changes which increase the risk to participant(s), any changes which considerably affect the conduct of the project, all unanticipated and harmful events that occur, and new information that may negatively affect the conduct of the project and safety of the participant(s). Modifications to the project, including consent and recruitment documentation, should be submitted to the Ethics Office for approval using the "Modification to research project" form available at: http://research.uottawa.ca/ethics/submissions-and-reviews.

Please submit an annual report to the Ethics Office four weeks before the above-referenced expiry date to request a renewal of this ethics approval. To close the file, a final report must be submitted. These documents can be found at: http://research.uottawa.ca/ethics/submissions-and-reviews.

If you have any questions, please do not hesitate to contact the Ethics Office at extension 5387 or by e-mail at: ethics@uOttawa.ca.

Appendix 1.4.4 Feasibility Study letter of information and consent form

Feasibility study letter of information and consent form

People Getting a Grip on Arthritis: The feasibility of using social media as a guideline dissemination strategy for arthritis health professionals

Investigators: Gino De Angelis (M.Sc.), Lucie Brosseau (Ph.D.), George Wells (Ph.D.),

Funded By: Canadian Institutes for Health Research Doctoral Research Award and **Arthritis Health Professions Association/The Arthritis Society and The Arthritis Research Foundation Research Grants**

Participant Information Letter & Consent Form

We are pleased to invite you to participate in an online arthritis educational program called *People with Arthritis Getting a Grip on Arthritis*. This program was designed to find efficient ways to exchange knowledge between the research community and the general public. This program is an intensive, evidence-based educational training in the People Getting a Grip on Arthritis program as an educational tool that health professionals can use in their practice for their patients with OA and RA.

To take part, you must be a 1) trained as a nurse (RN), occupational therapist, or physical therapist; 2) registered with your professional regulatory body; 3) practicing clinically defined as spending a minimum of 50% of your time (work week) in direct patient care 4) have internet access, 5) must be able to communicate in English.

What Your Participation Involves:

Three online questionnaires will be asked. Most will include questions about:

Perceived usability of Facebook as a guideline dissemination strategy

Barriers and facilitators of using Facebook as a guideline dissemination strategy

your behavior to use Facebook as a guideline dissemination strategy with patients

your use of Facebook tools (“like” feature, sharing links, commenting on the “wall”)

Roles:

Complete a pre-program online questionnaire. Each questionnaire should take approximately between 10 to 15 minutes to complete.

✳ During the program

● Access the arthritis information you will be provided

● Participate in online discussions

● Engage in the self-study material (videos)

✳ Post-online educational intervention

Complete a post-program online questionnaire at 2 weeks

Complete a 3-month follow up online questionnaire.

Privacy & Confidentiality

Your participation is voluntary; you can choose not to answer any of the questions asked. You can withdraw or dropout of the study at any time. If you wish, you may withdraw any data after it has been submitted by contacting the principal investigator. You will receive a $30.00 gift certificate for completing each of the 3 questionnaires and a personalized certificate of participation. Should you choose to withdraw from the study, you will still receive the compensation offered.

All the information collected from you will be kept confidential. All data will be kept on a secure computer; access to the computer will be secured by use of specific passwords known only to the research team. We will give access only to the recruited participants. Personal matters will not be discussed. The educational material will be distributed freely but, we will use a confidential tool (Fluid Survey) to distribute consent forms and the 3 questionnaires. We will not ask any questions that may affect the privacy of your patients. All questionnaires will be coded.

How will the information from you and other participants be used?

The information collected will be used to improve the arthritis education of health professionals and for scientific and academic papers. You may request a copy of the final report.

Risks and Benefits

There are no known risks to being part of this study. Your participation is expected to improve the arthritis education of arthritis health professionals. The study may benefit you, as a participant, by allowing you to share your experiences treating patients with arthritis and allowing those experiences to suggest ways to improve arthritis education and care.

Consent

I agree to complete the attached arthritis questionnaire.

I understand that I will need to provide some personal information such as my name and address, however, all of the information collected during this study will be kept confidential. Information from the questionnaires will be kept at the research unit on a secure computer only the study team will have access to.

I understand that if I have any questions or concerns regarding my participation in this study, I may contact the principal investigator, Gino De Angelis at (613) 562-5800 extension 8015

I understand that in no way does signing this form waive my legal rights nor relieve the investigators, sponsors, or involved institutions from their legal and professional responsibility. If I have any questions regarding my rights as a research participant in this study, I can call, Ethics Review Officer, University of Ottawa, at 550, Cumberland Street, room # 154, Ottawa ON K1N 6N5, (613) 562-5387 or ethics@uottawa.ca.

_____ _____ _____

Print Name of the researcher Signature Date

_____ _____ _____

Print Name of the participant Signature Date

_____ _____ _____

Print Name of the witness Signature Date

N.B. there are two copies of this consent form (one for the research team and one for your own records).

Eligibility Questionnaire

Please identify your profession:

Nurse (RN): ___

Physical Therapist ____

Occupational Therapist ____

Other (please list) _____

Are you registered with your professional regulatory body?

Yes ____

No ____

Do you spend a minimum of 50% of your time (work week) in direct patient care?

Yes ____

No ____

Do you have internet access?

Yes ____

No ____

How many years of experience do you have working with arthritis patients?

___ years

Appendix 1.5 Advisory Committee and Feasibility Questionnaires

Appendix 1.5.1 Advisory Committee Interview Topic Guide and Questions

Advisory Committee Interview Topic Guide and Questions

Thank you again for helping us with this study

The practice behaviour change of interest for today's discussion is « using Facebook as a guideline dissemination strategy with patients for the PGrip program ». I'm going to keep emphasizing this throughout the interview. Some of the questions may seem repetitive, but please bear with me as the questions are derived from multiple theories on human behaviour and we are trying to identify which theory best applies in this area. I may also ask for clarification during the interview using questions such as: *'What do you mean'; 'Would you explain that'; 'What were you thinking at the time'; 'Take me through the experience'*.

I also want to remind you that the discussion will be digitally recorded. All records and information will be kept confidential and protected.

Nature of the behaviours

Do you currently use clinical practice guidelines?

How do you currently access clinical practice guidelines? (Prompt: other ICTs)

How long would it take you to start using Facebook as a guideline dissemination strategy?

Skills

How easy or difficult is it to use Facebook as a guideline dissemination strategy?

What skills/expertise are required to use Facebook as a guideline dissemination strategy?

Social/professional role and identity

Do you think it is an appropriate part of your job to use Facebook as a guideline dissemination strategy?

Is there anything else about your professional role that influences you to use Facebook as a guideline dissemination strategy? Either positively or negatively?

Beliefs about capabilities

How confident are you that you can use Facebook as a guideline dissemination strategy? (Prompts: internal/external constraints/capabilities)

What difficulties do you think you might encounter and what could help you overcome these difficulties? (Prompt: additional training)

Beliefs about consequences

What do you see as the positive and negative impacts of using Facebook as a guideline dissemination strategy?

Motivation and goals

How much do you want to use Facebook as a guideline dissemination strategy? (Prompt: incentives, conflicts)

Memory, attention and decision processes

What thought process might guide your decision to use Facebook as a guideline dissemination strategy? (Prompt: competing tasks, time constraints) Can you walk me through how you might decide to use Facebook as a guideline dissemination strategy?

Environmental context and resources

To what extent do physical or resource factors facilitate or hinder the use Facebook as a guideline dissemination strategy? (Prompts: environmental stressors, availability/management [firewall])

Social influences (Norms)

To what extent do social influences facilitate or hinder use Facebook as a guideline dissemination strategy? (Prompts: social support, professional boundaries, social/group norms)

Emotion

How do you think emotion affect the use of Facebook as a guideline dissemination strategy? (Prompts: stress, fear, positive effect)

Behavioural regulation

What preparatory steps are needed to use Facebook as a guideline dissemination strategy? (Prompts: individual and organizational)

That is all the questions I have for you today. Has anything else occurred to you about this topic that we have not asked about?

Overall, what were your thoughts about the interview?

Appendix 1.5.2 Advisory Committee Questionnaire

Sample questionnaire

"An advisory committee determining the feasibility of using social media as a guideline dissemination strategy for arthritis health professionals"

The purpose of this questionnaire is to determine your perceived usability, barriers and facilitators, and practice behaviours of using a Facebook group page as a dissemination strategy for the People Getting a Grip on Arthritis program with patients.

We greatly appreciate your help with the evaluation of the *People Getting a Grip on Arthritis* Online project. Your participation in the project evaluation is voluntary and you may choose not to answer any of the questions. Also, responses on this questionnaire will remain strictly confidential. Your name will not appear on this questionnaire.

If you need help answering this questionnaire, please consult one of the researchers.

Today's date is: Day _____ Month _____ Year 201__

Are you familiar with Facebook? Yes__ No__

Do you have a Facebook account? Yes__ No__

Do you have access to Facebook at the workplace? Yes__ No__

If not, might you use Facebook outside work hours? Yes__ No__

Part 1

These questions will provide us with important information about your perceived usability of a Facebook group page to disseminate the People Getting a Grip on Arthritis program (PGrip).

For each statement, please provide a rating between 1 (Strongly Disagree) and 7 (Strongly Agree)

1a. Assuming I have access to the Facebook group page, I intend to use it

1	2	3	4	5	6	7
Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (Neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree

1b. Assuming I have access to the Facebook group page, I intend to use it **with patients**

1	2	3	4	5	6	7
Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (Neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree

2a. Given that I have access to the Facebook group page, I predict that I would use it

1	2	3	4	5	6	7
Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (Neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree

2b. Given that I have access to the Facebook group page, I predict that I would use it **with patients**						
1	2	3	4	5	6	7
Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (Neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree

3a. Using the Facebook group page improves my performance in my job						
1	2	3	4	5	6	7
Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (Neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree

4. Using the Facebook group page in my job increases my productivity						
1	2	3	4	5	6	7
Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (Neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree

5. Using the Facebook group page enhances my effectiveness in my job						
1	2	3	4	5	6	7
Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (Neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree

6. I find the Facebook group page to be useful in my job

1	2	3	4	5	6	7
Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (Neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree

7. My interaction with the Facebook group page is clear and understandable

1	2	3	4	5	6	7
Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (Neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree

8. Interacting with the Facebook group page does not require a lot of my mental effort

1	2	3	4	5	6	7
Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (Neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree

9a. I find the Facebook group page to be easy to use

1	2	3	4	5	6	7
Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (Neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree

9b. I find the Facebook group page to be easy to use **with patients**

1	2	3	4	5	6	7
Strongly	Moderately	Somewhat	Neutral	Somewhat	Moderately	Strongly

Disagree	Disagree	Disagree	(Neither disagree or agree)	Agree	Agree	Agree

10a. I find it easy to get the Facebook group page to do what I want it to do

1	2	3	4	5	6	7
Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (Neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree

11a. People who influence my behaviour think that I should use the Facebook group page

1	2	3	4	5	6	7
Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (Neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree

11b. People who influence my behaviour think that I should use the Facebook group page **with patients**

1	2	3	4	5	6	7
Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (Neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree

12a. People who are important to me think that I should use the Facebook group page

1	2	3	4	5	6	7
Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (Neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree

12b. People who are important to me think that I should use the Facebook group page **with patients**

1	2	3	4	5	6	7
Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (Neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree

13. My use of the Facebook group page with patients is voluntary

1	2	3	4	5	6	7
Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (Neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree

14a. My supervisor does not require me to use the Facebook group page

1	2	3	4	5	6	7
Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (Neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree

14b. My supervisor does not require me to use the Facebook group page **with patients**

1	2	3	4	5	6	7
Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (Neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree

15a. Although it might be helpful, using the Facebook group page is certainly not compulsory in my job

1	2	3	4	5	6	7
Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (Neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree

15b. Although it might be helpful, using the Facebook group page **with patients** is certainly not compulsory in my job

1	2	3	4	5	6	7
Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (Neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree

16a. People in my organization who use the Facebook group page have more prestige than those who do not

1	2	3	4	5	6	7
Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (Neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree

16b. People in my organization who use the Facebook group page **with patients** have more prestige than those who do not

1	2	3	4	5	6	7
Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (Neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree

17a. In my job, usage of the Facebook group page is important

1	2	3	4	5	6	7

Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (Neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree

17b. In my job, usage of the Facebook group page **with patients** is important

1	2	3	4	5	6	7
Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (Neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree

18a. In my job, usage of the Facebook group page is relevant

1	2	3	4	5	6	7
Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (Neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree

18b. In my job, usage of the Facebook group page **with patients** is relevant

1	2	3	4	5	6	7
Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (Neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree

19. The quality of the output I get from the Facebook group page is high

1	2	3	4	5	6	7
Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (Neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree

20. I have no problem with the quality of the Facebook group page output

1	2	3	4	5	6	7
Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (Neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree

21a. I have no difficult telling others about the results of using the Facebook group page

1	2	3	4	5	6	7
Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (Neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree

21b. I have no difficult telling others about the results of using the Facebook group page **with patients**

1	2	3	4	5	6	7
Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (Neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree

22a. I believe I could communicate to others the consequences of using the Facebook group page

1	2	3	4	5	6	7
Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (Neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree

22b. I believe I could communicate to others the consequences of using the Facebook group page **with patients**

1	2	3	4	5	6	7

Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (Neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree

23a. The results of using the Facebook group page are apparent to me

1	2	3	4	5	6	7
Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (Neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree

23b. The results of using the Facebook group page **with patients** are apparent to me

1	2	3	4	5	6	7
Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (Neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree

24a. I would have difficulty explaining why using the Facebook group page may or may not be beneficial

1	2	3	4	5	6	7
Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (Neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree

24b. I would have difficulty explaining why using the Facebook group page **with patients** may or may not be beneficial

1	2	3	4	5	6	7
Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (Neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree

Questionnaire modified from: Venkatesh V. Davis F.D. (2000). A Theoretical Extension of the Technology Acceptance Model: Four longitudinal Field Studies. Management Science; 46 (2): 186-204.

Appendix 1.5.4 Feasibility Study Online Questionnaire

Baseline Questionnaire
"People Getting a Grip on Arthritis (PGrip): The feasibility of using social media as a guideline dissemination strategy for arthritis health professionals"

Page #1

Simple Skipping Information
- If = I agree then Skip to Page 2
- If = I do not agree then Complete survey

Investigators: Gino De Angelis (Ph.D (c)), Lucie Brosseau (Ph.D.), George A. Wells (Ph.D.)

Funded By: Canadian Institutes for Health Research Doctoral Research Award

Participant Information Letter Consent Form

We are pleased to invite you to participate in an online arthritis educational program called People Getting a Grip on Arthritis. This program was designed to find efficient ways to exchange knowledge between the research community and the general public. The People Getting a Grip on Arthritis program is an evidence-based educational training program that health professionals can disseminate to their patients with OA and RA.

To take part, you must be a 1) trained as a nurse (RN), occupational therapist, or physical therapist; 2) registered with your professional regulatory body; 3) practicing clinically defined as spending a minimum of 50% of your time (work week) in direct patient care 4) have internet access, 5) must be able to communicate in English.

What Your Participation Involves:

Three online questionnaires will be asked. Most will include questions about: Perceived usability of Facebook as a guideline dissemination strategy Barriers and facilitators of using Facebook as a guideline dissemination strategy Your behavior to use Facebook as a guideline dissemination strategy with patients Your use of Facebook tools ("like" feature, sharing links, commenting on the "wall") Roles: Complete a pre-program online questionnaire. Each questionnaire should take approximately between 10 to 15 minutes to complete

-During the program Access the arthritis information you will be provided Participate in online discussions Engage in the self-study material (videos) -Post-online educational intervention Complete a post-program online questionnaire at 2 weeks Complete a 3-month follow up online questionnaire. Privacy Confidentiality

Your participation is voluntary; you can choose not to answer any of the questions asked. You can withdraw or dropout of the study at any time. If you wish, you may withdraw any data after it has been submitted by contacting the principal investigator. You will receive a $30.00 gift certificate for completing each of the 3 questionnaires and a personalized certificate of participation. Should you choose to withdraw from the study, you will still receive the compensation offered.

All the information collected from you will be kept confidential. All data will be kept on a secure computer; access to the computer will be secured by use of specific passwords known only to the research team. We will give access only to the recruited participants. Personal matters will not be discussed. The educational material will be distributed freely but, we will use a confidential tool (Fluid Survey) to distribute consent forms and the 3 questionnaires. We will not ask any questions that may affect the privacy of your patients. All questionnaires will be coded.

How will the information from you and other participants be used?
The information collected will be used to improve the arthritis education of health professionals and for scientific and academic papers. Data from this study may be used in a doctoral thesis. You may request a copy of the final report.

Risks and Benefits

There are no known risks to being part of this study. Your participation is expected to improve the arthritis education of arthritis health professionals. The study may benefit you, as a participant, by allowing you to share your experiences treating patients with arthritis and allowing those experiences to suggest ways to improve arthritis education and care.
Consent

I agree to complete the attached arthritis questionnaire.

I understand that I will need to provide some personal information such as my name and address, however, all of the information collected during this study will be kept confidential. Information from the questionnaires will be kept at the research unit on a secure computer only the study team will have access to.

I understand that if I have any questions or concerns regarding my participation in this study, I may contact the research coordinator, Gino De Angelis at (613) 562-5800 extension 8015

By clicking "I agree" below you are indicating that you have read and understood this consent form and agree to participate in this research study. Please print a copy of this page for your records.

Full Name

_____

Today's date is:

_____/____/____(YYYY/MM/DD)

- ○ I agree
- ○ I do not agree

Eligibility Questionnaire

1. Please identify your profession:

- [ ] Nurse (RN)
- [ ] Physical Therapist
- [ ] Occupational Therapist
- [ ] Other (please list) _____

2. Are you registered with your professional regulatory body?

- ( ) Yes
- ( ) No

3. Do you spend a minimum of 50% of your time (work week) in direct patient care?

- ( ) Yes
- ( ) No

4. Do you have internet access?

- ( ) Yes
- ( ) No

Email Address

_____

Mailing address for gift certificate

Please provide us with a mailing address where we can mail your $30 gift card for completing each questionnaire

Civic Address (Street Name and Number)

_____

City, Province, Postal Code

_____

Page #3

Simple Skipping Information

- If Do you have access to Facebook at the workplace? = Yes then Skip to Page 4

The purpose of this questionnaire is to determine your perceived usability, barriers and facilitators, and practice behaviours of using a Facebook group page as a dissemination strategy for the People Getting a Grip on Arthritis program with patients.

We greatly appreciate your help with the evaluation of the People Getting a Grip on Arthritis Online project. Your participation in the project evaluation is voluntary and you may choose not to answer any of the questions. Also, responses on this questionnaire will remain strictly confidential. Your name will not appear on this questionnaire.

If you have any questions or concerns regarding this questionnaire please contact Gino De Angelis by E-mail gdean053@uottawa.ca Thank you!

If you need help answering this questionnaire, please consult one of the researchers.

Are you familiar with Facebook?

- Yes
- No

Do you have a Facebook account?

- Yes
- No

Do you have access to Facebook at the workplace?

- Yes
- No

If not, might you use Facebook outside work hours?

- Yes
- No

Page #4

Part 1

These questions will provide us with important information about your perceived usability of a Facebook group page to disseminate the People Getting a Grip on Arthritis program (PGrip). Please note that you will have access to the Facebook page only after the completion of this baseline questionnaire.

For each statement, please provide a rating between 1 (Strongly Disagree) and 7 (Strongly Agreee)

1. Assuming I have access to the Facebook group page, I intend to use it with patients

Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree
○	○	○	○	○	○	○

2. Given that I have access to the Facebook group page, I predict that I would use it with patients

Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree
○	○	○	○	○	○	○

3. Using the Facebook group page may improve my performance in my job

Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree
○	○	○	○	○	○	○

4. Using the Facebook group page in my job may increase my productivity

Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree
○	○	○	○	○	○	○

5. Using the Facebook group page may enhance my effectiveness in my job

Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree
○	○	○	○	○	○	○

6. The Facebook group page may be useful in my job

Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agreee

○	○	○	○	○	○	○

7. My interaction with the Facebook group page is clear and understandable

Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree
○	○	○	○	○	○	○

8. Interacting with the Facebook group page does not require a lot of my mental effort

Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree
○	○	○	○	○	○	○

9. I find the Facebook group page easy to use with patients

Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree
○	○	○	○	○	○	○

10. I find it easy to get to the Facebook group page to do what I want to do

Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree
○	○	○	○	○	○	○

11. People who influence my behaviour think that I should use the Facebook group page with patients

Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree
○	○	○	○	○	○	○

12. People who are important to me think that I should use the Facebook group page with patients

Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree
○	○	○	○	○	○	○

13. My use of the Facebook group page with patients is voluntary

Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree

○	○	○	○	○	○	○

14. My supervisor does not require me to use the Facebook group page with patients

Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree
○	○	○	○	○	○	○

15. Although it might be helpful, using the Facebook group page with patients is certainly not compulsory in my job

Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree
○	○	○	○	○	○	○

16. People in my organization who use the Facebook group page with patients have more prestige than those who do not

Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree
○	○	○	○	○	○	○

17. In my job, usage of the Facebook group page with patients is important

Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree
○	○	○	○	○	○	○

18. In my job, usage of the Facebook group page with patients is relevant

Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree
○	○	○	○	○	○	○

19. The quality of the output I get from the Facebook group page is high

Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree
○	○	○	○	○	○	○

20. I have no problem with the quality of the Facebook group page output

Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree

○	○	○	○	○	○	○

21. I have no difficulty telling others about the results of using the Facebook group page with patients

Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree
○	○	○	○	○	○	○

22. I believe I could communicate to others the consequences of using the Facebook group page with patients

Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree
○	○	○	○	○	○	○

23. The results of using the Facebook group page with patients are apparent to me

Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree
○	○	○	○	○	○	○

24. I would have no difficulty explaining why using the Facebook group page with patients may or may not be beneficial

Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree
○	○	○	○	○	○	○

Questionnaire tailored from: Venkatesh V. Davis F.D. (2000). A Theoretical Extension of the Technology Acceptance Model: Four longitudinal Field Studies. Management Science; 46 (2): 186-204.

Part 2

These questions will provide us with important information about specific barriers and facilitators you may encounter while using the Facebook group page for the People Getting a Grip on Arthritis program

1. Please list three (3) barriers that may limit you from using the Facebook group page with patients

1. _____
2. _____
3. _____

2. Please list three (3) facilitators that may enable you to use the Facebook group page with patients

1. _____
2. _____
3. _____

Part 3

These questions will provide us with important information about your practice behaviours to use Facebook to disseminate the People Getting a Grip on Arthritis program. For each statement, please provide a rating between 1 (Strongly Agree) and 5 (Strongly Disagree)

1. I am aware of the content and objectives of the Facebook group page

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
○	○	○	○	○

2. I know the content and objectives of the Facebook group page

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
○	○	○	○	○

3. I am familiar with the content and objectives of the Facebook group page

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
○	○	○	○	○

4. I am aware of how to use the Facebook group page to disseminate PGrip with patients

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
○	○	○	○	○

5. I have the skills to use the Facebook group page to disseminate PGrip with patients

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
○	○	○	○	○

6. I have practiced using the Facebook group page to disseminate PGrip with patients

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
○	○	○	○	○

7. Using the Facebook group page to disseminate PGrip with patients is part of my work as an arthritis health professional

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
○	○	○	○	○

8. As an arthritis health professional, it is my job to use the Facebook group page to disseminate PGrip with patients

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
○	○	○	○	○

9. It is my responsibility as an arthritis health professional to use the Facebook group to disseminate PGrip with patients

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
○	○	○	○	○

10. Using the Facebook group page to disseminate PGrip with patients is consistent with my job as a health professional

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
○	○	○	○	○

11. I am confident that I can use the Facebook group page to disseminate PGrip with patients even when there is little time

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
○	○	○	○	○

12. I am confident that if I wanted I could use the Facebook group page to disseminate PGrip with patients

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
○	○	○	○	○

13. With regard to using the Facebook page to disseminate PGrip with patients in uncertain times, I usually expect the best

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
○	○	○	○	○

14. With regard to using the Facebook group page to disseminate PGrip with patients I'm always optimistic about the future

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
○	○	○	○	○

15. If I use the Facebook page to disseminate PGrip with patients, it will benefit public health

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
○	○	○	○	○

16. If I use the Facebook group page to disseminate PGrip with patients, it will not have disadvantages for my relationship with them

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
○	○	○	○	○

17. For how many of the next 10 patients do you intend to use the Facebook group page to disseminate PGrip?

0	1	2	3	>4
○	○	○	○	○

18. I will definitely use the Facebook group page to disseminate Pgrip with patients

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
	○	○	○	○	○

19. I intend to use the Facebook group page to disseminate PGrip with patients

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
	○	○	○	○	○

20. How strong is your intention to use the Facebook group page to disseminate PGrip with patients?

	Very strong	Strong	Neutral	Weak	Very weak
	○	○	○	○	○

21. How often do you forget to use the Facebook group page to disseminate PGrip with patients?

	Never	Almost never	Occasionally	Almost always	Always
	○	○	○	○	○

22. When I need to concentrate to use the Facebook group page to disseminate PGrip with patients, I have no trouble focusing my attention

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
	○	○	○	○	○

23. When trying to focus my attention on using the Facebook group page to disseminate PGrip with patients, I have no difficulty blocking out distracting thoughts

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
	○	○	○	○	○

24. When concentrating on using the Facebook group page to disseminate PGrip with patients, I can focus my attention so that I become unaware of what's going on around me

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
	○	○	○	○	○

25. Within the socio-political context (clinical unit) there is sufficient financial support (e.g., from local authorities, insurance companies) for using the Facebook group page to disseminate PGrip with patients

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
	○	○	○	○	○

26. Within the socio-political context (clinical unit) there are good networks between parties involved in using the Facebook group page to disseminate PGrip with patients

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
	○	○	○	○	○

27. Most people who are important to me think that I should use the Facebook group page to disseminate PGrip with patients

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
○	○	○	○	○

28. Most people whose opinion I value would approve me of using the Facebook group page to disseminate PGrip with patients

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
○	○	○	○	○

Questionnaire tailored from: Huijg JM, Gebhardt WA, Crone MR, Dusseldorp E, Presseau J. (2014) Discriminant content validity of a theoretical domains framework questionnaire for use in implementation research. Implementation Sci, 15(9):11

Please share any comments you might have about this questionnaire

_____

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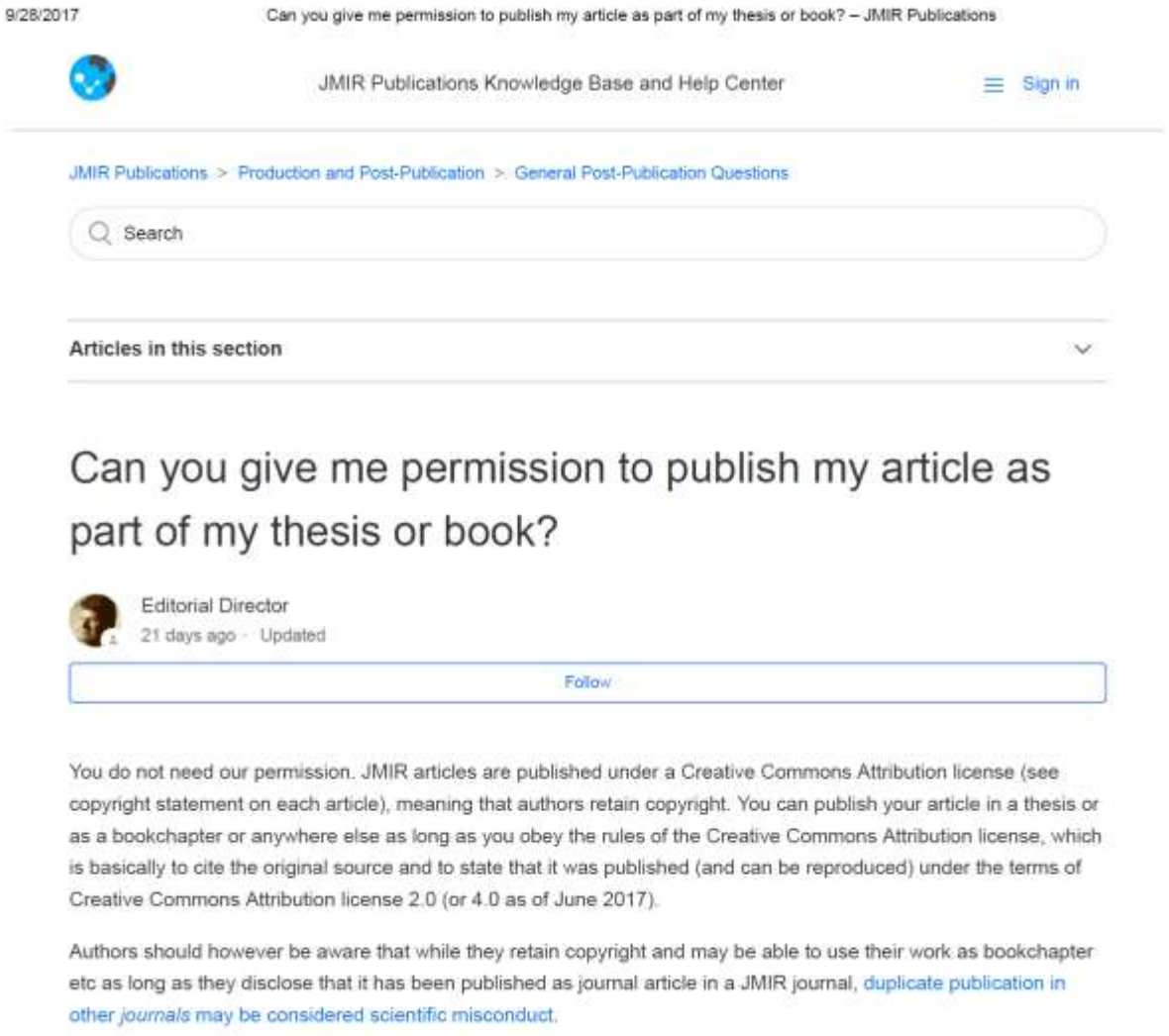

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Chapter 2 Appendices

Appendix 2.1 Definitions of TAM2 Domains

Domain	Definition*
Intention to Use	Determined by perceived usefulness and perceived ease of use
Perceived Usefulness	The degree to which a person believes that a particular system would enhance his or her performance
Perceived Ease of Use	The degree to which a person believes that a particular system would be free from effort
Subjective Norm	Perception that most people who are important think he should or should not perform the behaviour in question
Voluntariness	The degree to which use of the innovation is perceived as being voluntary, or of free will
Image	The degree to which use of an innovation is perceived to enhance one's image or status in one's social system
Job Relevance	Perception regarding the degree to which the target system is applicable to his or her job
Output Quality	What tasks a system is capable of performing and the degree to which those tasks match their job goals (job relevance)
Result Demonstrability	Tangibility of the results of using the innovation will directly influence perceived usefulness

*Source: Venkatesh V. Davis F.D. (2000). A Theoretical Extension of the Technology Acceptance Model: Four longitudinal Field Studies. Management Science; 46 (2): 186-204.

Reproduced from De Angelis G, Davies B, King J, Wells GA, Brosseau L. The use of social media by arthritis health professionals to disseminate a self-management program to patients: A feasibility study. Digital Health 2017;3

Appendix 2.2 Definitions of TDF Domains

*Source: Cane J, O'Connor D, Michie S: Validation of the theoretical domains framework for use in

Domain	Definition*
Knowledge	An awareness of the existence of something
Skills	An ability or proficiency acquired through practice
Social/professional role and identity	A coherent set of behaviours and displayed personal quality s of an individual in a social or work setting
Beliefs about capabilities (self-efficacy)	Acceptance of the trust, reality, validity about an ability, talent, or facility that a person can put to constructive us
Beliefs about consequences (anticipated outcomes/ attitude)	Acceptance of the truth, reality, or validity about outcomes of a behaviour in a given situation
Motivation and goals (intention)	A conscious decision to perform a behaviour or a resolve to act in a certain way/ mental representations of outcomes or end states that an individual wants to achieve
Memory, attention and decision processes	The ability to retain information, focus selectively on aspects of the environment and choose between two or more alternatives
Environmental context and resources (environmental constraints)	Any circumstance of a person's situation or environment that discourages or encourages the development of skills and abilities, independence, social competence, and adaptive behaviour
Social influences (norms)	Those interpersonal processes that can cause individuals to change their thoughts, feelings, or behaviours
Emotions	A complex reaction pattern, involving experiential, behavioural, and physiological elements, by which the individual attempts to deal with a personally significant matter or event
Behavioural regulation	Anything aimed at managing or changing objectively observed or measured actions
Nature of behaviours (habits)**	Behaviours that are routine, automatic, or habits

behaviour change and implementation research. Implement Sci 2012, 7:37.

** Source: Michie S, Johnston M, Abraham C, Lawton R, Parker D, Walker A. Qual Saf Health Care 2005 14: 26-33

Reproduced from: De Angelis G, Davies B, King J, Wells GA, Brosseau L. The use of social media by arthritis health professionals to disseminate a self-management program to patients: A feasibility study. Digital Health 2017;3

Chapter 3 Appendices

The following appendiced are reproduced from: De Angelis G, Davies B, King J, McEwan J, Cavallo S, Loew L, Wells GA, Brosseau L. Information and Communication Technologies for the Dissemination of Clinical Practice Guidelines to Health Professionals: A Systematic Review. JMIR Med Educ 2016;2(2):e16

Appendix 3.1 Search Strategy - Manuscript #1

MEDLINE
Database: Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations and Ovid MEDLINE(R)
Search Strategy:
---

1 local area networks/
2 exp telemedicine/
3 (telemedicine or "tele health").tw.
4 computer communication networks/
5 internet/
6 blogging/
7 social media/
8 electronic mail/
9 search engine/
10 ("remote communication*" or "remote consultation*").tw.
11 information services/
12 (ehealth or e-health or m-health or mhealth or "health informatics").tw.
13 (internet or email or www or "world wide web" or virtual or "web site" or website).tw.
14 (e-learning or elearning or telecommunicat$).tw.
15 databases, bibliographic/
16 health information exchange/
17 libraries, digital/
18 ("computerised reminder$" or "computerized reminder$").tw.
19 ("social media*" or "second life" or facebook* or youtube or twitter* or tweet* or webmd or linkedin or noodle or zotero or mendeley or refworks or endnote or picsearch or flickr or Skype or elluminate or upstream).tw.
20 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19
21 (clinician* or dentist* or doctor* or family practition* or general practition* or physician* or gyn?ecologist* or h?ematologist* or internist* or nurse* or obstetrician* or occupational therapist* or p?ediatrician* or pharmacist* or physiotherapist* or psychiatrist* or psychologist* or radiologist* or surgeon* or therapist* or counsel?or* or neurologist* or optometrist* or "health profession*" or health* personnel or “health care profession*” OR “health care personnel" or resident*).ti,ab.
22 exp evidence-based medicine/
23 clinical competence/
24 professional competence/
25 professional practice/
26 guideline adherence/
27 guidelines as topic/
28 22 or 23 or 24 or 25 or 26 or 27
29 randomized controlled trial.pt.
30 controlled clinical trial.pt.
31 randomized.ab.
32 placebo.ab.
33 clinical trials as topic.sh.
34 randomly.ab.
35 trial.ti.
36 (control* adj8 trial*).ti,ab.
37 (systematic: review or systematic: overview).ti,ab. or meta-analysis.pt,sh. or (meta-anal: or metaanal:).tw.
38 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37
39 exp animals/ not humans.sh.
40 38 not 39
41 20 and 21 and 28 and 40

****

Database: Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations and Ovid MEDLINE(R)
Search Strategy:
---
1 (telemedicine or "tele health").tw.
2 ("remote communication*" or "remote consultation*").tw.
3 (ehealth or e-health or m-health or mhealth or "health informatics").tw.
4 (internet or email or www or "world wide web" or virtual or "web site" or website).tw.
5 (e-learning or elearning or telecommunicat$).tw.
6 ("digital librar*" or "electronic librar*").tw.
7 ("computerised reminder$" or "computerized reminder$").tw.
8 ("social media*" or "second life" or facebook* or youtube or twitter* or tweet* or webmd or linkedin or noodle or zotero or mendeley or refworks or endnote or picsearch or flickr or Skype or elluminate or upstream).tw.
9 email or internet or social media).ti,ab.
10 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9
11 ("clinical competence" or evidence-based or "professional competence" or guideline*).ti,ab.
12 (randomized or placebo or randomly).ab. or trial.ti. or (control* adj8 trial*).ti,ab. or (systematic: review or systematic: overview).ti,ab. or (meta-anal: or metaanal:).tw.
13 10 and 11 and 12
14 limit 13 to in process

****
COCHRANE CENTRAL
Database: EBM Reviews - Cochrane Central Register of Controlled Trials
Search Strategy:
---
1 (clinician* or dentist* or doctor* or "family practition*" or "general practition*" or physician* or gyn?ecologist* or h?ematologist* or internist* or nurse* or obstetrician* or "occupational therapist*" or p?ediatrician* or pharmacist* or physiotherapist* or psychiatrist* or psychologist* or radiologist* or surgeon* or therapist* or counsel?or* or neurologist* or optometrist* or "health* professional*" or health* personnel or “health care professional*” OR “health care personnel" or resident*).ti,ab.
2 ("clinical practic*" or "clinical competenc*" or "professional practice" or "professional competenc*" or "guideline* adj3 adherence" or "evidence-based" or "evidence based").ti,ab.
3 (phone* or texting or email* or email* or MSN* or SMS* or pda or "personal digital assistant*" or "smart phone*" or smartphone* or i-phone* or i phone* or tablet or computer* or internet or "information communication technolog*" or online or Virtual or "world wide web*" or "social media*" or "second life" or facebook* or youtube or twitter* or tweet* or webmd or linkedin or noodle or zotero or mendeley or refworks or endnote or picsearch or flicker or blog* or wiki or podcast* or "RSS feed*" or "really simple syndicat*" or "video conferenc*" or teleconference* or "real-time app*" or "real time app*" or Skype or illuminate or stream or "digital librar*" or "electronic librar*" or "electronic database*").ti,ab.
4 1 and 2 and 3

****
EMBASE
Database: Embase Classic+Embase
Search Strategy:
---
1 local area network/
2 exp telehealth/
3 (telemedicine or "tele health").tw.
4 computer network/
5 internet/
6 social media/
7 e-mail/
8 search engine/
9 ("remote communication*" or "remote consultation*").tw.
10 information service/

11 (health or e-health or m-health or mhealth or "health informatics").tw.
12 (internet or email or www or "world wide web" or virtual or "web site" or website).tw.
13 (e-learning or elearning or telecommunicat$).tw.
14 exp bibliographic database/
15 ("digital librar*" or "electronic librar*").tw.
16 ("computerised reminder$" or "computerized reminder$").tw.
17 ("social media*" or "second life" or facebook* or youtube or twitter* or tweet* or webmd or linkedin or noodle or zotero or mendeley or refworks or endnote or picsearch or flickr or Skype or elluminate or upstream).tw.
18 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17
19 (clinician* or dentist* or doctor* or family practition* or general practition* or physician* or gyn?ecologist* or h?ematologist* or internist* or nurse* or obstetrician* or occupational therapist* or p?ediatrician* or pharmacist* or physiotherapist* or psychiatrist* or psychologist* or radiologist* or surgeon* or therapist* or counsel?or* or neurologist* or optometrist* or "health profession*" or health* personnel or “health care profession*” OR “health care personnel" or resident*).ti,ab.
20 *evidence based medicine/ or *evidence based practice/ or *evidence based nursing/ or *evidence based emergency medicine/ or *evidence based dentistry/ or *evidence based practice center/
21 *clinical competence/
22 exp *professional competence/
23 *good clinical practice/
24 *practice guideline/
25 20 or 21 or 22 or 23 or 24
26 controlled clinical trial/
27 randomized controlled trial/
28 randomized.ab.
29 placebo.ab.
30 randomly.ab.
31 trial.ti.
32 (control* adj8 trial*).ti,ab.
33 (systematic: review or systematic: overview).ti,ab. or meta-analysis.pt,sh. or (meta-anal: or metaanal:).tw.
34 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33
35 18 and 19 and 25 and 34

****
PsycINFO
Database: PsycINFO
Search Strategy:
---
1 internet/
2 computer mediated communication/
3 cellular phones/
4 electronic communication/
5 social media/
6 computer searching/
7 mobile devices/
8 telemedicine/
9 teleconferencing/
10 (telemedicine or "tele health").tw.
11 online social networks/
12 ("remote communication*" or "remote consultation*").tw.
13 (ehealth or e-health or m-health or mhealth or "health informatics").tw.
14 (internet or email or www or "world wide web" or virtual or "web site" or website).tw.
15 (e-learning or elearning or telecommunicat$).tw.
16 automated information retrieval/
17 computer searching/
18 information technology/
19 ("digital librar*" or "electronic librar*").tw.

20 ("computerised reminder$" or "computerized reminder$").tw.
21 ("social media*" or "second life" or facebook* or youtube or twitter* or tweet* or webmd or linkedin or noodle or zotero or mendeley or refworks or endnote or picsearch or flickr or Skype or elluminate or upstream).tw.
22 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21
23 (clinician* or dentist* or doctor* or family practition* or general practition* or physician* or gyn?ecologist* or h?ematologist* or internist* or nurse* or obstetrician* or occupational therapist* or p?ediatrician* or pharmacist* or physiotherapist* or psychiatrist* or psychologist* or radiologist* or surgeon* or therapist* or counsel?or* or neurologist* or optometrist* or "health profession*" or health* personnel or "health care profession*" OR "health care personnel" or resident*).ti,ab.
24 clinical practice/
25 professional competence/
26 treatment guidelines/
27 evidence based practice/
28 24 or 25 or 26 or 27
29 randomized.ab.
30 placebo.ab.
31 randomly.ab.
32 trial.ti.
33 (control* adj8 trial*).ti,ab.
34 (systematic: review or systematic: overview).ti,ab. or meta-analysis.pt,sh. or (meta-anal: or metaanal:).tw.
35 29 or 30 or 31 or 32 or 33 or 34
36 22 and 23 and 28 and 35
****

Appendix 3.2 List of Included Studies - Manuscript #1

Study	Reason for exclusion
Bailey TC, Noirot LA, Blickensderfer A, Rachmiel E, Schaiff R, Kessels A, et al. An intervention to improve secondary prevention of coronary heart disease. Arch Intern Med. 2007; 167(6): 586-90.	Irrelevant population
Coberly E, Boren SA, Mittal M, Davis JW, Scoville C, Chitima-Matsiga R et al. MedlinePlus-based health information prescriptions: A comparison of email vs paper delivery. Inform Prim Care. 2012; 20(3): 197-205	Irrelevant intervention
Buchanan H, Siegfried N, Jelsma J, Lombard C. Comparison of an interactive with a didactic educational intervention for improving the evidence-based practice knowledge of occupational therapists in the public health sector in south Africa: A randomised controlled trial. Trials. 2014; 15:216 doi: 10.1186/1745-6215-15-216.	Irrelevant intervention
Bury J, Hurt C, Roy A, Cheesman L, Bradburn M, Cross S, et al. LISA: A web-based decision-support system for trial management of childhood acute lymphoblastic leukaemia. British Journal of Haematology.2005; 129(6), 746-54.	Irrelevant intervention
Bunt CW, Burke HB, Towbin AJ, Goang A, Stephens MB, Gontelo P et al. Point-of-care estimated radiation exposure and imaging guidelines can reduce pediatric radiation burden. Journal of the American Board of Family Medicine. 2015; 28(3): 343-350	Irrelevant outcome
Campbell L, Novak I, McIntyre S. Patterns and rates of use of an evidence-based practice intranet resource for allied health professionals: a randomised controlled trial. Developmental Medicine and Child Neurology. 2010; 52(S2):31.	Abstract
Campbell L, Novak I, McIntyre S. Effectiveness of providing evidence-based practice education with workplace supports for changing health professionals decision-making and outcomes of care: an evaluator-blinded randomised controlled trial. Aust Occup Ther J. 2011; 58(S1): 120.	Abstract
Campbell L, Novak I, McIntyre S, Lord S. A KT intervention including the evidence alert system to improve clinician's evidence-based practice behavior—a cluster randomized controlled trial. Implement Sci. 2013; 13; 8: 132.	Irrelevant intervention
Cannon DS, Allen SN. A comparison of the effects of computer and manual reminders on compliance with a mental health clinical practice guideline. Journal of the American Medical Informatics Association. 2000; 7(2): 196-203.	Irrelevant population
Caulfield JJ. Examining the effect of teaching method and learning style on work performance for practicing home care clinicians. ProQuest Dissertations and Theses.2001; 143-143 (275860831).	Irrelevant intervention
Chan D, Patel P, Booth L, Lee D, Dent T, Harris F et al. A novel approach for implementing evidence-based guidelines in the community: The appropriate choices in dyspepsia project. Journal of Clinical Excellence. 2001; 2(4): 219-24.	Irrelevant intervention
Choi J. Development and Evaluation of a Computer-Interpretable Guideline for Depression Screening and Initial Management in Primary Care [dissertation]. New York, NY: Columbia University. 2006; 195-195.	Inappropriate study design
Cicolini G, Simonetti V, Comparcini D, Celiberti I, Di Nicola M, Capasso LM et al. Efficacy of a nurse-led email reminder program for cardiovascular prevention risk reduction in hypertensive patients: A randomized controlled trial. International journal of nursing studies. 2014; 51(6): 833-43.	Irrelevant population
Davis J, Chryssafidou E, Zamora J, Davies D, Khan K, Coomarasamy A. Computer-based teaching is as good as face to face lecture-based teaching of evidence based medicine: a randomised controlled trial. BMC medical education. 2007; 7(1): 23.	Irrelevant intervention
Durieux P, Nizard R, Ravaud P, Mounier N, Lepage E. A clinical decision support system for prevention of venous thromboembolism: effect on physician behavior. Jama. 2000; 283(21): 2816-21.	Irrelevant outcome
Eaton CB, Parker DR, Borkan J, McMurray J, Roberts MB, Lu B et al. Translating cholesterol guidelines into primary care practice: a multimodal cluster randomized trial. The Annals of Family Medicine. 2011; 9(6): 528-37.	Irrelevant outcome
Eccles M, McColl E, Steen N, Rousseau N, Grimshaw J, Parkin D et al. Effect of computerised	Irrelevant outcome

evidence based guidelines on management of asthma and angina in adults in primary care: cluster randomised controlled trial. BMJ. 2002; 325(7370): 941.	
Etxeberria A, Pérez I, Alcorta I, Emparanza JI, de Velasco ER, Iglesias MT et al. The CLUES study: a cluster randomized clinical trial for the evaluation of cardiovascular guideline implementation in primary care. BMC health services research. 2013; 13(1):1.	Protocol
Farah SS, Winter M, Appu S. Helping doctors utilize the prostate-specific antigen effectively: an online randomized controlled trial (The DUPE trial). ANZ journal of surgery. 2012; 82(9): 633-8.	Irrelevant intervention
Fricton J, Rindal DB, Rush W, Flottemesch T, Vazquez G, Thoele MJ et al. The effect of electronic health records on the use of clinical care guidelines for patients with medically complex conditions. The Journal of the American Dental Association. 2011; 142(10): 1133-42.	Irrelevant outcome
Gerbert B, Bronstone A, Maurer T, Berger T, McPhee SJ, Caspers N. The effectiveness of an internet-based tutorial in improving primary care physicians' skin cancer triage skills. Journal of Cancer Education. 2002; 17(1):7-11.	Irrelevant intervention
Gordon M, Chandratilake M, Baker P. Improved junior paediatric prescribing skills after a short e-learning intervention: a randomised controlled trial. Archives of disease in childhood. 2011; 96(12):1191-4.	Irrelevant intervention
Ista E, van Dijk M, van Achterberg T. Do implementation strategies increase adherence to pain assessment in hospitals? A systematic review. International journal of nursing studies. 2013; 50(4):552-68.	Irrelevant intervention
Korner-Bitensky N, Roy MA, Teasell R, Kloda L, Storr C, Asseraf-Pasin L et al. Creation and pilot testing of StrokEngine: a stroke rehabilitation intervention website for clinicians and families. Journal of rehabilitation medicine. 2008; 40(5):329-33.	Irrelevant intervention
Laibhen-Parkes N, Codone S. Web-based evidence based practice educational intervention to improve EBP competence among BSN-prepared pediatric bedside nurses: a mixed methods pilot study. Journal of Nursing. 2014;1(1):2.	Irrelevant intervention
Liaw SY, Wong LF, Chan SW, Ho JT, Mordiffi SZ, Ang SB, Goh PS, Ang EN. Designing and Evaluating an Interactive Multimedia Web-Based Simulation for Developing Nurses' Competencies in Acute Nursing Care: Randomized Controlled Trial. Journal of medical Internet research. 2015; 17(1).	Irrelevant intervention
Lee NJ, Bakken S. Development of a prototype personal digital assistant-decision support system for the management of adult obesity. International journal of medical informatics. 2007; 76:S281-92.	Irrelevant population
Lobach DF, Hammond WE. Computerized decision support based on a clinical practice guideline improves compliance with care standards. The American journal of medicine. 1997; 102(1):89-98.	Irrelevant intervention
Murtaugh CM, Pezzin LE, McDonald MV, Feldman PH, Peng TR. Just-in-Time Evidence-Based E-mail "Reminders" in Home Health Care: Impact on Nurse Practices. Health Services Research. 2005; 40(3): 849-64.	Duplicate
Nilasena DS, Lincoln MJ. A computer-generated reminder system improves physician compliance with diabetes preventive care guidelines. InProceedings of the Annual Symposium on Computer Application in Medical Care 1995 (p. 640). American Medical Informatics Association.	Irrelevant population
Noonan VK, Wolfe DL, Thorogood NP, Park SE, Hsieh JT, Eng JJ. Knowledge translation and implementation in spinal cord injury: a systematic review. Spinal cord. 2014; 52(8):578-87.	Irrelevant intervention
Pearce J, Mann MK, Jones C, van Buschbach S, Olff M, Bisson JI. The most effective way of delivering a Train-the-Trainers program: A systematic review. Journal of Continuing Education in the Health Professions. 2012; 32(3):215-26.	Irrelevant outcome
Putten GJ, Visschere L, Schols J, Baat C, Vanobbergen J. Supervised versus non-supervised implementation of an oral health care guideline in (residential) care homes: a cluster randomized controlled clinical trial. BMC oral health. 2010; 10(1):1.	Irrelevant intervention
Raghu A, Praveen D, Peiris D, Tarassenko L, Clifford G. Engineering a mobile health tool for resource-poor settings to assess and manage cardiovascular disease risk: SMARThealth study. BMC medical informatics and decision making. 2015; 15(1): 1.	Inappropriate study design
Stein BD, Celedonia KL, Swartz HA, DeRosier ME, Sorbero MJ, Brindley RA et al. Implementing a web-baed intervention to train community clinicians in an evidence-based	Irrelevant intervention

psychotherapy: a pilot study. Psychiatric Services. 2015.	
Thomas L, Cullum N, McColl E, Rousseau N, Soutter J, Steen N. Guidelines in professions allied to medicine. The Cochrane Database of Systematic Reviews. 1999; 1.	Irrelevant intervention
Tierney WM, Overhage JM, Murray MD, Harris LE, Zhou XH, Eckert GJ et al. Effects of computerized guidelines for managing heart disease in primary care. Journal of General Internal Medicine. 2003; 18(12): 967-76.	Irrelevant population
Tierney WM, Overhage JM, Murray MD, Harris LE, Zhou XH, Eckert GJ et al. Can Computer-Generated Evidence-Based Care Suggestions Enhance Evidence-Based Management of Asthma and Chronic Obstructive Pulmonary Disease? A Randomized, Controlled Trial. Health services research. 2005; 40(2): 477-98.	Irrelevant population
Vollmar HC, Butzlaff ME, Lefering R, Rieger MA. Knowledge translation on dementia: a cluster randomized trial to compare a blended learning approach with a. BMC health services research. 2007; 7(1):92.	Protocol
Were MC, Shen C, Tierney WM, Mamlin JJ, Biondich PG, Li X, et al. Evaluation of computer-generated reminders to improve CD4 laboratory monitoring in sub-Saharan Africa: a prospective comparative study. Journal of the American Medical Informatics Association. 2011; 18(2): 150-5.	Irrelevant population

Appendix 3.3 Included Study Characteristics – Manuscript #1

Study	Country	Study Design	Population	Intervention	Comparator	Outcome(s) (Framework)	Duration/ Follow-up
Balamuth et al. [22]	US	RCT	physicians	Online 1-page summary sheet of guidelines (n=128)	Web link to guidelines (n=109)	Knowledge (TDF) Perceived Ease of Use (TAM2)	6 weeks
Bell et al. [23]	US	RCT	family and internal medicine residents	Self-study online guidelines (n=79)	Print-based guidelines (n=83)	Knowledge (TDF) Perceived Ease of Use (TAM2)	immediate post-intervention, 4 to 6 months
Bernhardsson et al. [33]	Sweden	CCT	physiotherapists	Multifaceted: Implementation seminar/group discussion, website and email reminders (n=168)	No intervention (n=88)	Knowledge (TDF) Perceived Ease of Use (TAM2)	12 months
Bullard et al. [26]	Canada	RCT	physicians	Wirelessly networked mobile computer program (n=10)**	Desktop computer program (n=10)**	Perceived Usefulness (TAM2)	8-hour shifts/3 months
Butzlaff et al. [27]	Germany	RCT	physicians	CPGs via CD-ROM/Interne (n=53)	No intervention (n=66)	Knowledge (TDF)	~70 days, ~5 months
Chan et al. [34]	Canada	RCT	nurses	Multifaceted in- person education session and online support (n=31)	No intervention (n=22)	Beliefs about capabilities (TDF) Intention (TDF) Perceived Usefulness (TAM2)	2 weeks
Desimone et al. [35]	US	RCT	internal medicine residents	Multifaceted: In person education, online support, printed material (n=11)	Usual education (n=11)	Knowledge (TDF)	4 weeks
Epstein et al. [20]	US	RCT	physicians (pediatricians)	Online didactic education session/workshop (n=27)	No intervention (received intervention after 6	Skills (TDF)	6 months

					months) (n=22)		
Fordis et al. [29]	US	RCT	physicians	Live online CME workshop (n=51) Online CME workshop (n=52)	No intervention (n=20)	Knowledge (TDF) Skills (TDF) Perceived Usefulness (TAM2)	12 weeks
Gill et al. [30]	US	RCT	physicians/clinicians in ambulatory practices	EHR-based clinical decision support (n=53	No intervention (n=66)	Skills (TDF)	12 months
Schroter et al. [17]	UK/Germany	RCT	physicians/nurses	Interactive web-based tool + online material (n=527)	Online material (n=527)	Knowledge (TDF) Perceived Usefulness (TAM2)	4 months
Jousimaa et al. [28]	Finland	RCT	physicians	CD-ROM computer-based guidelines (n=72)	Text-book-based guidelines (n=67)	Skills (TDF)	1 month
Kerfoot et al. [21]	International*	RCT	physicians (urologists)	Online game/survey 2 questions every 2 days (n=735)	Online game/survey 4 questions every 4 days (n=735)	Knowledge (TDF)	34 weeks
Lobach et al. [19]	US	RCT	physicians /general internist/nurses/physician assistant/family medicine residents	Biweekly email of computer based audit/feedback program (n=22)	No intervention (n=23)	Skills (TDF)	12 weeks
McDonald et al. [36]	UK	RCT	nurses	Multifaceted: Email reminder with provider prompts, patient education material, and clinical nurse specialist outreach (n=97) Email reminder of recommendations (n=121)	Usual care (n=118)	Skills (TDF)	24 months
Fretheim et al. [18]	US	RCT	physicians and practice nurses	Multifaceted: Educational Outreach Visit, Audit and Feedback at	Passive guideline dissemination (n=244)	Skills (TDF)	45 days

				Outreach Visit, Computerized Reminders , Risk Assessment Tools, Patient Information Material, Telephone follow-up (n=257)			
Peremans et al. [31]	France	RCT	nurses	EHR-based clinical decision support (n=15) Empowered patient group (n=15)	No intervention (n=13)	Skills (TDF)	24 weeks (10 week intervention, 4 week washout, 10 week control)
Sassen et al. [24]	Norway	RCT	physicians (orthopedic surgeons)	Website with educational modules (n=48)	Waiting list (n=33)	Intention (TDF) Barriers (TDF)	12 months
Shenoy [37]	Belgium	RCT	physicians	Multifaceted: education, audit, feedback (n=24)	Mailed guidelines (n=21)	Knowledge	5 months
Stewart et al. [32]	Netherlands	RCT	physicians	Email on-line learning for two evidence-based cases (type 2 diabetes, prevention) (n=27)	Waiting list (n=31)	Knowledge (TDF) Skills (TDF)	6 months
Wolpin et al. [25]	US	RCT	medicine residents and fellows	Website enhanced learning (additional case studies) (n=33)	Website with usual care instructions (same content, without case studies) (n=36)	Knowledge (TDF) Perceived Ease of Use (TAM2)	12 weeks

*A total of 63 countries were included. Please see publication for complete list.

** cross-over design

CCTs = comparative controlled trials; CD-ROM = compact disc read-only memory; CDSS = computerized decision support system; CME = continuing medical education; CI = confidence interval; EHR = electronic health record; IQR = interquartile range (25^{th} and 75^{th} percentile); NR = not reported; OR = odds ratio; RCT = randomized controlled trial; TAM2 = Technology Acceptance Model; TDF = Theoretical Domains Framework; UK = United Kingdom; US = United States of America

Appendix 3.4 Methodological Assessment of Included Studies – Manuscript #1

Study	Random sequence generation	Allocation concealment	Blinding of participants and personnel	Blinding of outcome assessment	Incomplete outcome data	Selective reporting	Other Bias
Balamuth et al. [22]	+	?	-	?	+	+	-
Bell et al. [23]	+	?	-	?	+	+	+
Bernhardsson et al. [33]	-	?	?	?	-	+	+
Bullard et al. [26]	+	-	-	?	+	+	-
Butzlaff et al. [27]	+	+	?	?	+	+	+
Chan et al. [34]	?	?	?	?	-	+	-
Desimone et al. [35]	?	?	-	?	?	+	-
Epstein et al. [20]	+	?	-	?	+	?	-
Gill et al. [30]	?	?	?	?	-	+	-
Schroter et al. [17]	+	+	?	?	-	+	+
Jousimaa et al. [28]	+	?	?	?	+	?	+
Kerfoot et al. [21]	+	?	?	?	-	?	+
Fordis et al. [29]	+	?	?	+	+	+	-

Lobach et al. [19]	-	?	?	?	?	+	-
McDonald et al. [36]	+	?	?	+	-	?	-
Fretheim et al. [18]	+	+	+	+	+	+	+
Peremans et al. [31]	+	?	+	?	+	?	+
Sassen et al. [24]	+	?	?	?	-	+	-
Shenoy [37]	?	?	?	?	+	+	-
Stewart et al. [32]	+	?	?	?	-	?	-
Wolpin et al. [25]	-	-	?	?	-	?	-

+ = low risk of bias; - = high risk of bias; ? = uncertain risk of bias

Chapter 4 Appendices

Appendix 4.1 Literature search strategy

MEDLINE
Database: Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations and Ovid MEDLINE(R)
Search Strategy:
---

1 local area networks/
2 exp telemedicine/
3 (telemedicine or "tele health").tw.
4 computer communication networks/
5 internet/
6 blogging/
7 social media/
8 electronic mail/
9 search engine/
10 ("remote communication*" or "remote consultation*").tw.
11 information services/
12 (ehealth or e-health or m-health or mhealth or "health informatics").tw.
13 (internet or email or www or "world wide web" or virtual or "web site" or website).tw.
14 (e-learning or elearning or telecommunicat$).tw.
15 databases, bibliographic/
16 health information exchange/
17 libraries, digital/
18 ("computerised reminder$" or "computerized reminder$").tw.
19 ("social media*" or "second life" or facebook* or youtube or twitter* or tweet* or webmd or linkedin or noodle or zotero or mendeley or refworks or endnote or picsearch or flickr or Skype or elluminate or upstream).tw.
20 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19
21 (clinician* or dentist* or doctor* or family practition* or general practition* or physician* or gyn?ecologist* or h?ematologist* or internist* or nurse* or obstetrician* or occupational therapist* or p?ediatrician* or pharmacist* or physiotherapist* or psychiatrist* or psychologist* or radiologist* or surgeon* or therapist* or counsel?or* or neurologist* or optometrist* or "health profession*" or health* personnel or "health care profession*" OR "health care personnel" or resident*).ti,ab.
22 exp evidence-based medicine/
23 clinical competence/
24 professional competence/
25 professional practice/
26 guideline adherence/
27 guidelines as topic/
28 22 or 23 or 24 or 25 or 26 or 27
29 randomized controlled trial.pt.
30 controlled clinical trial.pt.
31 randomized.ab.
32 placebo.ab.
33 clinical trials as topic.sh.
34 randomly.ab.
35 trial.ti.
36 (control* adj8 trial*).ti,ab.
37 (systematic: review or systematic: overview).ti,ab. or meta-analysis.pt,sh. or (meta-anal: or metaanal:).tw.
38 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37
39 exp animals/ not humans.sh.

40 38 not 39
41 20 and 21 and 28 and 40

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Database: Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations and Ovid MEDLINE(R)
Search Strategy:
---
1 (telemedicine or "tele health").tw.
2 ("remote communication*" or "remote consultation*").tw.
3 (ehealth or e-health or m-health or mhealth or "health informatics").tw.
4 (internet or email or www or "world wide web" or virtual or "web site" or website).tw.
5 (e-learning or elearning or telecommunicat$).tw.
6 ("digital librar*" or "electronic librar*").tw.
7 ("computerised reminder$" or "computerized reminder$").tw.
8 ("social media*" or "second life" or facebook* or youtube or twitter* or tweet* or webmd or linkedin or noodle or zotero or mendeley or refworks or endnote or picsearch or flickr or Skype or elluminate or upstream).tw.
9 email or internet or social media).ti,ab.
10 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9
11 ("clinical competence" or evidence-based or "professional competence" or guideline*).ti,ab.
12 (randomized or placebo or randomly).ab. or trial.ti. or (control* adj8 trial*).ti,ab. or (systematic: review or systematic: overview).ti,ab. or (meta-anal: or metaanal:).tw.
13 10 and 11 and 12
14 limit 13 to in process

****
COCHRANE CENTRAL
Database: EBM Reviews - Cochrane Central Register of Controlled Trials
Search Strategy:
---
1 (clinician* or dentist* or doctor* or "family practition*" or "general practition*" or physician* or gyn?ecologist* or h?ematologist* or internist* or nurse* or obstetrician* or "occupational therapist*" or p?ediatrician* or pharmacist* or physiotherapist* or psychiatrist* or psychologist* or radiologist* or surgeon* or therapist* or counsel?or* or neurologist* or optometrist* or "health* professional*" or health* personnel or “health care professional*” OR “health care personnel" or resident*).ti,ab.
2 ("clinical practic*" or "clinical competenc*" or "professional practice" or "professional competenc*" or "guideline* adj3 adherence" or "evidence-based" or "evidence based").ti,ab.
3 (phone* or texting or email* or email* or MSN* or SMS* or pda or "personal digital assistant*" or "smart phone*" or smartphone* or i-phone* or i phone* or tablet or computer* or internet or "information communication technolog*" or online or Virtual or "world wide web*" or "social media*" or "second life" or facebook* or youtube or twitter* or tweet* or webmd or linkedin or noodle or zotero or mendeley or refworks or endnote or picsearch or flicker or blog* or wiki or podcast* or "RSS feed*" or "really simple syndicat*" or "video conferenc*" or teleconference* or "real-time app*" or "real time app*" or Skype or illuminate or stream or "digital librar*" or "electronic librar*" or "electronic database*").ti,ab.
4 1 and 2 and 3

****
EMBASE
Database: Embase Classic+Embase
Search Strategy:
---
1 local area network/
2 exp telehealth/
3 (telemedicine or "tele health").tw.
4 computer network/

5 internet/
6 social media/
7 e-mail/
8 search engine/
9 ("remote communication*" or "remote consultation*").tw.
10 information service/
11 (health or e-health or m-health or mhealth or "health informatics").tw.
12 (internet or email or www or "world wide web" or virtual or "web site" or website).tw.
13 (e-learning or elearning or telecommunicat$).tw.
14 exp bibliographic database/
15 ("digital librar*" or "electronic librar*").tw.
16 ("computerised reminder$" or "computerized reminder$").tw.
17 ("social media*" or "second life" or facebook* or youtube or twitter* or tweet* or webmd or linkedin or noodle or zotero or mendeley or refworks or endnote or picsearch or flickr or Skype or elluminate or upstream).tw.
18 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17
19 (clinician* or dentist* or doctor* or family practition* or general practition* or physician* or gyn?ecologist* or h?ematologist* or internist* or nurse* or obstetrician* or occupational therapist* or p?ediatrician* or pharmacist* or physiotherapist* or psychiatrist* or psychologist* or radiologist* or surgeon* or therapist* or counsel?or* or neurologist* or optometrist* or "health profession*" or health* personnel or "health care profession*" OR "health care personnel" or resident*).ti,ab.
20 *evidence based medicine/ or *evidence based practice/ or *evidence based nursing/ or *evidence based emergency medicine/ or *evidence based dentistry/ or *evidence based practice center/
21 *clinical competence/
22 exp *professional competence/
23 *good clinical practice/
24 *practice guideline/
25 20 or 21 or 22 or 23 or 24
26 controlled clinical trial/
27 randomized controlled trial/
28 randomized.ab.
29 placebo.ab.
30 randomly.ab.
31 trial.ti.
32 (control* adj8 trial*).ti,ab.
33 (systematic: review or systematic: overview).ti,ab. or meta-analysis.pt,sh. or (meta-anal: or metaanal:).tw.
34 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33
35 18 and 19 and 25 and 34

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PsycINFO
Database: PsycINFO
Search Strategy:
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1 internet/
2 computer mediated communication/
3 cellular phones/
4 electronic communication/
5 social media/
6 computer searching/
7 mobile devices/
8 telemedicine/
9 teleconferencing/
10 (telemedicine or "tele health").tw.
11 online social networks/
12 ("remote communication*" or "remote consultation*").tw.

13 (ehealth or e-health or m-health or mhealth or "health informatics").tw.
14 (internet or email or www or "world wide web" or virtual or "web site" or website).tw.
15 (e-learning or elearning or telecommunicat$).tw.
16 automated information retrieval/
17 computer searching/
18 information technology/
19 ("digital librar*" or "electronic librar*").tw.
20 ("computerised reminder$" or "computerized reminder$").tw.
21 ("social media*" or "second life" or facebook* or youtube or twitter* or tweet* or webmd or linkedin or noodle or zotero or mendeley or refworks or endnote or picsearch or flickr or Skype or elluminate or upstream).tw.
22 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21
23 (clinician* or dentist* or doctor* or family practition* or general practition* or physician* or gyn?ecologist* or h?ematologist* or internist* or nurse* or obstetrician* or occupational therapist* or p?ediatrician* or pharmacist* or physiotherapist* or psychiatrist* or psychologist* or radiologist* or surgeon* or therapist* or counsel?or* or neurologist* or optometrist* or "health profession*" or health* personnel or “health care profession*” OR “health care personnel" or resident*).ti,ab.
24 clinical practice/
25 professional competence/
26 treatment guidelines/
27 evidence based practice/
28 24 or 25 or 26 or 27
29 randomized.ab.
30 placebo.ab.
31 randomly.ab.
32 trial.ti.
33 (control* adj8 trial*).ti,ab.
34 (systematic: review or systematic: overview).ti,ab. or meta-analysis.pt,sh. or (meta-anal: or metaanal:).tw.
35 29 or 30 or 31 or 32 or 33 or 34
36 22 and 23 and 28 and 35
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Appendix 4.2 List of excluded studies

Authors	Title	Published Year	Journal	Exclusion Reason
Adsett, J. A.; Mullins, R.; Page, K.; Hickey, A.	Heart education assessment and rehabilitation toolkit: Heart online. Translating research into practice	2014	European Journal of Heart Failure	Abstract
Ahern, D. K.; Stinson, L. J.; Uebelacker, L. A.; Wroblewski, J. P.; McMurray, J. H.; Eaton, C. B.	E-health blood pressure control program	2012	J Med Pract Manage	Wrong intervention
Allen, Marybeth; lezzoni, Lisa I.; Huang, Annong; et al.	Improving patient-clinician communication about chronic conditions: Description of an Internet-based nurse e-coach intervention	2008	Nursing Research	Wrong intervention
Batchelor-Murphy, M; Amella, EJ.; Zapka, J; Mueller, M; et al.	Feasibility of a web-based dementia feeding skills training program for nursing home staff	2015	Geriatric Nursing	Wrong intervention
Beattie, J.; Brady, L.; Tobias, T.	Improving clinician confidence and skills: piloting a web-based learning program for clinicians in supportive care screening of cancer patients	2014	J Cancer Educ	Wrong intervention
Becker, W. J.; Giammarco, R.; Wiebe, V.	Moving forward to improve migraine management in Canada	2007	Can J Neurol Sci	Abstract
Bell, J. A.; Patel, B.; Malasanos, T.	Knowledge improvement with web-based diabetes education program: brainfood	2006	Diabetes Technol Ther	Wrong intervention
Bereznicki, L. R.; Jackson, S. L.; Peterson, G. M.	Supervised patient self-testing of warfarin therapy using an online system	2013	J Med Internet Res	Wrong intervention
Berry, D. L.; Blumenstein, B. A.; Halpenny, B.; Wolpin, S.; Fann, J. R.; Austin-Seymour, M.; et al.	Enhancing patient-provider communication with the electronic self-report assessment for cancer: a randomized trial	2011	Journal of Clinical Oncology	Wrong intervention
Best, J.; Muzaffar, J.; Mitchell-Innes, A.	Quality of information available via the internet for patients with head and neck cancer: are we improving?	2015	Eur Arch Otorhinolaryngol	Wrong study design
Blankstein, R.; Cannon, C.; Udelson, J.	Update on pharmacological cardiac stress testing: efficacy, risk stratification and patient selection	2014	Am J Med	Abstract
Blazer, K; Christie, C; Uman, G; Weitzel, J	Impact of Web-Based Case Conferencing on Cancer Genetics Training Outcomes for Community-Based Clinicians	2012	Journal of Cancer Education	Wrong intervention
Blazer, Kathleen R.	Examining the Use of Distance-Mediated Case Conferencing for Case-Based Training in Clinical Cancer Genetics	2010	ProQuest LLC. Ed.D. Dissertation, University of California, Los Angeles	Wrong intervention
Blomberg, K.; Wengstrom, Y.; Sundberg, K.; Browall, M.; Isaksson, A. K.; Nyman, M. H.; et al.	Symptoms and self-care strategies during and six months after radiotherapy for prostate cancer - Scoping the perspectives of patients, professionals and literature	2016	Eur J Oncol Nurs	Wrong study design
Blonstein, A. C.; Yank, V.; Stafford, R. S.; Wilson, S. R.; Rosas, L. G.; Ma, J.	Translating an evidence-based lifestyle intervention program into primary care: lessons learned	2013	Health Promot Pract	Wrong population
Bond, G. E.; Burr, R. L.; Wolf, F. M.; Feldt, K.	The effects of a web-based intervention on psychosocial well-being among adults aged 60 and older with diabetes: a randomized trial	2010	Diabetes Educator	Wrong population
Bonderup, A. M.; Hangaard, S. V.; Lilholt,	Patient support ICT tool for hypertension monitoring	2012	Stud Health Technol Inform	Wrong population

P. H.; Johansen, M. D.; Hejlesen, O. K.				
Borosund, E.; Cvancarova, M.; Moore, S. M.; Ekstedt, M.; Ruland, C. M.	Comparing effects in regular practice of e-communication and Web-based self-management support among breast cancer patients: preliminary results from a randomized controlled trial	2014	J Med Internet Res	Wrong population
Bradway, M.; Grottland, A.; Blixard, H.; Giordanengo, A.; Arsand, E.	System for enabling clinicians to relate to a mobile health APP: Preliminary results of the norwegian trial in the EU FI-star project	2016	Diabetes Technology and Therapeutics	Abstract
Burgess, M.	Development of a website for multiple sclerosis: involving service users and providers	2008	British Journal of Neuroscience Nursing	Wrong intervention
Burns, P; Jones, SC.; Iverson, D; Caputi, P	Usability Testing of AsthmaWise With Older Adults	2015	CIN: Computers, Informatics, Nursing	Wrong population
Calvert, C.; Lal, S.; Stansfield, C.; McLaughlin, J.; Robinson, A.	A study evaluating clinicians' attitudes and preferences for a web-based IBD patient portal designed to facilitate self-management	2013	Journal of Crohn's and Colitis	Abstract
Carpenter, D. M.; Geryk, L. L.; Arrindell, C.; Tate, D.; Alexander, D. S.; Sage, A.; et al.	Adolescent, caregiver, and provider preferences for an asthma self-management app	2015	Journal of Adolescent Health	Abstract
Carrera, P.	Primary care transformation as a solution to the epidemic of chronic diseases	2012	Value in Health	Abstract
Carter, L.; Rukholm, E.; Kelloway, L.	Stroke education for nurses through a technology-enabled program	2009	J Neurosci Nurs	Wrong intervention
Chan, A. H. Y.; Reddel, H. K.; Apter, A.; Eakin, M.; Riekert, K.; Foster, J. M.	Adherence Monitoring and E-Health: How Clinicians and Researchers Can Use Technology to Promote Inhaler Adherence for Asthma	2013	Journal of Allergy and Clinical Immunology: In Practice	Wrong study design
Chawla, A. S.; Paul, A.; Horowicz-Mehler, N.; Faulkner, E. C.; Doyle, J. J.	Companion devices: Transformative mobile health technology towards improved patient care delivery	2015	Value in Health	Abstract
Chen, A. T.	Exploring online support spaces: Using cluster analysis to examine breast cancer, diabetes and fibromyalgia support groups	2012	Patient Education & Counseling	Wrong population
Chopra, V.; McMahon, L.	Readmissions, facebook and information sharing: Lessons learned for future paths	2011	Journal of Hospital Medicine	Abstract
Cox, A.; Illsley, M.; Knibb, W.; Lucas, C.; O'Driscoll, M.; Potter, C.; et al.	The acceptability of e-technology to monitor and assess patient symptoms following palliative radiotherapy for lung cancer	2011	Palliat Med	Wrong intervention
Crenshaw, K.; Curry, W.; Salanitro, A. H.; Safford, M. M.; Houston, T. K.; Allison, J. J.; et al.	Is physician engagement with Web-based CME associated with patients' baseline hemoglobin A1c levels? The Rural Diabetes Online Care study	2010	Acad Med	Wrong intervention
Davies, E.; Yeoh, K.	Attitudes of health professionals to patients who receive chemotherapy information from the internet and their discussion of internet information with patients	2010	Annals of Oncology	Abstract
Davis, S.; Oakley-Girvan, I.	mHealth Education Applications Along the Cancer Continuum	2015	Journal of Cancer Education	Wrong population
de Jongh, T.; Gurol-Urganci, I.; Vodopivec-Jamsek, V.; Car, J.; Atun, R.	Mobile phone messaging for facilitating self-management of long-term illnesses	2012	Cochrane Database of Systematic Reviews	Wrong intervention
de Jong, C. C.; Ros, W. J.; Schrijvers, G.	The effects on health behavior and health outcomes of Internet-based asynchronous communication between health providers	2014	J Med Internet Res	Wrong population

	and patients with a chronic condition: a systematic review			
Dekker, N.; Hermens, R. P.; de Wilt, J. H.; van Zelst-Stams, W. A.; Hoogerbrugge, N.; Nagengast, F.; et al.	Improving recognition and referral of patients with an increased familial risk of colorectal cancer: Results from a randomized controlled trial	2015	Colorectal disease	Wrong intervention
Desimone, M. E.; Blank, G. E.; Virji, M.; Donihi, A.; DiNardo, M.; Simak, D. M.; et al.	Effect of an educational Inpatient Diabetes Management Program on medical resident knowledge and measures of glycemic control: a randomized controlled trial	2012	Endocr Pract	Wrong intervention
Diar Bakerly, N.; McCorkindale, S.; Patel, G.	The use of smartphone application (COPD assist) to support the implementation of local primary care guidelines on the management of patients with COPD	2014	Thorax	Abstract
Duffy, F. D.; Lynn, L. A.; Didura, H.; Hess, B.; Caverzagie, K.; Grosso, L.; et al.	Self-assessment of practice performance: Development of the ABIM practice improvement module (PIM^{SM})	2008	Journal of Continuing Education in the Health Professions	Wrong intervention
Duvvuri, V. R. S. K.; Jianhong, W.	Information and communication technology developments in asthma management: A systematic review	2007	Indian Journal of Medical Sciences	Wrong intervention
Dy, S. M.; Roy, J.; Ott, G. E.; McHale, M.; Kennedy, C.; Kutner, J. S.; Tien, A.	Tell Us^{TM}: A web-based tool for improving communication among patients, families, and providers in hospice and palliative care through systematic data specification, collection, and use	2011	Journal of Pain and Symptom Management	Wrong intervention
Eaton-Spiva, L.; Day, A.	Effectiveness of a computerized educational module on nurses' knowledge and confidence level related to diabetes	2011	J Nurses Staff Dev	Wrong intervention
Estrella, M. M.; Jaar, B. G.; Cavanaugh, K. L.; Fox, C. H.; Perazella, M. A.; Soman, S. S.; et al.	Perceptions and use of the national kidney foundation KDOQI guidelines: A survey of U.S. renal healthcare providers	2013	BMC Nephrology	Wrong intervention
Euller Ziegler, L.	Patient education, a full component of patient care in France : Impact of the new regulations-results of a national survey	2013	Annals of the Rheumatic Diseases. Conference: Annual European Congress of Rheumatology of the European League Against Rheumatism, EULAR	Abstract
Fairfield, K. M.; Chen, W. Y.; Colditz, G. A.; Emmons, K. M.; Fletcher, S. W.	Colon cancer risk counseling by health-care providers: perceived barriers and response to an Internet-based cancer risk appraisal instrument	2004	Journal of Cancer Education	Wrong intervention
Faiman, B. M.; Jacobsen, P.; Callahan, A.; Nadia, S.; Panzer, S. L.; Baz, R.	Feasibility of implementing innovative supportive care plans for symptom management in multiple myeloma	2015	Blood	Wrong intervention
Fenny, N.; Wolf, R.; Dimov, V.	Rapid growth of twitter use by allergists and immunologists for professional purposes	2012	Annals of Allergy, Asthma and Immunology	Abstract
Field, K. M.; Rosenthal, M. A.; Dimou, J.; Kaye, A.; Gibbs, P.; Drummond, K.	Neuro-oncology Multidisciplinary Team (MDT) meetings: An effective method of documentation and information dissemination	2009	Asia-Pacific Journal of Clinical Oncology	Abstract
Finkelstein, J.; Knight, A.; Marinopoulos, S.; Gibbons, M. C.; Berger, Z.; Aboumatar, H.; et al.	Enabling patient-centered care through health information technology	2012	Evid rep/technol assess	Wrong intervention

Fisher, EB.; Ballesteros, J; Bhushan, N; Coufal, MM.; Kowitt, SD.; McDonough, A. M; et al.	Key Features Of Peer Support In Chronic Disease Prevention And Management	2015	Health Affairs	Wrong intervention
Forrest, B.; Brinson, S.; Bavisotto, S. H.; Joyner, J. N.	Time to talk cardio communication tool use improves cardiovascular disease management behaviors and satisfaction	2011	Journal of Clinical Hypertension	Abstract
Gaggioli, A.; Pallavicini, F.; Morganti, L.; Serino, S.; Scaratti, C.; Briguglio, M.; et al.	Experiential virtual scenarios with real-time monitoring (interreality) for the management of psychological stress: a block randomized controlled trial	2014	J Med Internet Res	Wrong intervention
Ganschow, P. S.; Hahn, E. A.; Jacobs, E. A.	Innovative multimedia methods to enhance pat ient-centered care in underserved populations	2013	Journal of General Internal Medicine	Abstract
Gilmour, J. A.; Huntington, A.; Broadbent, R.; Strong, A.; Hawkins, M.	Nurses' use of online health information in medical wards	2012	J Adv Nurs	Wrong intervention
Giordano, A.; Lugaresi, A.; Martinelli, V.; Granella, F.; Confalonieri, P.; Trojano, M.; et al.	Developing and testing of the "Sapere Migliora" information aid for newly diagnosed ms patients (#50)		Multiple sclerosis (Houndmills, Basingstoke, England)	Abstract
Glasgow, R. E.; Dickinson, P.; Fisher, L.; Christiansen, S.; Toobert, D. J.; Bender, B. G.; et al.	Use of RE-AIM to develop a multi-media facilitation tool for the patient-centered medical home	2011	Implement Sci	Wrong intervention
Gogovor, A.; Visca, R.; Symeonidis, I.; Ahmed, S.	Informing the design of a chronic pain webbased self-management portal	2013	Pain Research and Management	Abstract
Goodrich, D. E.; Buis, L. R.; Janney, A. W.; Ditty, M. D.; Krause, C. W.; Zheng, K.; et al.	Integrating an internet-mediated walking program into family medicine clinical practice: a pilot feasibility study	2011	BMC Med Inf Decis Mak	Wrong intervention
Goulding, E.; Dopke, C.; Michaels, T.; Aneja, M.; Martin, C.; Bank, A.; Begale, M.; Mohr, D.	User-centered development and field testing of livewell: A smart phone application for bipolar disorder	2015	Neuropsychopharmacology	Abstract
Greenhalgh, T.; Hinder, S.; Stramer, K.; Bratan, T.; Russell, J.	Adoption, non-adoption, and abandonment of a personal electronic health record: case study of HealthSpace	2010	BMJ	Wrong intervention
Gregory, J.; Robling, M.; Bennert, K.; Channon, S.; Cohen, D.; Crowne, E.; et al.	Development and evaluation by a cluster randomised trial of a psychosocial intervention in children and teenagers experiencing diabetes: the DEPICTED study	2011	Health Technol Assess	Wrong intervention
Guarino, H.; Moore, S.; Rosenblum, A.; Marsch, L.	Provider perspectives on the potential utility of technology-based tools in the treatment of chronic pain	2015	Journal of Pain	Abstract
Guattery, D.; Pegus, C.; Eslava, S.; Winfield, D.	The important role of the health care provider during a human factors trial when developing a new remote monitoring device for self- management of diabetes	2009	Canadian Journal of Diabetes	Abstract
Gubert, E.; Pal, K.; Dack, C.; Murray, E.	Developing a computer-based selfmanagement programme for people with Type 2 diabetes: User perspectives	2012	Diabetic Medicine	Abstract
Gund, A.; Lindecrantz, K.; Schaufelberger, M.; Patel, H.; Sjoqvist, B. A.	Attitudes among healthcare professionals towards ICT and home follow-up in chronic heart failure care	2012	BMC Med Inf Decis Mak	Wrong intervention
Gutteling, J. J.; Busschbach, J. J.; de Man, R. A.; Darlington, A. S.	Logistic feasibility of health related quality of life measurement in clinical practice: results of a prospective study in a large population of chronic liver patients	2008	Health Qual Life Outcomes	Wrong intervention

Haase, K. R.; Loiselle, C. G.	Oncology team members' perceptions of a virtual navigation tool for cancer patients	2012	Int J Med Inf	Wrong intervention
Hanson, Tabitha K.; Aleman, Martha; Hart, Lacey; Yawn, Barbara	Increasing Availability to and Ascertaining Value of Asthma Action Plans in Schools Through Use of Technology and Community Collaboration	2013	Journal of School Health	Wrong intervention
Hariharan, J.; Rehm, J.; Kaho, J.; Bragg, D.	Using multi-media to teach medical students diabetes management and enhance clinical skills	2011	Journal of General Internal Medicine	Abstract
Harper, R.; Donnelly, R.; Burke, M.	Telemonitoring for type 2 diabetes-Di@l-log	2010	Diabetic Medicine	Abstract
Harth, C.; Xue, Y.; Yang, J.	Internet teaching of the neurologic examination and OSCE performance in the neurology clerkship	2015	Neurology	Abstract
Hartmann, C. W.; Sciamanna, C. N.; Blanch, D. C.; Mui, S.; Lawless, H.; Manocchia, M.; et al.	A website to improve asthma care by suggesting patient questions for physicians: qualitative analysis of user experiences	2007	J Med Internet Res	Wrong intervention
Haze, K. A.; Lynaugh, J.	Building patient relationships: a smartphone application supporting communication between teenagers with asthma and the RN care coordinator	2013	Comput Inform Nurs	Wrong intervention
Hefelfinger, J.; Brady, T. J.; Berktold, J.; Goldstein, M.; Bonilla, E.; Brick, M.; et al.	Reaching out to physical therapists: Results of a survey on physical therapists preferences for learning about evidence-based community programs	2014	Arthritis and Rheumatology	Abstract
Heinrich, E.; de Nooijer, J.; Schaper, N. C.; Schoonus-Spit, M. H.; Janssen, M. A.; de Vries, N. K.	Evaluation of the web-based Diabetes Interactive Education Programme (DIEP) for patients with type 2 diabetes	2012	Patient Education & Counseling	Wrong population
Hoffman, J; Salzman, C; Garbaccio, C; Burns, SP.; Crane, D; et al.	Use of on-demand video to provide patient education on spinal cord injury	2011	Journal of Spinal Cord Medicine	Wrong population
Hope, S.; Greenwell, K.; Murphy, J.; Corbett, S.; Forster, R.	Development of inflammatory bowel disease information service	2011	Journal of Crohn's and Colitis	Abstract
Howren, M.; van Liew, Julia R.; Christensen, Alan J.	Advances in patient adherence to medical treatment regimens: The emerging role of technology in adherence monitoring and management	2013	Social and Personality Psychology Compass	Wrong intervention
Hughes, T.; Fu, K.; Fajardo, M.; Isaacson, R.	Age-related memory loss and alzheimer's disease: A randomized, interactive web-based educational intervention study	2013	Neurology. Conference: 65th American Academy of Neurology Annual Meeting San Diego, CA United States. Conference Start	Abstract
Hunt, Caralise W.; Sanderson, Bonnie K.; Ellison, Kathy Jo	Support for Diabetes Using Technology: A Pilot Study to Improve Self-Management	2014	MEDSURG Nursing	Wrong population
Hunt, C. W.	Technology and diabetes self-management: An integrative review	2015	World J Diabetes	Wrong population
Hurley, M. V.; Carter, A.; Carter, D.; Hughes, L.; Mhuiri, A. N.; Walsh, N. E.	Delivering escape-pain (enabling self-management and coping of arthritic pain through exercise)-an online guide for healthcare professionals	2014	Arthritis and Rheumatology	Abstract
Hussainy, S. Y.; Marriott, J. L.; Beattie, J.; Nation, R. L.; Dooley, M. J.	A palliative cancer care flexible education program for Australian community pharmacists	2010	Am J Pharm Educ	Wrong intervention
In't Veen, J.; Mennema, B.; Van Noort, E.	Online self-management in patients with COPD or asthma: With or without the healthcare provider?	2012	European Respiratory Journal. Conference: European Respiratory	Abstract

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Jacob, E.; Pavlish, C.; Duran, J.; Stinson, J.; Lewis, M. A.; Zeltzer, L.	Facilitating patient provider communications using wireless technology	2012	American Journal of Hematology	Abstract
Jerant, A.; Kravitz, R. L.; Rooney, M.; Amerson, S.; Kreuter, M.; Franks, P.	Effects of a tailored interactive multimedia computer program on determinants of colorectal cancer screening: a randomized controlled pilot study in physician offices	2007	Patient Educ Couns	Wrong population
Jerant, A.; Kravitz, R. L.; Sohler, N.; Fiscella, K.; Romero, R. L.; Parnes, B.; et al.	Sociopsychological tailoring to address colorectal cancer screening disparities: a randomized controlled trial	2014	Annals of family medicine	Wrong population
Jimbo, M.; Shultz, C. G.; Nease, D. E.; Fetters, M. D.; Power, D.; Ruffin 4th, M. T.	Perceived barriers and facilitators of using a Web-based interactive decision aid for colorectal cancer screening in community practice settings: findings from focus groups with primary care clinicians and medical office staff	2013	Journal of medical Internet research	Wrong intervention
Jiwa, M.; Halkett, G.; Meng, X.; Pillai, V.; Berg, M.; Shaw, T.	Supporting patients treated for prostate cancer: a video vignette study with an email-based educational program in general practice	2014	J Med Internet Res	Wrong intervention
Joshi, V. K.	Creation of a mouth-cancer website and online support group	2005	British Journal of Healthcare Computing & Information Management	Wrong study design
Kern, R.; Haase, R.; Eisele, J. C.; Thomas, K.; Ziemssen, T.	Designing an Electronic Patient Management System for Multiple Sclerosis: Building a Next Generation Multiple Sclerosis Documentation System	2016	Interact J Med Res	Wrong intervention
Khurana, L.; Durand, E.; Gary, S.; Otero, T.; Hall, C.; Dallabrida, S.	Patient preference for using technology to track and self-manage osteoarthritis	2015	Arthritis and Rheumatology. Conference: American College of Rheumatology/Association of Rheumatology Health Professionals Annual Scientific Meeting, ACR/ARHP	Abstract
Khurana, L.; Durand, E.; Gary, S.; Otero, T.; Hall, C.; Dallabrida, S.	Preferences for using phone calls, text messaging, and email to communicate with physicians among patients with four chronic diseases	2015	Value in Health	Abstract
Khurana, L.; Gary, S.; Vazquez, V.; Otero, A. V.; Dallabrida, S. M.; Arnera, V.	Diabetes patient preferences for using technology to communicate with physicians	2015	Diabetes Technology and Therapeutics	Abstract
Kim, H. A.; Bae, Y. D.; Seo, Y. I.	Arthritis information on the Wed and its influence on patients and physicians: A Korean study	2004	Clinical and Experimental Rheumatology	Wrong intervention
Kim, H. S.; Hwang, Y.; Lee, J. H.; Oh, H. Y.; Kim, Y. J.; Kwon, H. Y.; et al.	Future prospects of health management systems using cellular phones	2014	Telemed J E Health	Wrong intervention
Kirkovits, T.; Wuerstlein, R.; Drewes, C.; Schiltz, D.; Bauerfeind, I.; Goldmann-Posch, U.; et al.	New ways of caring for patients with breast cancer: Acceptance of eHealth among breast cancer patients and medical professionals	2014	European Journal of Cancer	Abstract
Ko, G. T.; So, W. Y.; Tong, P. C.; Le Coguiec, F.; Kerr, D.; Lyubomirsky, G.; et al.	From design to implementation--the Joint Asia Diabetes Evaluation (JADE) program: a descriptive report of an electronic web-based diabetes management program	2010	BMC Med Inf Decis Mak	Wrong intervention

Kruijssen, V; Staa, A; Dwarswaard, J; Mennema, B; Adams, S A.; Veen, J	Use of Online Self-Management Diaries in Asthma and COPD: A Qualitative Study of Subjects' and Professionals' Perceptions and Behaviors	2015	Respiratory Care	Wrong intervention
Kumar, N.; Garg, N.; Venkatraman, A.; Pandey, A.	Are video sharing websites a useful source of information on hypertension?	2014	Journal of the American Society of Hypertension	Abstract
Kwiatek, R.; Powell, C.; Faulkner, J.; True, B.	The fibromyalgia Australia website: A new paradigm for productive community management	2013	Internal Medicine Journal	Abstract
LaBresh, K. A.; Ellrodt, A. G.; Gliklich, R.; Liljestrand, J.; Peto, R.	Get with the guidelines for cardiovascular secondary prevention: pilot results	2004	Arch Intern Med	Wrong intervention
Lalloo, C.	"There's a pain app for that": Promoting pain self-management among adolescents and young adults	2013	Pain Research and Management	Abstract
Lee, R.; Whitley, H. P.	Use of social media to support patients with diabetes mellitus	2014	Consultant Pharmacist	Wrong population
Leveille, S. G.; Mejilla, R.; Ngo, L.; Fossa, A.; Elmore, J. G.; Darer, J.; et al.	Do Patients Who Access Clinical Information on Patient Internet Portals Have More Primary Care Visits?	2016	Medical Care	Wrong population
Lin, C. A.; Neafsey, P. J.; Anderson, E.	Advanced practice registered nurse usability testing of a tailored computer-mediated health communication program	2010	CIN: Computers, Informatics, Nursing	Wrong intervention
Linn, A. J.; van Weert, J. C. M.; Smit, E. G.; Perry, K.; van Dijk, L.	1+1=3? The systematic development of a theoretical and evidence-based tailored multimedia intervention to improve medication adherence	2013	Patient Education and Counseling	Wrong study design
Loiselle, C. G.; Haase, K.; Peters, O.; Girouard, L.	The promise of virtual navigation in cancer care: Is there concordance between patients' and health care providers' views?	2011	Psycho-Oncology	Abstract
Magnezi, R.; Grosberg, D.; Novikov, I.; Ziv, A.; Shani, M.; Freedman, L. S.	Characteristics of patients seeking health information online via social health networks versus general Internet sites: a comparative study	2015	Inform Health Soc Care	Wrong population
Mahmood, R. Z.; Grossi, J.; Koelling, T. M.	Pilot study examining heart failure patient internet use and adherence to a web based portal designed to support self-care	2013	Circulation: Cardiovascular Quality and Outcomes. Conference: American Heart Association's Quality of Care and Outcomes Research in Cardiovascular Disease and Stroke	Abstract
Mallow, JA.; Theeke, LA.; Barnes, ER.; Whetsel, T; Mallow, BK.	Using mHealth Tools to Improve Rural Diabetes Care Guided by the Chronic Care Model	2014	Online Journal of Rural Nursing & Health Care	Wrong population
Marco, J.; Barba, R.; Losa, J. E.; De La Serna, C. M.; Sainz, M.; Fernandez Lantigua, I.; De La Serna, J. L.	Advice from a medical expert through the internet on queries about AIDS and hepatitis: Analysis of a pilot experiment	2006	PLoS Medicine	Wrong population
Marton, Christine	Consumer health 2.0 in Canada: tweeting about cancer	2012	Journal of the Canadian Health Libraries Association (JCHLA)	Wrong population
Massoudi, B. L.; Olmsted, M. G.; Zhang, Y.; Carpenter, R. A.; Barlow, C. E.; Huber, R.	A web-based intervention to support increased physical activity among at-risk adults	2010	J Biomed Inform	Wrong intervention
McLaughlin, M; Nam, Y; Gould, J; Pade, C; Meeske, KA.; Ruccione, KS.; et al.	A videosharing social networking intervention for young adult cancer survivors	2012	Computers in Human Behavior	Wrong population

McTigue, K. M.; Conroy, M. B.; Simkin-Silverman, L. R.; Tudorascu, D. L.; Hess, R.; Fischer, G.; et al.	Provider response to online self-management support for obesity integrated with primary care	2014	Journal of General Internal Medicine	Abstract
Moretti, A.; Rossi, A.; Gutierrez, M.; Grassi, W.	Rheumatology nursing: An italian experience of e-learning	2012	Annals of the Rheumatic Disease. Conference: Annual European Congress of Rheumatology of the European League Against Rheumatism, EULAR	Abstract
Nakamura, M.; Nakahira, M.; Tokunaga, K.; Murakami, Y.; Kinosita, C.; Okino, Y.	Development of online education program for certified chemotherapy nurses regarding molecular targeted therapy	2015	Annals of Oncology	Abstract
Nwalie, J.; Kaan, A.	An evaluation of virtual heart: Internet based heart failure self management	2012	Canadian Journal of Cardiology	Abstract
Ong, S.; Jassal, V.; Seto, E.; So, S.; Uddin, A.; Shier, A.; et al.	Mobile self-management system for CKD patients: Conceptual framework and design principles	2014	American Journal of Kidney Diseases	Abstract
O'Reilly, D. J.; Bowen, J. M.; Sebaldt, R. J.; Petrie, A.; Hopkins, R. B.; Assasi, N.; et al.	Evaluation of a chronic disease management system for the treatment and management of diabetes in primary health care practices in Ontario: an observational study	2014	Ont Health Technol Assess Ser	Wrong intervention
Ormandy, P.; Vlaminck, H.; Harrington, M.; Forest, M.; Visser, R.	A new internet resource for chronic kidney disease patients	2006	EDTNA/ERCA Journal of Renal Care	Wrong study design
Pace, A.; Villani, V.; Focarelli, S.; Benincasa, D.; Benincasa, A.; Carapella, C. M.; et al.	Telemedicine and palliative care in neuro-oncology: Web assistance for symptoms management and end of life support	2013	Neuro-Oncology	Abstract
Park, J. H.; Park, C. S.; Jang, H. J.	Development and pilot testing of smartphone based self-management application for adult asthma	2015	European Respiratory Journal. Conference: European Respiratory Society Annual Congress	Abstract
Parmanto, B.; Pramana, G.; Yu, D. X.; Fairman, A. D.; Dicianno, B. E.; McCue, M. P.	iMHere: A Novel mHealth System for Supporting Self-Care in Management of Complex and Chronic Conditions	2013	JMIR Mhealth Uhealth	Wrong intervention
Patel, M. R.; Shah, S.; Cabana, M.; Sawyer, S. M.; Toelle, B.; Mellis, C.; et al.	Translation of evidence-based asthma interventions: Physician asthma care education (PACE) program in the united states and Australia	2012	American Journal of Respiratory and Critical Care Medicine. Conference: American Thoracic Society International Conference, ATS	Abstract
Pelayo-Alvarez, M.; Perez-Hoyos, S.; Agra-Varela, Y.	Clinical effectiveness of online training in palliative care of primary care physicians	2013	J Palliat Med	Wrong intervention
Peters, S.; Abotseng, L.; Faleatua, R. J.; Harvey, S.; Mulligan, H.	Experiences of health care professionals with the training and delivery of the self-management program "Minimise Fatigue, Maximise Life" for persons with MS	2014	Multiple Sclerosis	Abstract
Plaete, J.; Crombez, G.; DeSmet, A.; Deveugele, M.; Verloigne, M.; De Bourdeaudhuij, I.	What do general practitioners think about an online self-regulation programme for health promotion? Focus group interviews	2015	BMC Fam Pract	Wrong intervention
Rabin, B. A.; Gaglio, B.; Sanders, T.; Nekhlyudov, L.; Dearing, J. W.; Bull, S.;	Predicting cancer prognosis using interactive online tools: a systematic review and implications for cancer care providers	2013	Cancer Epidemiol Biomarkers Prev	Wrong intervention

et al.				
Raptis, D. A.; Graf, R.; Peck, J.; Mouzaki, K.; Patel, V.; Skipworth, J.; et al.	Development of an electronic web-based software for the management of colorectal cancer target referral patients	2011	Inform Health Soc Care	Wrong intervention
Requarth, J. A.	MyCareLibrary.org: A website containing imageguided palliative care information for patients and physicians	2015	Journal of Vascular and Interventional Radiology	Abstract
Revenas, A.; Martin, C.; C, H. Opava; Brusewitz, M.; Keller, C.; Asenlof, P.	A Mobile Internet Service for Self-Management of Physical Activity in People With Rheumatoid Arthritis: Challenges in Advancing the Co-Design Process During the Requirements Specification Phase	2015	JMIR Res Protoc	Wrong intervention
Richardson, J.; De Paul, V.; Officer, A.; Wilkins, S.; Letts, L.; Bosch, J.; et al.	An evidence based intervention for stroke rehabilitation in the home environment: A knowledge translation study	1046	Physiotherapy	Abstract
Robinson, J. K.; Alam, M.; Ashourian, N.; Khan, M.; Kundu, R.; Laumann, A. E.; et al.	Skin cancer prevention education for kidney transplant recipients: a systematic evaluation of Internet sites	2010	Prog Transplant	Wrong study design
Rodgers, P. T.	Helping patients with diabetes: resources from the National Diabetes Education Program	2012	J Am Pharm Assoc (2003)	Wrong study design
Salbach, N.; Jaglal, S.; Rappolt, S.; Bayley, M.; Burnett, D.; Judd, M.; et al.	Feasibility and impact of a multi-component education intervention on improving self-efficacy to implement evidence-based practice among physiotherapists in stroke rehabilitation	2011	Physiotherapy (United Kingdom)	Abstract
Sanfelix-Genoves, J.; Peiro, S.; Sanfelix-Gimeno, G.; Hurtado, I.; Pascual de la Torre, M.; Trillo-Mata, J. L.; et al.	Impact of a multifaceted intervention to improve the clinical management of osteoporosis. The ESOSVAL-F study	2010	BMC Health Serv Res	Wrong study design
Saraiya, B.; Johnson, R. W.; Avvento, P.	Google chat as an online innovative, personalized communication skills training program	2013	Journal of Pain and Symptom Management	Abstract
Savas, J. A.; Huang, K. E.; Tuchayi, S. M.; Feldman, S. R.	Understanding the influence of social media in medicine: lesson learned from Facebook	2014	Dermatol Online J	Wrong population
Silva, A. P.; Bertoni, V. D.; Mulvey, T. M.; Sampaio, C.	Quality-of-care implications of improving physician communication through a Web-based tool (Teamwork)	2012	Journal of Clinical Oncology. Conference: ASCO's Quality Care Symposium	Abstract
Singh, AG.; Singh, S; Singh, P	YouTube for Information on Rheumatoid Arthritis -- A Wakeup Call?	2012	Journal of Rheumatology	Wrong population
Slater, H.; Davies, S.; Milne, G.; Kelso, J.; Slattery, M.; Briggs, A.	The painhealth website: A western australian policy-into-practice initiative to deliver holistic, consumer-focused best-evidence pain management for people with musculoskeletal pain	1410	Physiotherapy	Abstract
Smits, R.; Bryant, J.; Sanson-Fisher, R.; Tzelepis, F.; Henskens, F.; Paul, C.; et al.	Tailored and integrated Web-based tools for improving psychosocial outcomes of cancer patients: the DoTTI development framework	2014	J Med Internet Res	Wrong study design
Steele Gray, C.; Khan, A. I.; Kuluski, K.; McKillop, I.; Sharpe, S.; Bierman, A. S.; et al.	Improving Patient Experience and Primary Care Quality for Patients With Complex Chronic Disease Using the Electronic Patient-Reported Outcomes Tool: Adopting Qualitative Methods Into a User-Centered Design Approach	2016	JMIR Res Protoc	Wrong intervention
Steinberg, J. D.; Curbelo, M. C.; Rojas,	Argentine's experience in developing and implementing a blog, as a tool for better	2014	Multiple Sclerosis	Abstract

G.; Martinez, A. D.; Carra, A. J.	interaction between multiple sclerosis patients and their doctors			
Steinberg, P. L.; Wason, S.; Stern, J. M.; Deters, L.; Kowal, B.; Seigne, J.	YouTube as source of prostate cancer information	2010	Urology	Wrong intervention
Stell, A.; Sinnott, R.	The ENSAT registry: a digital repository supporting adrenal cancer research	2012	Stud Health Technol Inform	Wrong intervention
Stephen, J. E.; Christie, G.; Flood, K.; Golant, M.; Rahn, M.; Rennie, H.; et al.	Facilitating online support groups for cancer patients: the learning experience of psycho-oncology clinicians	2011	Psychooncology	Wrong intervention
Storni, Cristiano	Diabetes self-care in-the-wild: Design challenges for personal health record systems and self-monitoring technologies	2014	Information Technology & People	Wrong intervention
Sundin, E.; Blidberg, K.; Carlsson, A.	Empowerment and support for a healthier life style	2015	Annals of the Rheumatic Diseases	Abstract
Taite, A.; Minard, J.; Ferrone, M.; Licskai, C.; To, T.; Lougheed, M. D.	AsthmaLife portal: Supporting clinical care and research at the point of care	2015	European Respiratory Journal. Conference: European Respiratory Society Annual Congress	Abstract
Teixeira, L.; Saavedra, V.; Ferreira, C.; Sousa Santos, B.	Improving the management of chronic diseases using web-based technologies: an application in hemophilia care	2010	Conf Proc IEEE Eng Med Biol Soc	Wrong intervention
Testa, M. A.; Simonson, D. C.	Physician and patient usability of a web-based mobile-health diabetes management system	2011	Diabetes	Abstract
Thirumurthi, S.; Ross, W. A.; Lum, P.; Pande, M.; Miller, E.; Lee, J.; et al.	When patients watch a video, physicians see more adenomas: An educational bowel preparation video improves adenoma detection RATES	2015	Gastrointestinal Endoscopy	Abstract
Thomson, A.; Davis, A.; Paterson, A.; Giovannoni, G.; Schmierer, K.	Designing an information resource to explain diagnostic lumbar puncture and promote best practice	2015	European Journal of Neurology	Abstract
Urowitz, S.; Wiljer, D.; Dupak, K.; Kuehner, Z.; Leonard, K.; Lovrics, E.; et al.	Improving diabetes management with a patient portal: a qualitative study of diabetes self-management portal	2012	Journal of medical Internet research	Wrong intervention
van der Eijk, M.; Faber, M. J.; Aarts, J. W.; Kremer, J. A.; Munneke, M.; Bloem, B. R.	Using online health communities to deliver patient-centered care to people with chronic conditions	2013	J Med Internet Res	Wrong study design
van der Weegen, S.; Verwey, R.; Spreeuwenberg, M.; Tange, H.; van der Weijden, T.; de Witte, L.	The development of a mobile monitoring and feedback tool to stimulate physical activity of people with a chronic disease in primary care: a user-centered design	2013	JMIR Mhealth Uhealth	Wrong intervention
Vargas-Lombardo, M.; Jipsion, A.; Alvarez, H.; Ruiz, E. M.; Mora, E. V.	Scope of information communications technology in the health of diabetes patients in poor rural zones of panama through holistic, interactive, and persuasive model to facilitate self-care of diabetes patients	2010	Diabetes Technol Ther	Wrong study design
Verdonck-De Leeuw, I.; Cnossen, I. C.; Van Uden-Kraan, C. F.; Eerenstein, S. E.; De Bree, R.; Leemans, C. R.	Development of a self-management portal for patients after total laryngectomy	2013	Supportive Care in Cancer	Abstract
Verwey, R; van der Weegen, S; Tange, H; Spreeuwenberg, M; van der Weijden, T; de	Get moving: the practice nurse is watching you! A case study of the user-centred design process and testing of a web-based coaching system to stimulate	2012	Informatics in Primary Care	Wrong intervention

Witte, L	the physical activity of chronically ill patients in primary care			
Voncken-Brewster, V.; Tange, H.; Moser, A.; Nagykaldi, Z.; de Vries, H.; van der Weijden, T.	Integrating a tailored e-health self-management application for chronic obstructive pulmonary disease patients into primary care: a pilot study	2014	BMC Fam Pract	Wrong intervention
Weitzman, E. R.; Kelemen, S.; Garvey, K. C.	Social networking for care improvement and panel management	2013	Diabetes	Abstract
Whitehouse, S. R.; Lam, P. Y.; Balka, E.; McLellan, S.; Deevska, M.; Penn, D.; et al.	Co-Creation With TickiT: Designing and Evaluating a Clinical eHealth Platform for Youth	2013	JMIR Res Protoc	Wrong intervention
Wiecha, J. M.; Adams, W. G.	BostonBreathes: an RCT to improve pediatric asthma care with a home-based interactive website for patient education, monitoring, and clinical teamwork	2007	AMIA Annu Symp Proc	Abstract
Wildevuur, S. E.; Simonse, L. W.	Information and communication technology-enabled person-centered care for the "big five" chronic conditions: scoping review	2015	J Med Internet Res	Wrong study design
Woodbury, M.G; Botros, M; Kuhnke, JL.; Greene, J	Evaluation of a peer-led self-management education programme PEP Talk: Diabetes, Healthy Feet and You	2013	International Wound Journal	Wrong population
Wuerstlein, R.; Kirkovits, T.; Drewes, C.; Schiltz, D.; Bauerfeind, I.; Haidinger, R.; et al.	eHealth in modern breast cancer treatment: New possibilities in communication between patients, doctors and nursing staff	2015	Cancer Research. Conference: 37th Annual CTRC AACR San Antonio Breast Cancer Symposium San Antonio, TX United States.	Abstract
Wurstlein, R.; Kirkovits, T.; Drewes, C.; Bauerfeind, I.; Goldmann-Posch, U.; Schiltz, D.; et al.	eHealth in modern patient-caregiver-communication: Use of modern media in breast cancer patients and their physicians	2014	Oncology Research and Treatment	Abstract

Appendix 4.3 Methodological quality of included studies

RCTs	
Wiecha J (2015)	
Strengths	**Limitations**
The study addressed an appropriate and clearly focused question The assignment of subjects to treatment groups was randomized Investigators were blinded to participants intervention groups during the study period	While the study was randomized, there was no mention of how this was performed There was no mention of how randomization was concealed The study was not designed to blind participants to intervention group Unclear whether intervention and control groups were similar at the start of the study as no details were provided for the health professional sample Unclear whether the tool used to assess the health professional population was validated Unclear whether health professionals dropped out before the completion of study The study was carried out at a single site
Cohort Studies	
Anhøj J (2004)	
Strengths	**Limitations**
The study addressed an appropriate and clearly focused question The study indicated how many of the people asked to take part did so The outcomes were clearly defined The method of assessment of exposure is reliable as a some questions were stratified by level of experience with LinkMedica	The study had a low response rate (26.8%) Some questions were only provided to participants who indicated they had ample experience in using LinkMedica It was unclear what the primary outcome of this study was The tool used to measured subjects was not validated Only one survey was sent out at one time point (no follow-up assessment) No subgroup analyses were performed No statistical analyses were performed
Gupta S (2011) and Gupta (2012)	
Strengths	**Limitations**
The study addressed an appropriate and clearly focused question The study had a high response rate (83%) The study indicated how many of the people asked to take part did so The outcomes were clearly defined Subgroup analyses by profession were assessed The method of assessment was reliable with a validated tool (SUS) Confounding was considered through considering differences by profession and conducting focus groups to address barriers to using the Wiki tool	The study had a low response rate (26.8%) Some questions were only provided to participants who indicated they had ample experience in using the discussion forum It was unclear what the primary outcome of this study was The tool used to measured subjects was not validated Only one survey was sent out at one time point (no follow-up assessment) Only descriptive analyses were performed
Qualitative Studies	

Anttila M (2008)	
Strengths	**Limitations**
There was a clear statement of the aims of the research The qualitative methodology was appropriate the recruitment strategy appropriate to the aims of the research (multi-centre sites) the data was collected in a way that addressed the research issue with introductory sessions and open ended survey Ethical issues were taken into consideration The data analysis sufficiently rigorous as data went through several coding processes There was clear statement of findings	Unclear why the investigators decided to use surveys rather than focus group or interviews Unclear whether the relationship between researcher and participants was adequately considered as the researcher selected a research contact from each ward to disseminate material and surveys Unclear whether data analysis was done by one assessor or multiple
Nordfeldt S (2012)	
Strengths	**Limitations**
There was a clear statement of the aims of the research The qualitative methodology was appropriate the data was collected in a way that addressed the research issue as two reviewers assessed and categorized the essays The data analysis sufficiently rigorous as multiple researchers, summarized into tentative themes, discrepancies resolved through discussion There was clear statement of findings	Unclear why the investigators decided to use surveys to have participants respond to two open ended questions rather than focus group or interviews Unclear whether the recruitment strategy was appropriate to the aims of the research as no details were provided Unclear whether the relationship between researcher and participants was adequately considered Unclear whether ethical issues were taken into consideration as there was no mention of consent or ethics approval
Nordqvist C (2009)	
Strengths	**Limitations**
There was a clear statement of the aims of the research The qualitative methodology was appropriate The data was collected in a way that addressed the research issue as the investigators used interviews The data collected in a way that addressed the research issue as interview was conducted by an experienced sociologist The interviewer did not start studying the use of information technology in patient care until the analysis had been complete Interviews were coded into themes There was clear statement of findings	Unclear how participants were recruited Unclear whether ethics approval was sought, or if interviewees gave verbal consent Data were coded by one reviewer
Oh H (2011)	
Strengths	**Limitations**
There was a clear statement of the aims of the research There was clear statement of findings	Unclear whether qualitative methodology was appropriate Unclear why investigator used structured interviews with mostly close-ended question rather than focus groups or open interviews Recruitment strategy was not described for health professional participants

	Limited information was provided on how data was collected, though it did state a structured interview was used There was no mention of the relationship of researcher and participants No mention of whether informed consent was obtained, ethics approval sought Limited details on analysis and whether any coding was performed

Appendix 4.4 Summary of participant baseline characteristics in included studies

Author (year)	Participant Characteristics*	
Anhøj J (2004)	**Physician, n (%)**	**127 (97%)**
	Nurse, n (%)	**4 (3%)**
	Male, n (%)	**4 (80%)**
	Female, n (%)	**1 (20%)**
	Age, mean (SD)	**51 (6.63)**
Anttila M (2008)	**Registered Nurses, (%)**	**56%**
	Practical Nurses, (%)	**41%**
	Female, (%)	**58%**
	Male, (%)	**42%**
	Age, range (mean)	**26 to 64 years (41 years)**
Gupta S (2011) and Gupta (2012)	**Asthma educators, n (%)**	**5 (25%)**
	Physician, n (%)	**6 (30%)**
	Pulmonologists, n (%)	**9 (45%)**
	Male, n (%)	**11 (61)**
	Age, n (%)	

	<30 years	**0**
	30–39 years	**4 (22%)**
	40–49 years	**10 (56%)**
	50–59 years	**4 (22%)**
	≥60 years	**0**
	Average number of years in practice (SD)	**16 (8%)**
	Practice location	
	Suburban, n (%)	**1 (6%)**
	Urban, n (%)	**16 (89%)**
	Mixed, n (%)	**1 (6%)**
	Practice type	
	Group, n (%)	**14 (78%)**
	Solo, n (%)	**4 (22%)**
	Practice setting	
	Academic, n (%)	**11 (61%)**
	Community, n (%)	**7 (39%)**
	Average number of patients with asthma seen each month (SD)	**52 (30%)**

	Prior experience preparing an AAP, n (%)	**16 (89%)**
Nordfeldt S (2012)	**Not reported**	
Nordqvist C (2009)	**Physician, n (%)**	**7 (35%)**
	Nurse specialists in diabetes, n (%)	**8 (40%)**
	Nurse, n (%)**	**1 (5%)**
	Dieticians, n (%)	**2 (10%)**
	Social welfare officers, n (%)	**2 (%)**
Oh H (2011)	**Physician, n (%)**	**4 (20%)**
	Outpatient nurse, n (%)	**1 (5%)**
	Inpatient nurse, n (%)	**20 (80%)**
Wiecha J (2015)	**Physician, n (%)**	**13 (93%)**
	Nurse practitioner, n (%)	**1 (7%)**
	Female,%	**61%**
	Located in urban practice area,%	**95%**
	Age, mean, n (%)	**45 years**

Appendix 4.5 Summary of findings of included studies

Author (year)	Outcome (Theoretical Model)	Analysis	Findings	Authors' Conclusions
Anhøj J (2004)	Perceived Usefulness (TAM2)	Descriptive and Qualitative	*Do you think that there is a need for Internet tools like LinkMedica in medical practice?* Yes: 96 (73%) No: 35 (27%) Total: 131 (100%)	"The self-selected survey responses and in-depth interviews indicated that LinkMedica is generally considered a trustworthy and reliable site by both patients and doctors. However, there was a contrast between users' positive perception of LinkMedica and their unwillingness to use the site for more than short periods. The primary reason for this was that LinkMedica did not fit into their everyday lives because of technical and psychological aspects. A number of recommendations to improve LinkMedica are suggested." (p.1)
			Do you ever use LinkMedica in collaboration with your patients? I have looked at it-but did not find it useful: 4 (3%) No-but I would like to try: 29 (22%) Total: 130 (99%)	
			Interviews (n=5) "GPs themselves are not confident PCusers, they find it very difficult to instruct the patients in the system" (p. 10)	

			"Patients benefit from using LinkMedica. The system helps patients understand their disease, improves compliance, and reduces symptoms. Furthermore, LinkMedica stresses the patient's own responsibility for his other disease" (p. 10) "GPs themselves, however , found that using LinkMedica was difficult" (p. 10) "GPs have a positive attitude towards the system, their use of it is influenced by external factors such as time and economy" (p. 10) "It needs to be adapted to the conditions of the users, so it becomes a natural and integrated part of their everyday lives" (p. 13)	
Anttila M (2008)	Perceived Usefulness (TAM2)	Qualitative	"Nurses experienced the IT portal as a broad information source for patients" (p. 150) "The IT education was a self-help aid for patients" (p. 150) "The IT education was useful to patients when their mental state was good" (p. 150)	"Systematic patient education using information technology is a promising method of patient-centred care which supports nurses in their daily work. However, it must fit in with clinical activities, and nurses need some guidance in understanding its benefits. The study data can be used in policymaking when developing methods to improve the transparency of information provision in psychiatric nursing." (p.147)

			"Nurses experienced the portal as supporting patients' self-management abilities because it enabled autonomous access to information and could be used independently outside the education sessions" (p. 150) "IT education was a motivating method because of the interesting experiences gained in the course of using it" (p. 151) "The portal was a supportive, fast and thorough information source which was pleasant for nurses to use" (p. 151)
	Perceived Ease of Use (TAM2)	Qualitative	"Absence of IT skills was an obstacle in patients' use of the portal as it required technology skills" (p. 152) "Due to the long home-page address of the portal for research purposes, it was difficult for patients to get into the portal itself" (p. 152) "Nurses did not feel comfortable with IT and saw it as difficult" (p. 152)
	Environmental context and resources (TDF)	Qualitative	"Inadequate resource as it took too much time away from their basic work" (p. 152) "Nurses did not feel comfortable with IT and saw it as difficult" (p. 153)

			"No space for it as there was not always a quiet room available containing a computer and Internet connection" (p. 152)	
	Intention to use (TAM2)	Qualitative	"Some nurses did not want to educate patients via IT or they did not have any experience in it, while some had no opinion about it or had only slight experience of it through the research training" (p. 152) "Because of the lack of practice, it had no chance of becoming routine" (p. 152)	
Gupta S (2011) and Gupta (2012)	Perceived Usability (TAM2)	Descriptive	Development stage: the mean SUS (range from 0 to 100) was 72.2 (SD 10.2) 75.0 (SD 8.16) for pulmonologists; 76.2 (SD 11.1) for PCPs; 66.7 (SD 5.77) for CAEs; 70.0 (SD 13.5) for patients Wiki stage: (overall) mean SUS score was 75.9 (SD 19.6)	"We have developed an AAP through a rigorous methodology that included all relevant stakeholders and considered user preferences, the best evidence and expert opinion not only for content, but also for appearance and usability. Our systematic development process and results would favor this AAP over most existing AAPs for clinical implementation." (p.414)(68)
	Perceived Usefulness (TAM2)	Descriptive	*The chat room feature was useful to communicate with other participants* Disagree: 10% Neutral: 17% Agree: 73%	

		I found it useful to have a "comments" field under each selection Disagree: 6% Neutral: 19% Agree: 75%
		I am satisfied with the overall asthma action plan that was created Disagree: 9% Neutral: 11% Agree: 80%
		The wiki tool was an effective way to design an asthma action plan Disagree: 11% Neutral: 11% Agree: 77%
Perceived Ease of Use (TAM2)	Descriptive	*I was able to make the format/visual changes that I wanted to* Disagree: 15% Neutral: 12% Agree: 74%

		I found the logon process easy Disagree: 11% Neutral: 6% Agree: 83%
		The tool webpage loaded and updated too slowly Disagree: 77% Neutral: 14% Agree: 9%
		I would be able to use the asthmas actin plan that was created Disagree: 6% Neutral: 3% Agree: 91%
Environmental context and resources (TDF)	Descriptive	*If my schedule permitted I would have used the site more often* Disagree: 20% Neutral: 31% Agree: 49%
Intention to Use (TAM2)		*I would be willing to use a wiki tool to design visual media in the future*

			Disagree: 11% Neutral: 3% Agree: 86%	
	Knowledge (TDF)		*The chat room feature allowed me to understand the preferences of other participants* Disagree: 13% Neutral: 20% Agree: 67%	
	Social influences (TDF)		*There were certain participants whose opinions were more influential than others* Disagree: 37% Neutral: 37% Agree: 26%	
	Beliefs about capabilities (TDF)		*I was able to make more changes and suggestions through this web-based process than I would have been able to in a face-to-face group discussion* Disagree: 29% Neutral: 34% Agree: 37%	
Nordfeldt S	Perceived Usefulness	Qualitative	“Respondents thought that it mostly functioned well. Users considered the design easy to understand. Practitioners found it	“Practitioners expressed positive perceptions toward a tailored open Web portal. They suggested

(2012)	(TAM2)		to be a manageable tool when seeking information. The information was easily accessible to everyone: wherever there was a computer, the information was close by" (p. 7)	that future benefits could be derived from systems that integrate factual information and online dialogues between practitioners and patients (ie, exchanging information for everyone's benefit)." (p.1)
	Environmental context and resources (TDF)		"Problems that respondents perceived when using the website comprised a range of factors, such as technical problems, lack of time, inadequate computer experience, a lack of commitment, a lack of computer access, and disorganized information" (p. 7)	
	Output Quality (TAM 2)		"Viewed the Web portal as a source of scientifically sound information and advice that is available to several categories of professionals, as well as patients and their significant others" (p. 7)	
	Perceived Ease of Use (TAM2)		"Easy access to the website made it useful for everyone, including new staff, students, school and preschool staff, primary-care and other hospital staff" (p. 7)	
	Intention to Use (TAM2)		"Practitioners felt safe in recommending the website because they knew that the information was produced by, and the practitioners were part of, a multi-professional community" (p. 7)	
Nordqvist C (2009)	Beliefs about consequences (TDF)	Qualitative	"Clinicians were confident that the portal's use in diabetes care would extend beyond the clinics, in addition to being a part of the internal routine of the clinics" (p. 4)	"Experienced clinical practitioners working in diabetes teams exhibited positive attitudes towards a Web 2.0 portal tailored for young patients with type 1 diabetes and their parents. The portal included provision of third-party information, as well as practical and social means of support. The practitioners' early and active participation provides a possible explanation for these positive attitudes. The findings encourage close collaboration with all user groups when implementing Web 2.0 systems for the care of young patients with chronic diseases,

				particularly type 1 diabetes. The study also highlights the need for efforts to educate clinical practitioners in the use of Web publishing, social networking, and other Web 2.0 resources. Investigations of attitudes towards implementing similar systems in the care of adults with chronic diseases are warranted." (p.1)
	Perceived Usefulness (TAM2)		"It facilitated closer interaction between diabetes teams and families" (p. 5) "Newly updated diabetes information would be available to families at any time" (p. 5)	
	Social/professional role and identity (TDF)		"Several interviewees also pointed out that it was unclear whether current legislation permitted email contact with patients, while others were uncertain about this but expected email communication to be safe" (p. 5)	
	Job Relevance (TAM2)		"Several interviewees expressed that a locally shared source of reliable information, such as references to verified websites, would be a great support to their work with patients, assuming that it was regularly updated" (p. 5)	
	Environmental context and resources (TDF)		"Lack of time and how to deal with this problem was an issue often raised during the interviews. Several interviewees expected the portal to save time in the execution of some routine tasks and when providing general information" (p. 6)	
Oh H (2011)	Perceived Usefulness (TAM2)	Qualitative	"Regarding causes, symptoms, diagnosis, treatments, and prognosis of gout, 80%–88% of the experts indicated that such information was useful to understand gout" (p. 338)	"Program contents and ease of site navigation (http://goutin.kr) were found to be appropriate and satisfactory to both patient and expert groups" (p.333)

			"Regarding self-management techniques, 84% of the gout experts indicated satisfaction" (p. 338) "88% of the experts responded that the website was useful in the understanding of patients' gout-related experiences" (p. 338) "44% of the experts opined that the website aroused their interest" (p. 338) "Further information on diet and gout progress/medications was suggested by 60% of experts" (p. 338)	
	Perceived Ease of Use (TAM2)		"Results of evaluation of ease of site navigation and content access showed that experts were highly satisfied" (p. 340)	
	Intention to Use (TAM2)		"All subjects indicated a willingness to use the website frequently" (p. 338)	
Wiecha J (2015)	Perceived Usefulness (TAM2)	Descriptive	*The discussion board was an effective way to communicate with my patient (s)*: Mean score of 5.6 *The feedback from Asthma Specialist posted to the discussion board was useful in helping me to manage my asthma patient(s)*: Mean score of 6.3 All answers rated on Likert scale 0-10 (0=Strongly Disagree to	"Multidimensional web-based educational, monitoring, and communication platform may have positive influences on pediatric patients' asthma-related knowledge and use of asthma preventer medications" (p.1)

10=Strongly Agree), SD not reported

Chapter 5 Appendices

The following appendices are reproduced from: De Angelis G, Davies B, King J, Wells GA, Brosseau L. The use of social media by arthritis health professionals to disseminate a self-management program to patients: A feasibility study. Digital Health 2017;3

Appendix 5.1 Tailored TAM2 Questionnaire

Domain	1	2	3	4	5	6	7
Item #	Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree
Intention to Use							
1	Assuming I have access to the Facebook group page, I intend to use it with patients						
2	Given that I have access to the Facebook group page, I predict that I would use it with patients						
Perceived Usefulness							
3	Using the Facebook group page may improve my performance in my job						
4	Using the Facebook group page in my job may increase my productivity						
5	Using the Facebook group page may enhance my effectiveness in my job						
6	I find the Facebook group page may be useful in my job						
Perceived Ease of Use							
7	My interaction with the Facebook group page is clear and understandable						
8	Interacting with the Facebook group page does not require a lot of my mental effort						
9	I find the Facebook group page easy to use with patients						
10	I find it easy to get to the Facebook group page to do what I want it to do						
Subjective Norm							
11	People who influence my behaviour think that I should use the Facebook group page with patients						
12	People who are important to me think that I should use the Facebook group page with patients						
13	My use of the Facebook group page with patients is voluntary						

14	My supervisor does not require me to use the Facebook group page with patients
15	Although it might be helpful, using the Facebook group page with patients is certainly not compulsory in my job
Image	
16	People in my organization who use the Facebook group page with patients have more prestige than those who do not
Job Relevance	
17	In my job, usage of the Facebook group page with patients is important
18	In my job, usage of the Facebook group page with patients is relevant
Output Quality	
19	The quality of the output I get from the Facebook group page is high
20	I have no problem with the quality of the Facebook group page output
Result Demonstrability	
21	I have no difficulty telling others about the results of using the Facebook group page with patients
22	I believe I could communicate to others the consequences of using the Facebook group page with patients
23	The results of using the Facebook group page with patients are apparent to me
24	I would have no difficulty explaining why using the Facebook group page with patients may or may not be beneficial

Source : adapted from Venkatesh V. Davis F.D. (2000). A Theoretical Extension of the Technology Acceptance Model: Four longitudinal Field Studies. Management Science; 46 (2): 186-204.

Appendix 5.2 Tailored TDF Questionnaire

	1	2	3	4	5
Item #	**Strongly Disagree**	**Disagree**	**Neutral (neither disagree or agree)**	**Agree**	**Strongly Agree**
Knowledge					
1	I am aware of the content and objectives of the Facebook group page				
2	I know the content and objectives of the Facebook group page				
3	I am familiar with the content and objectives of the Facebook group page				
4	I am aware of how to use the Facebook group page to disseminate PGrip with patients				
Skills					
5	I have the skills to use the Facebook group page to disseminate PGrip with patients				
6	I have practiced using the Facebook group page to disseminate PGrip with patients				
Social/professional role and identity					
7	Using the Facebook group page to disseminate PGrip with patients is part of my work as an arthritis health professional				
8	As an arthritis health professional, it is my job to use the Facebook group page to disseminate PGrip with patients				
9	It is my responsibility as an arthritis health professional to use the Facebook group to disseminate PGrip with patients				
10	Using the Facebook group page to disseminate PGrip with patients is consistent with my job as a health professional				
Optimism					
11	I am confident that I can use the Facebook group page to disseminate PGrip with patients even when there is little time				
12	I am confident that if I wanted I could use the Facebook group page to disseminate PGrip with patients				
13	With regard to using the Facebook page to disseminate PGrip with patients in uncertain times, I usually expect the best				
14	With regard to using the Facebook group page to disseminate PGrip with patients I'm always optimistic about the future				

Beliefs about consequences	
15	If I use the Facebook page to disseminate PGrip with patients, it will benefit public health
16	If I use the Facebook group page to disseminate PGrip with patients, it will not have disadvantages for my relationship with them
Intentions	
17[a]	For how many of the next 10 patients do you intend to use the Facebook group page to disseminate PGrip?
18	I will definitely use the Facebook group page to disseminate PGrip with patients
19	I intend to use the Facebook group page to disseminate PGrip with patients
20[b]	How strong is your intention to use the Facebook group page to disseminate PGrip with patients?
Memory/attention /decision	
21[c]	How often do you forget to use the Facebook group page to disseminate PGrip with patients?
22	When I need to concentrate to use the Facebook group page to disseminate PGrip with patients, I have no trouble focusing my attention
23	When trying to focus my attention on using the Facebook group page to disseminate PGrip with patients, I have no difficulty blocking out distracting thoughts
24	When concentrating on using the Facebook group page to disseminate PGrip with patients, I can focus my attention so that I become unaware of what's going on around me
Environmental context and resources	
25	Within the socio-political context (clinical unit) there is sufficient financial support (e.g., from local authorities, insurance companies) for using the Facebook group page to disseminate PGrip with patients
26	Within the socio-political context (clinical unit) there are good networks between parties involved in using the Facebook group page to disseminate PGrip with patients
Social influences	
27	Most people who are important to me think that I should use the Facebook group page to disseminate PGrip with patients

28	Most people whose opinion I value would approve me of using the Facebook group page to disseminate PGrip with patients

Source: Huijg JM, Gebhardt W a, Crone MR, Dusseldorp E, Presseau J. Discriminant content validity of a theoretical domains framework questionnaire for use in implementation research. *Implement Sci*. 2014;9:11. doi:10.1186/1748-5908-9-11.

[a] none = 1; one patient = 2; two patients =3; three patients= 4; >4 patients = 5
[b] very weak =1; weak = 2; neutral = 3; strong = 4; very strong = 5
[c] never = 1; almost never = 2; occasionally = 3; almost always = 4; always =5

Chapter 6 Appendices

Appendix 6.1 Tailored Technology Acceptance Model 2 (TAM2) questionnaire

Domain	1	2	3	4	5	6	7
Item #	Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral (neither disagree or agree)	Somewhat Agree	Moderately Agree	Strongly Agree
Intention to Use							
1	Assuming I have access to the (ICT intervention) group page, I intend to use it with patients						
2	Given that I have access to the (ICT intervention) group page, I predict that I would use it with patients						
Perceived Usefulness							
3	Using the (ICT intervention) may improve my performance in my job						
4	Using the (ICT intervention) in my job may increase my productivity						
5	Using the (ICT intervention) may enhance my effectiveness in my job						
6	I find the (ICT intervention) may be useful in my job						
Perceived Ease of Use							
7	My interaction with the (ICT intervention) is clear and understandable						
8	Interacting with the (ICT intervention) does not require a lot of my mental effort						
9	I find the (ICT intervention) easy to use with patients						
10	I find it easy to get to the (ICT intervention) to do what I want it to do						
Subjective Norm							
11	People who influence my behaviour think that I should use the (ICT intervention) with patients						

12	People who are important to me think that I should use the (ICT intervention) with patients
13	My use of the (ICT intervention) with patients is voluntary
14	My supervisor does not require me to use the (ICT intervention) with patients
15	Although it might be helpful, using the (ICT intervention) with patients is certainly not compulsory in my job
Image	
16	People in my organization who use the (ICT intervention) with patients have more prestige than those who do not
Job Relevance	
17	In my job, usage of the (ICT intervention) with patients is important
18	In my job, usage of the (ICT intervention) with patients is relevant
Output Quality	
19	The quality of the output I get from the (ICT intervention) is high
20	I have no problem with the quality of the (ICT intervention) output
Result Demonstrability	
21	I have no difficulty telling others about the results of using the (ICT intervention) with patients
22	I believe I could communicate to others the consequences of using the (ICT intervention) with patients
23	The results of using the (ICT intervention) with patients are apparent to me
24	I would have no difficulty explaining why using the (ICT intervention) with patients may or may not be beneficial

Source: adapted from Venkatesh V. Davis F.D. (2000). A Theoretical Extension of the Technology Acceptance Model: Four longitudinal Field Studies. Management Science; 46 (2): 186-204.