Towards an AI-driven selfmanagement app for patients with hip and knee osteoarthritis: development of a theory-driven model as a first step

C. J. J. Kloek, E. Boonstra, C. Veenhof, F. Groen, B. Cijs, M. Klein

Purpose Osteoarthritis (OA) of the hip and knee is among the most common and rapidly increasing chronic diseases. Guidelines recommend a stepped-care strategy: starting with nonsurgical treatments including self-care, education and behavioral and rehabilitative components prior to more expensive joint-replacement. However, there is an underuse of self-care, exercises and weight management and an overuse of surgical treatments[1]. The SMART app aims to empower people throughout their entire OA journey by using self-administered data and AI-algorithms to provide just-in-time guidance in optimal selfmanagement. Guidance that can be provided by the app consist of selfcare modules on physical activity, weight management or sleep, general information on OA, information on relevant (healthcare) professionals or positive reinforcement. To determine at what time people could benefit from which type of guidance, the (potential) determinants of a worsening in pain, physical functioning and participation were determined with a systematic review[2] and a focus group with experts and interviews with patients. As a first step in the development of the AI-algorithm in the SMART app, this study aimed to develop a theory-driven model to predict at what time people might benefit from what guidance. **Method** For this developmental study, researchers with a background in the medical field and computer science worked closely together. First, (potential) determinants were screened on feasibility for self-measurement via an app or wearable and listed: age, gender, educational level, alcohol usage, pain medication usage, duration of complaints, BMI, comorbidities, tiredness, support, pain, stiffness, job satisfaction, coping, self-efficacy, anxiety and depression, kinesiophobia and physical functioning. Second, for each determinant the most appropriate measurement instrument was chosen. Third, in a 2-hour pressure cooker with 10 researchers, cut-off points for each measurement instrument were determined using available interpretations and minimal clinical important difference scores. Thereafter, the authors intensively discussed how the combination of determinants that should led to guidance in general. Lastly, based on clinical expertise, criteria were formulated to decide which type of guidance would be the most optimal guidance for which patient. All these decisions together were summarized in a rule-based model. **Results and discussion** Input from literature, patients, clinical experts and researchers resulted in theory-based model with rules that describe which patient, at what time (i.e. for what changes in which number of determinants) receives which guidance in the SMART app. Characteristics of the individual patient at baseline will be taken in account to assure that more complex patients will receive their guidance earlier than less complex people. Also, threshold scores for the main OA symptoms were determined, to assure that extreme scores directly result in guidance. Since a lot of choices in this study had to be made based on consensus instead of available theory, this study stresses the need for data-driven decision models. The theory-based model will now be integrated in the SMART-app and used in the SMART e-cOAch cohort to collect continuous data in a large group of patients (n=600) over a period of 1 year. In the next years, a data-driven model will be created based on the cohort data, compared and possibly combined with the theory-based model and, finally, evaluated in an RCT study to compare AI-supported selfmanagement with usual care in patients with hip or knee OA.

References:

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Keywords: digital health, artificial intelligence, osteoarthritis, self-management

Main affiliation and country of first author: HU University of applied sciences Utrecht, Research Group Innovation of Human Movement Care, The Netherlands

Email: corelien.kloek@hu.nl;

Acknowledgement: This research is part of the project SMART with project number KICH1.GZ03.21.005 of the research programme 'Access to care in the living environment' which is (partly) financed by the Dutch Research Council (NWO). The authors wish to thank the following SMART (Research) Consortium members for their valuable contribution: Catherine Bolman, Tim Boymans, Rik Crutzen, Britt van Dongen, Brian Doornenbal, Dorien Ginsel, Martijn Pisters, Amber Ronteltap, Mariette de Rooij.