



## Translating research into practice through user-centered design: An application for osteoarthritis healthcare planning



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### ABSTRACT

**Objective:** To identify the needs and requirements of the end users, to inform the development of a user-interface to translate an existing evidence-based decision support tool into a practical and usable interface for health service planning for osteoarthritis (OA) care.

**Materials and Methods:** We used a user-centered design (UCD) approach that emphasized the role of the end-users and is well-suited to knowledge translation (KT). The first phase used a needs assessment focus group (n = 8) and interviews (n = 5) with target users (health care planners) within a provincial health care organization. The second phase used a participatory design approach, with two small group sessions (n = 6) to explore workflow, thought processes, and needs of intended users.

**Results:** The needs assessment identified five design recommendations: ensuring the user-interface supports the target user group, allowing for user-directed data explorations, input parameter flexibility, clear presentation, and provision of relevant definitions. The second phase identified workflow insights from a proposed scenario. Graphs, the need for a visual overview of the data, and interactivity were key considerations to aid in meaningful use of the model and knowledge translation.

**Conclusion:** A UCD approach is well suited to identify health care planners' requirements when using a decision support tool to improve health service planning and management of OA. We believe this is one of the first applications to be used in planning for health service delivery. We identified specific design recommendations that will increase user acceptability and uptake of the user-interface and underlying decision support tool in practice. Our approach demonstrated how UCD can be used to enable knowledge translation.

### 1. Introduction

Osteoarthritis is a chronic condition that affects 4.6 million Canadians and costs the Canadian health care system billions of dollars in medical bills and lost wages each year [1,2]. Affecting 1 in 4 Canadians by 2040, this financial burden is expected to increase substantially as the population ages and obesity rates increase [3]. Long-term strategies for effective and efficient health care delivery are critical for planning sustainable services, particularly for chronic conditions like OA. However, such strategies are currently difficult to identify and prioritize.

There is a lack of decision support tools capable of concurrently revealing the effects of care process changes and population dynamics on patient outcomes, system performance, resource requirements, and the costs of care in the long-term. Without such tools, it is difficult to

anticipate the consequences of healthcare planning decisions; yet long-term planning is vital to ensure the health care system is equipped to meet the needs of future patients [4]. To address this, the project team previously developed an evidence-based simulation model to support resource planning and policy development relating to osteoarthritis health care delivery, funded by the Canadian Institute for Health Research (CIHR) operating grant [Grant #: 126128] [5]. The long-term, population-level simulation uses system dynamics to model osteoarthritis patients as they transition through the continuum of care from disease onset through end-stage care, and provides insight into the size and characteristics of the patient population, their resource requirements and associated health care costs. Estimating how many patients will require care, the nature of the care they require, and when and where they will require it, is critical when planning resources for a sustainable health care system. The model simulates the movement of

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patients through the system as they use different system resources, allowing target users (e.g., health care planners) to explore the potential effects of different planning scenarios on system performance. The aim of this study was to provide end-user input to inform the future development of a user-interface to translate an existing evidence-based decision support model into a practical and usable interface for health service planning. This paper reports on how end users (health care planners) were involved in the design process for a web-based interface tool, to facilitate the translation of the OA care decision-support model into practical use.

To maximize the effectiveness of the user-interface developed, a User-Centered Design (UCD) approach was utilised, in which target users are involved throughout the product development process [6]. This approach has successfully created effective tools that help users with their workflows and tasks. For this process, the target users are healthcare planners, and the target application domain is an evidence-based decision support tool for healthcare planners. The authors included elements of participatory design (PD), where target users, and stakeholders are invited to draw and share their own designs, co-create with software designers, or critique prototype designs in an iterative manner throughout the software design and development process [7]. Both these approaches have similarities to integrated knowledge translation (iKT), defined by the Canadian Institute for Health Research (CIHR) as “a dynamic and iterative process that includes the synthesis, dissemination and exchange of ethically sound application of knowledge, to improve the health of Canadians, provide more effective health services and products, and strengthen the health care system”. CIHR also recognize that collaborative approaches to research, such as participatory research, could also be known as iKT [8]. Creating meaningful user engagement is a cornerstone for the CIHR initiatives regarding the translation of knowledge generated from research. Knowledge translation is seen to take place in two main ways; integrated throughout the research project and ‘end of project KT’ activities, such as publication and presentations [8]. This difference is worth noting, we believe, because of the nuanced differences in user needs between a tool that supports decision making on the level of a specific workflow for specific patient treatment/diagnosis and the needs of policy planners looking to forecast and predict impact of changed policies on health care systems. In UCD, these are two very different problems with very different needs. We were unable to locate any studies that used UCD as an approach for knowledge translation and were intrigued to explore if there were similarities in their goals and concepts.

Participatory design (PD) approaches are a set of research methods through which user-centered design can be achieved. PD has been advocated as a user design approach in the development and evaluation of eHealth technologies for nearly twenty years [9–11] and yet widespread adoption of this approach remains variable. These frameworks place the user as an integral participant to the development and evaluation of the technology and avoid the “high tech-with-a-low impact” outcome [12,13]. It has been suggested that there can be wide variation in the extent of the end user involvement in health information systems; from just the design to a more integrated approach covering the planning, performance and evaluation [14].

Most examples of PD in healthcare are in specific clinical settings i.e., public health nursing [15], primary care referrals to secondary care [16–18], collaborative clinical trial protocol writing system [9], rather than health services delivery and planning. An example of PD from the UK’s National Health Service (NHS), where family practitioners and patients co-designed services together, generated significant improvements in primary care services [19]. A further example of the success of this method within the NHS was where wait times were shortened from two years to 2 weeks, by moving 24 h monitoring for electro-cardiograph, spirometry, and ambulatory blood pressure into primary care [20]. These examples focus on individual patient groups and/or practitioners but we were unable to locate any studies that have taken

a health service planning perspective.

Involving target end user groups in the design process of health care innovations such as our user-interface, through UCD, has proven successful in the creation of better decision support tools. Whilst we could find examples of its application in health, we were unable to identify any for planning healthcare delivery.

## 2. Objective

Our ultimate study objective was to develop a user-interface to enable us, as part of our knowledge translation strategy, to take our existing evidence based OA care decision-support model into a practical and usable user-interface tool for health service planning. To achieve this, the specific objective of this study was to identify the needs and requirements of the end-users, to inform the development of this user interface. The future development of the user-interface required us to: i) identify the needs and requirements of provincial healthcare planners (end-users) that should be addressed by the interface; ii) define end-users’ performance expectations that must be considered in the interface design; iii) specify functions critical to the design and usability of the interface; iv) identify and recommend specific technical requirements for the design of the interface; and, v) identify similar goals and concepts between UCD and iKT

## 3. Method and materials

### 3.1. Design

Phase one of our UCD approach was a needs assessment that informed a PD session (phase two), where participants were asked to consider a paper-based prototype of the user-interface [21]. The Conjoint Health Research Ethics Board at the University of Calgary granted ethics approval (#:REB14-1032) and all participants provided informed consent.

### 3.2. Procedures

In phase one, the needs assessment established our contextual understanding by gathering information about the end-users’ requirements and desires (e.g., their expectations about the user-interface, types of inquiries they wanted to perform, their goals regarding its use, day-to-day habits, etc.) and the organizational environment (e.g., existing or anticipated technological infrastructure) where the interface would be implemented. A focus group was chosen as the preferred data collection method as it is particularly useful to elicit discussions around a particular topic where participants can respond to the facilitator but also interact with other participants [22]. These interactions can produce new insights and ideas together, as well as a better understanding of issues [23]. It is particularly useful for developing ideas, as participants can build upon each other’s thinking and contributions [24]. A needs assessment focus group is a standard qualitative research methodology used in the early stages of software development and is one of the main data collections methods [25,26]. It is used to collect information from end-users regarding the functionality, ease of use, and barriers/catalysts to creating and implementing the interface. Typically, focus groups require between 8 to 12 participants for meaningful interaction between participants to provide sufficiently-rich data [27]. An invitation to participate in the study was sent to healthcare delivery planners and policy makers in a Canadian provincial health services’ executive team, via an email invitation. A focus group was conducted with potential users (healthcare planners and one analyst) by JB and LBL within a provincial health services’ executive team. The focus group lasted approximately an hour, and began with a round-table of introductions from the participants and the researchers, followed by a brief introduction of the topic area. Group participants (n = 8) were asked to share and discuss their thoughts around OA care planning and

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