DR. MIIA MARIKA JANSSON (Orcid ID : 0000-0001-5815-0325)

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Healthcare professionals' proposed eHealth needs in elective primary fast-track hip and knee arthroplasty journey: A qualitative interview study.

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Corresponding author: Miia Marika Jansson (female)

miia.jansson@oulu.fi

Tel: +358445925948

Postdoctoral researcher, PhD

Research Group of Medical Imaging, Physics and Technology, University of Oulu, Oulu, Finland.

Oulu University Hospital, Oulu, Finland

Postal address: Oulu Business School, P.O.Box 8000, FI-90014 University of Oulu, Finland

ORCID: 0000-0001-5815-0325

Marja Harjumaa (female)

Senior scientist, PhD

marja.harjumaa@vtt.fi

VTT Technical Research Centre of Finland, Oulu, Finland.

Postal address: VTT Technical Research Centre of Finland, P.O.Box 1100, FI-90571, Oulu, Finland

ORCID: 0000-0002-5919-5709

Ari-Pekka Puhto (male)

MD, PhD

ari-pekka.puhto@ppshp.fi

Division of Operative Care, Department of Orthopaedic and Trauma Surgery, Oulu University Hospital, Oulu, Finland

Postal address: Division of Operative Care, P.O.Box 21, FI-90029 Oulu University Hospital, Finland

ORCID: 0000-0002-5006-4876

Minna Pikkarainen (female)
Professor of Connected Health, PhD in Computer Science
Research Group of Medical Imaging, Physics and Technology, University of Oulu, Oulu, Finland
Martti Ahtisaari Institute, Oulu Business School, Oulu University, Oulu, Finland
VTT, Technical Research Centre of Finland, Oulu, Finland
minna.pikkarainen@oulu.fi
Postal address: Oulu Business School, P.O.Box 8000, FI-90014 University of Oulu, Finland
ORCID: 0000-0003-4516-6584

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informed consent was obtained from participants prior to inclusion in the study to ensure that the participation was voluntary (Declaration of Helsinki 2013).

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Abstract

Aims and objectives. This study examined the lived experience of healthcare professionals providing care for patients with total hip and knee arthroplasty. The aim of this study is to understand healthcare professionals' proposed eHealth needs in elective primary fast-track hip and knee arthroplasty journey.

Background. There is little evidence in nursing literature to indicate how to develop new eHealth services to support surgical care journeys. Evidence is particularly lacking regarding the development of eHealth solutions.

Design. This was a qualitative interview study.

Methods. Semi-structured interviews were conducted with four surgeons, two anaesthesiologists, ten nurses, and four physiotherapists in a single joint replacement centre during autumn 2018. The data were analysed using an inductive content analysis method. NVivo qualitative data analysis software was used. The COREQ checklist for qualitative studies was followed.

Results. Our research addressed the gap in evidence by focusing on the four main parts of the patient journey in the selected context. Analysis of the data revealed nine main categories for the proposed eHealth needs: eligibility criteria, referrals, meeting the Health Care Guarantee, patient flow, post-discharge care, patient counselling, communication, transparency of the journey, and receiving feedback. In addition, the requirements and further development needs for eHealth solutions were generally identified.

Conclusions. From the point of view of healthcare professionals, eHealth solutions have huge potential in supporting the elective primary fast-track hip and knee arthroplasty journey. However, it is important to acknowledge that these needs may be very different depending on the technological and organisational environment in question.

Relevance to clinical practice. More effective use of information and communication technologies is needed for organisational optimisation resulting in a streamlined pathway, better access to healthcare services, improved outcomes, and an improved patient experience. These results can be used in the development of new eHealth solutions to support surgical care journeys and patient education.

Keywords: Care Pathways, Hip Replacement, Knee Replacement, Qualitative Study

What does this paper contribute to the wider global community?

- There is global interest in developing patient-centred eHealth solutions that support surgical care journeys.
- This article provides important insight into the needs of healthcare professionals.

Introduction

Fast-track (Kehlet, 2013; Hansen, 2017) and other enhanced recovery protocols (Lombardi et al., 2016) have been implemented in surgery, resulting in a reduction in postoperative length of stay (LOS), shorter convalescence, and rapid functional recovery without increased morbidity and mortality (Winther et al., 2015; Berend, Lombardi, Berend, Adams, & Morris, 2018). These pathways constitute the four main time periods that represent the different parts of the patient journey; from preoperative surgical visit (e.g., preoperative preparation and planning for surgery) to post-discharge care (e.g., recovery and rehabilitation, follow-up during the first year) and beyond (Hansen, 2017; Berend et al., 2018).

At the same time, the number of total hip arthroplasties (THA) and total knee arthroplasties (TKA) have increased threefold, while staffing levels have remained unchanged (Specht, Kjaersgaard-Andersen, Kehlet, & Pedersen, 2015). In addition, access to healthcare services has been a critical issue, while long waiting times for core specialized healthcare services have consistently been identified as a key barrier to access to care (Pomey et al., 2013). Moreover, considerable variations in indications for surgery have been observed (Dreinhofer et al., 2006; McBride, Hardoon, Walters, Gilmour, & Raine, 2010). Meanwhile 45% of patients have had preoperative

risk factors, which may potentially lead to complications or a prolonged LOS (Hansen, Bredtoft, & Larsen, 2012).

The pressure on health budgets, reductions in hospital beds, and patient expectations have changed the nature of nursing care to being more communicative, including teaching, information-giving and motivation (Specht et al., 2015; Jakobsen, Rud, Kehlet, & Egerod, 2014). Consequently, patients need to be more involved in their own treatment and rehabilitation in order to manage the situation at home after discharge (Specht et al., 2015). There is an urgent need for focused, proactive care to improve patient satisfaction, long-term recovery and avoid unnecessary hospital days.

This study examined the lived experience of healthcare professionals providing care for patients with elective primary THA/TKA. The study is a part of a larger research and development project that aims to develop a digital patient journey solution together with patients, hospitals, technology providers and researchers. We will examine the needs of healthcare professionals and patients, and we will modify and integrate the existing solutions of technology providers to meet the needs of different user groups. This article, however, focuses solely on the proposed eHealth needs of healthcare professionals. The research question asks *what kinds of needs and suggestions do healthcare professionals themselves propose regarding future eHealth services developed for the elective primary fast-track THA/TKA journey.*

Background

eHealth is often used as an umbrella term for the use of information and communication technologies in treating patients, diagnosing disease, informing and communicating with patients or other healthcare professionals, conducting research, and supporting counselling (Eysenbach, 2001; WHO, 2005). Previous research shows that eHealth solutions can be used to detect certain conditions through sensors, for example, and, also as a delivery platform for interventions. For instance, in orthopaedics, mobile techniques have been used to assess knee flexion (Dietz, Sprando, Hanselman, Regier, & Frye, 2017; Mehta et al., 2017; Pereira, Rwakabayiza, Lécureux, & Jolles, 2017) and cup positioning (Meermans & Kats, 2013; Kurosaka et al., 2016). In addition, automated mobile-delivered interventions have been used to increase perioperative communication (Day et al., 2018), manage follow-up (Clari et al., 2015; Bitsaki, Koutras, Heep, & Koutras, 2017), and reduce the occurrence of postoperative adverse events (Krumsvik & Babic, 2017). Correspondingly, Internet-delivered behavioural

interventions have been used in telerehabilitation, especially in rural areas (Russell, Buttrum, Wootton, & Jull, 2011; Tousignant et al., 2015).

eHealth solutions can also provide educational interventions, which can be defined as 'pedagogic interventions, verbal or written, with a knowledge-based emphasis designed to convey information' (Roter et al., 1998). A review by Dekkers, Melles, Groeneveld, and De Ridder (2017) showed that in patient education in orthopaedics, web-based solutions can be time- and cost-effective alternatives to current educational interventions, measured by knowledge acquisition, patient satisfaction and patient feedback, anxiety, empowerment, self-efficacy, and health attitudes, self-management and behaviour change as well as clinical outcomes; but until now, most trials have included considerably younger, higher-educated, and Internet-savvy participants only. However, the use of smart devices and the Internet is becoming more and more common among the older population. As an example, in 2018, 89% of Finnish people aged 16 to 89 years had used the Internet and the share of users is still growing in the oldest age groups (Official Statistics of Finland, 2018).

Nevertheless, much remains unknown about the proposed eHealth needs of healthcare professionals; from the first preoperative surgical visit at the outpatient clinic until post-discharge care. Although eHealth solutions should be developed on the basis of a patient's specific needs and conditions for use, in accordance with the healthcare professionals' commitment to providing high- quality care (Skär & Söderberg, 2017), the current research still only provides limited evidence to indicate how to develop new eHealth services to support surgical care journeys. Evidence is particularly lacking regarding the needs that could, in the near future, be resolved with new information and communication technologies.

Therefore, the aim of this study is to understand healthcare professionals' proposed eHealth needs in the elective primary fast-track THA/TKA journey, from the preoperative surgical visit to post-discharge care and beyond. Here, healthcare professionals represent a prospective user group of future eHealth services. The results of this study can be used in the development of new eHealth solutions to support surgical care journeys.

Methods

Design

This was a qualitative exploratory study using semi-structured interviews with healthcare professionals.

Setting and participants

This study was conducted within a single joint replacement centre, in a 900-bed, tertiary-level, university teaching hospital in Finland, where fast-track methodology was launched in 2012. Participants were recruited from the hospital. First, the corresponding author informed healthcare professionals at a staff meeting about study availability and encouraged completion. Secondly, employees, recommended by their managers, were recruited via electronic mail and/or telephone by the corresponding author. All participants were purposively sampled healthcare professionals who care for THA and TKA patients (Patton, 1990). The inclusion criteria for participation in the study were as follows: 1) willing and able to give informed consent for participation in the study, 2) able to communicate in Finnish, 3) an employee of the hospital, 4) in one of the healthcare provider groups, and 5) provide care for lower limb joint replacement surgery patients. Information power used as a guide in determining an adequate sample size (Malterud, Siersma, & Guassora, 2016). Two participants dropped out before completing the interviews due to sudden illness.

Fast-track methodology

During the study period, a specialist assessment of the patient was performed on the same day as the preoperative surgical visits with a surgeon and patient education with a nurse. In addition, an interview was conducted with an anaesthesiologist. All patients received oral counselling in conjunction with written instructions about their surgery and preliminary home care instructions. During the hospitalization, patients were admitted and mobilised on the day of the surgery and discharged one to three days after surgery through well-defined discharge criteria (Hansen, 2017). Patients were discharged with written post-surgery home care instructions about wound care, removal of stitches, analgesia, physical activity, potential complications, and instructions for follow-up. Follow-up was conducted by a physiotherapist (if not contraindicated) at 6-8 weeks post-discharge for patients with TKA and at 8-12 weeks for patients with THA.

Data collection

The period for recruitment and data collection lasted from the 8th of November to 7th of December 2018. Prior to the interviews, the corresponding author, trained in the qualitative research method (PhD) and having working experience in the operation theatre, introduced herself (e.g., name, occupation, affiliations) and explained the purpose of the research and that the interview would be audio-recorded, transcribed, and the collected data would be pseudonymised. Participants who agreed to participate signed a consent form prior to the interview.

Participation was voluntary, and the participants could withdraw without giving a reason. Private, face-to-face interviews were carried out once in the hospital during shift hours and it was made clear to the participants that the corresponding author was not a member of the clinical staff.

The interview questions were prepared together and framed by a topic guide (based on the process mapping and literature review) that constituted the four main parts of the patient journey in the selected context (Trebble, Hansi, Hydes, Smith, & Baker, 2010). The interviews were semi-structured in nature with prompts and open-ended questions. The opening question was '*What needs have you encountered prior to, during, and post-surgery?'*. After that, more specific questions were presented, such as '*What needs have you encountered in meeting the discharge criteria within the target time?'* to understand the healthcare professionals' proposed eHealth needs in the elective primary fast-track THA/TKA journey.

The interviews lasted between 22 and 58 minutes (mean 41.2 minutes). The adequacy of the final sample size was evaluated continuously during the interviews (Malterud et al., 2016). Altogether, 20 interviews were conducted. All data were treated as confidential and transcribed immediately by a transcription service provider. Physical data was stored behind lock and key at the university and digital data was stored at the research organisations' professionally maintained servers, protected by passwords.

Data analysis

Data from the transcribed interviews were analysed using an inductive content analysis method (Elo & Kyngäs, 2008) and using NVivo software (NVivo qualitative data analysis Software; QRR International Pty Ltd., Version 12). Pseudoanonymised transcripts were used. The interviews were first audio-recorded and then transcribed verbatim, to ensure that each response was wholly and accurately recorded for the purpose of data analysis. Secondly, the answers were collected in sub-categories on the basis of the participants' descriptions using open coding. Thirdly, similar open codes were grouped together into a generic and a main category and then labelled using content-specific keywords through manual and digital tabulation independently by the corresponding author and a PhD-qualified expert in the team. Any unresolved concerns were taken to a third researcher, an expert in the field (an orthopaedic surgeon), for resolution.

Rigor

Rigor was demonstrated, ensuring credibility, dependability, conformability, and transferability (Polit & Beck, 2017). To achieve credibility, the interviews were audio-recorded and transcribed. To achieve dependability, an audit trail was set up, which included clearly stating the research design and data collection process, as well as the steps taken to analyse the data. Confirmability was ensured by receiving feedback from a PhD-qualified expert in the team who checked the early interviews to ensure that adequate information was collected and that all the transcribed interviews were checked against the recording. This expert also provided alternative perspectives and challenged any assumptions made by the corresponding researcher. In addition, transcripts were presented to participants for comment. Finally, rigor was ensured by using the participants' quotes in their original form. The sample selection and data analysis process were explained in detail and the findings were presented without any comments in order to ensure transferability (Shenton, 2004). As the material was so rich in information, two distinct reports were extracted from the data. The first analysis of the perceived problems of healthcare professionals during fast-track hip and knee arthroplasty has been sent for review. It did not include any of the needs or suggestions presented by the participants, which are analysed in this study. Reporting of the study findings adheres to the COREQ checklist (Tong, Sainsbury, & Craig, 2009) for qualitative studies (See Supplementary File 1).

Ethical considerations

This study was approved by the relevant academic centre and was reviewed by the local Ethics Committee during autumn 2018 (Decision No: 83/2018). The aim and method of the study were explained to the participants, and they were also informed by a standard written information form. In order to ensure that the participation was voluntary, written informed consent was obtained from participants prior to inclusion in the study (Declaration of Helsinki, 2013). All researchers processing the raw interview data signed a Data Processing Agreement.

Results

The majority of participants were female with a mean age of 44.6 years. The participants consist of four surgeons, two anaesthesiologists, ten nurses, and four physiotherapists. All participants work in the same joint replacement centre. Analysis of the data revealed nine main categories for the proposed eHealth needs: 1) *eligibility criteria*, 2) *referrals*, 3) *meeting the Health Care Guarantee*, 4) *patient flow*, 5) *post-discharge care*,

6) *patient counselling*, 7) *communication*, 8) *transparency of the journey*, and 9) *receiving feedback*. These are described in detail in Appendix 1. In addition, the requirements (e.g., accessible, smooth login, relevant information and questions, need to send and receive pictures and videos) and further development needs (e.g., need to include goniometry, radiological images, and sensors) for eHealth solutions were generally identified.

Proposed needs related to eligibility criteria

The participants described their needs and own ideas related to an eHealth solution that could help solve the problems they experience during the fast-track journey. First of all, they noted that if there was an eHealth solution for patients, it should be adopted in an early phase of primary care, in order to enable patients to receive information about the eligibility criteria for a specific surgery. An unhealthy lifestyle always increases the risks associated with a surgical procedure. This means that patients with chronic conditions should reach therapeutic equilibrium prior to receiving a referral. The professionals interviewed noted that eHealth solutions could provide suggestions based on HbA1c and body mass index (BMI) and provide self-care support such as monitoring blood glucose and improving the therapeutic equilibrium. The following excerpt from one of the interviews expresses these views: "*We would need a mobile solution that would automatically show the patient that their blood sugar level is too high… the solution should tell the patient that their blood sugar level must be reduced, otherwise there is an increased risk of infection at home after the surgery. The mobile solution should e.g., calculate the body mass index and blood glucose level of the patient and show a red flag if the patient has an increased risk of infection. This could guide the patient to discuss the situation with the diabetes nurse," (surgeon).*

Proposed needs related to referrals

The proposed needs regarding referrals were related to an improved selection of patients. The interviews demonstrate that referrals are incomplete and were received from multiple healthcare providers with varying referral systems and that important information is missing from the referrals. The healthcare professionals interviewed suggested that referrals should be indicated and structured with mandatory fields to be completed prior to a digital referral being sent from primary to secondary care. In relation to patient selection, there could be a (digital) risk calculator that would automatically measure the patient's risk based on HbA1c and BMI, for example, and suggest any necessary changes. The participants also suggested that the eHealth solution could

include patient-related outcome measures (PROMs) and an up-to-date checklist of the factors that influence the processing of the referral, such as the situation regarding any comorbidities (Appendix 1).

Proposed needs related to meeting the Health Care Guarantee

The participants stated that the eHealth solution could be used to monitor the referral status, including when a referral "arrived" and the referral "processing" in real time. Similarly, the eHealth solution could also collect information about the average processing and waiting times and provide the patient with this information. This would be beneficial to patients, as they want to know the referral status and waiting time and continuously contact the hospital by phone to enquire about this information. If patients were able to know the expected waiting time, it would also help them prepare for the surgery in terms of organising sick leave and home help. There is also a need for digital self-scheduling for the patient, both in terms of preoperative surgical scheduling and conducting follow-up visit after discharge. This would be beneficial, because it would reduce the need to re-schedule appointments due to patient-related reasons.

Proposed needs related to patient flow

The proposed needs regarding patient flow were related to preoperative preparation and discharge from hospital. There was also a clear need to receive additional information about the patient's overall situation through digital PROMs. The challenge with the current practice stems from the patient's status changing during the waiting time (and preoperative preparation), with information collected during the preoperative surgical visit being rendered invalid during the hospital admission prior to surgery. Thus, information should be digitally collected a few days before the surgical procedure. PROMs should include willingness for joint replacement, comorbidities, home medications, previous surgeries, physical functioning, physical performance, ability to sleep, weight (longitudinal in order to indicate trend), health behaviour, home situation, hobbies, motivation, vital signs, and laboratory results. This would bring benefits by reducing the incidence of duplicate documentation and by helping to evaluate the eligibility and planning for surgery. The healthcare professionals interviewed stated that patients could be guided to provide this information through digital reminders and a digital checklist of all the necessary information.

The eHealth solution could support preoperative preparation by providing information, checklists, reminders and diaries for self-reporting related to fasting, dental care, skin care, necessary laboratory tests, and acquired aids post-surgery. The eHealth solution could also include a monitoring function, which would relay

information relating to its use to the relevant health professionals. One interviewee said: "*We would need a checklist that includes the information about the surgery criteria, depending on the patient's individual needs, e.g., their skin is ok, no rash, no ulcer…*" *(nurse).*

In relation to patient discharge, the participants stated that there is a need to monitor the fulfilment of discharge criteria such as nausea, mobilisation, and the patient's ability to go to the bathroom. The patient would also be shown this information in a user-friendly way and supplemented by feedback, which would motivate patients to achieve the target behaviour. The eHealth solution could also be used for pain management, which is essential in order to support fast mobilisation after surgery. Moreover, the solution could monitor the intensity of pain and visualise how well it is managed, both prior and post-surgery.

Proposed needs related to discharge care

There is also a need to provide the patient with the eHealth solution for the purpose of discharge care. This could encourage patients to do physical activity and support rehabilitation by providing personalised targets, reminders for activities, and the ability to monitor patient compliance with the given instructions. As one interviewee stated: "*We would need more information about how much the patients could have done the exercises and how much they can actually do them. We would need information on how much the patients walk, do they still need or use a walking aid, how much pain they still feel, have they managed to reduce the amount of medicine that they use," (physiotherapist).*

The eHealth solution could also be used during recovery to monitor pain, sleep, and wound recovery by PROMs that affect the recovery. It could also provide additional information about the objectives of the medical treatment when the patient experiences acute and short-term pain and support safe medication withdrawal or help the patient acquire a new prescription when necessary. PROMs could be collected prior and post-surgery as well as one (1) year after the surgery. Moreover, the eHealth solution could also provide checklists for actions needed during discharge care in this phase of the journey.

Proposed needs related to patient counselling

The needs relating to patient counselling are linked to resources, implementation, and the content of counselling. The eHealth solution could support patient counselling by providing general information (see transparency of the journey), checklists, and reminders. It could also provide specific information, such as contact details, in a digital format. For instance, one interviewee noted: "*There is a need for a service that supports the patient*

during the whole care journey and helps the patient remember what is required, because we cannot look after each patient any longer," (nurse).

Moreover, a physiotherapist could give advanced instructions and encouragement through the eHealth solution. Use of multimedia, such as video instructions, would help patients understand what to do and how to do it and to encourage safe self-training. The eHealth solution could also send encouragement and reminders to promote physical activity. Because successful weight management is important for THA and TKA patients, the eHealth solution could also include gamified elements to support weight loss. In general, different kind of games could also be used to help the patient lose weight and support smoking cessation.

Proposed needs related to communication

The needs related to communication were linked to information transfer, non-real time communication methods, real-time communication methods, and a moderated discussion forum. Participants noted that patient-centred eHealth solutions cannot be limited to hospital care, as there is still a need for integration between primary and secondary care. For example, a medication list is a typical information source that must be up-to-date. In order for this to happen, the patients need to be reminded to review and update the list before the surgery and to note if any medication has been changed. The eHealth solution could, then, automatically update these changes in the hospital's medical records. Hospitals also need to provide a list of operated patients to the primary care provider, a task that is currently done via fax or phone. This could be replaced by more advanced information and communication technologies.

In the fast-track journey in question, physiotherapy is organized by the primary care provider and the patient then comes back to the hospital for a follow-up visit. There is a need to unify and develop documentation in physiotherapy in general and also to enable information transfer between organisations. This information should be provided in a structured format in order for it to be utilised effectively. From the perspective of consultations, it is important that the information would not be scattered across multiple locations and systems, but would, instead, be easily available from a single source.

Having valid contact details available in the eHealth solution would be essential to improving communication between healthcare professionals and patients. The eHealth solution could also include the option to send different kinds of messages; for example, text messages (SMS) and instant messaging (IM) with and without multimedia material such as image and/or video files. In its present form, the eHealth solution could include non-real time chat, which would not require healthcare professionals to respond immediately, because

the resources for this kind of service have not been allocated. Patients should be provided with an estimate of the average response time. Although a need to improve the communication was recognised, it was proposed that chat should only be available for selected patients who need additional information or, alternatively, some kind of software robots (bots) could be used as a support tool. These would reduce the resources required to answer patients' questions. If additional communication methods were included, the bots could provide ready-made response options for the most-frequently asked questions and also pre-prepared phrases relating to surgery and recovery.

Some needs related to real-time communication were noted, including situations in which it would bring additional value. There is a need to evaluate the physical performance of the patient and check urgent health issues such as flu and skin health prior to surgery. Post-surgery, there is a need to check swelling and wound recovery. In these situations, a remote visit could replace the follow-up visit in the outpatient clinic and the same technology could be also used for telerehabilitation purposes. Participants expected that the additional benefit would be privacy and the ease of communication when compared to a phone call. Additionally, there would not be a need to queue or travel a long distance to the hospital.

Participants suggested that there is a need for a voluntary, moderated, closed or open discussion forum, which patients could join using their own names and in which they could receive peer support. The content of the discussion forum could be used to improve current counselling.

Proposed needs related to transparency

There were perceived needs relating to the transparency of the whole journey, which could be partly solved with more comprehensive patient counselling via the eHealth solution. These needs include minor refinements regarding health behaviour, anticoagulation dosage forms, preparation for surgery, bone bank possibilities, surgical techniques, and complications before admission. Participants stated that, during the hospital visit, the eHealth solution could include information about rehabilitation, such as exercises and activities, movement restrictions, and the use of walking aids. In addition, patients could also be better informed about the fulfilment of discharge criteria within the target time, decreased LOS, how to get a sick leave certificate, and how to prepare for post-discharge care. Before discharge, the eHealth solution could include information about wound care, the symptoms of wound infection, medication, and the removal of stitches.

In addition, the eHealth solution could provide general information about joint replacement and the fast-track journey. Participants stated that both the primary care provider and the patient should be better prepared and pre-informed about the eligibility criteria for the surgery, associated risks, and patient flow, including the frequency of follow-up and examinations needed post-surgery. Patients should be encouraged to familiarise themselves with the instructions before the pre-surgery meeting in order to be able to ask questions during the meeting. In order to improve the transparency and decrease paper-based instructions, there also is a need to monitor the fast-track journey timeline in real-time and have a checklist of the activities and their schedules. Video material describing the whole journey would also increase transparency.

Proposed needs related to receiving feedback

The healthcare professionals interviewed also noted that there is a need to receive feedback and that the eHealth solution could provide them with an opportunity to receive general, anonymised patient feedback, with suggestions for improvements, which could then be addressed/targeted in the appropriate part of the patient's journey. Surgeons, anaesthesiologists, and physiotherapists would also like to receive targeted feedback related to their work. The patient feedback questionnaires would need to be short but also include space for patients to provide free-form feedback.

Discussion

Our qualitative research addressed the gap in research by focusing on the evidence of the perceived needs of the healthcare professionals in the four main parts of the patient journey in the selected context. In this study, we revealed nine main categories of needs proposed by healthcare professionals in relation to an eHealth solution in elective primary fast-track THA/TKA. In addition, the requirements and further development needs pertaining to the eHealth solutions were also identified.

We found that eHealth solutions should be adopted at an early phase in primary care, in order to provide patients with the opportunity to receive information about the eligibility criteria of a particular surgical procedure. Unhealthy lifestyle/health behaviour always increases the risks related to surgery and patients with chronic conditions should reach therapeutic equilibrium prior to receiving a referral. However, previous research has shown that 45% of patients have had preoperative risk factors such as smoking, alcohol consumption, polypharmacy, anaemia, high BMI, and low physical activity, which may potentially lead to complications or a

prolonged LOS in hospital (Hansen et al., 2012). The existence of risk factors is not only problematic from the patient's point of view, but it also has a detrimental effect on the processes involved at hospital. Currently, however, evaluation of a patient's eligibility criteria is a manual process based on inadequate information regarding the patient's current status.

The healthcare professionals interviewed suggested that referrals should be structured and include mandatory fields to be completed prior to a referral being sent to hospital. As has been shown in the previous literature, important information is currently missing from referrals (Gulati et al., 2012). Incomplete referrals can lead to a prolonged waiting time for examination and treatment and they also impinge upon the hospital's ability to process referrals. Referrals with relevant anamnestic information and clinical findings are essential to assigning patients an appropriate caregiver at the outpatient clinic and to determining if and which diagnostic imaging findings are of clinical relevance.

In recent decades, limited access to healthcare services has been a problem in many countries (Pomey et al., 2013). In addition, considerable variations in geographic and sociodemographic factors (Judge, Welton, Sanhu, & Ben-Shlomo, 2009; Neuburger, Hutchings, Allwood, Black, & van der Meulen, 2012) and indications for surgery (Dreinhofer et al., 2006; McBride et al., 2010) have been observed. Our study found out that the eHealth solution could be used to monitor referral status in real time. Similarly, the eHealth solution could also collect information about the average processing and waiting time and then provide the patient with this information. Our study also observed a need for the patient to be able to self-schedule events prior to the surgical procedure and after discharge. In the previous literature, the main barriers hampering waiting time and waiting list management have been organisational (e.g., physician involvement, human resources capacity, and information management systems) and contextual (e.g., stakeholder engagement, strong funding) factors (Pomey et al., 2013).

The needs proposed in relation to patient flow were associated with preoperative preparation and discharge from hospital. The eHealth solution would support preoperative preparation by providing information, checklists, reminders and diaries for self-reporting of patient-related workflow tasks. Furthermore, there is a need to monitor the fulfilment of discharge criteria. In the literature, anxiety, nausea and vomiting, and issues around using the bathroom have been considered to be significant in the immediate postoperative phase (Strickland et al., 2019).

There is also a need to provide patients with the eHealth solution for the purpose of supporting discharge care. The eHealth solution could also monitor pain, wound recovery, blood glucose, and sleep during the recovery period. In the literature, pain has been the primary postoperative issue for patients, affecting the overall recovery and well-being of the patient in the early recovery period (Strickland et al., 2019). Pain can limit postoperative mobilisation and physiotherapy, lead to postoperative complications, and an increased LOS, which can, in turn, affect the patient's satisfaction and long-term recovery (Strickland et al., 2019). Moreover, patients face challenges regaining postoperative mobility and range of motion (Strickland et al., 2019).

The needs expressed in relation to patient counselling were connected to resources, implementation, and the content of counselling. The eHealth solution could support patient counselling by providing general information, checklists, and reminders. Generally speaking, patients want to know what health changes are or are not normal post-surgery (Fagermoen & Hamilton, 2006), and the content of counselling should include information on nausea, fatigue, and possible bladder or bowel problems (Susilahti, Suominen, & Leino-Kilpi, 2004). The appropriate counselling methods should be used in order to achieve the counselling goals. In the previous literature, the eHealth services used have generated cost savings and improved access to care in rural areas (Russel et al., 2011; Tousignant et al., 2015). The counselling methods previously used may, however, not be applicable for the whole orthopaedic patient population: most trials have included considerably younger, more highly-educated, and internet-savvy participants only (Dekkers et al., 2018).

The needs expressed in relation to communication were connected to information transfer, real- and non-real time communication methods, and a moderated discussion forum. There is a need to evaluate the patient's physical performance, any swelling and wound recovery, and to check for urgent health issues throughout the journey. In these situations, a remote visit could replace the follow-up visit in an outpatient clinic and the same technology could also be used for telerehabilitation purposes. In the previous literature, automated mobile messaging has been used to increase perioperative communication (Day et al., 2018) and telephone screening has been used to estimate the rate of orthopaedic surgical site infection (Reilly et al., 2005) and other postoperative adverse events (Krumsvik & Babic, 2017). As previously stated, there is a need to provide the patient with more information. An eHealth solution could provide early general information about joint replacement and the whole surgical care journey. In line with previous literature, a need for digital educational material and videos with checklists and reminders for the activities and their schedules was noted. These should, however, be implemented in connection to increasing the transparency of the journey (Hansen, 2017) and surgical eligibility criteria (e.g., optimisation of comorbidities, malnutrition and weight reduction in morbidly

obese patients, and reduction in alcohol consumption and smoking), preparation for surgery and discharge (e.g., mobilisation on the day of THA surgery, information on intended LOS, well-defined discharge criteria), and how to prepare for post-discharge care regarding rehabilitation (e.g., muscle strength, knee extension and flexion, how to use walking aids, and for how long) (Pieper et al., 2006; Heikkinen et al., 2007; Hansen, 2017; Barnes et al., 2018), and recovery (e.g., regular use of analgesic, wound care, the symptoms of wound infection, and other complications) (Burden, 2007).

The healthcare professionals interviewed also remarked that there is a need to receive feedback and that the eHealth solution could offer them the opportunity to receive general, anonymised patient feedback, with suggestions for improvement, which could then be addressed in the appropriate part of the patient journey. In line with the literature, some feedback data have been gathered but not (systematically) utilised (Kaipio et al., 2018). Such data could provide opportunities to identify and address problems and gaps in patient flow and to monitor the effects of interventions. Additionally, this would allow for the comparison of healthcare providers and the benchmarking of hospital performance (LaVela & Gallan, 2014).

Our study has several limitations. Firstly, the interviews were conducted within a single hospital: for this reason, organisational policies or aspects of organisational culture that are unique to this organisation may not reflect experiences in other environments. However, many of the themes reported and identified in the current work align with the prior literature. Secondly, the questions were not pilot-tested. Thirdly, transcripts were not returned to all participants for comment or correction. However, because the transcripts were transcribed verbatim from the recordings, they can be considered reliable sources of information pertaining to the experiences of the healthcare personnel. In addition, the results were presented for the target group and no inconsistencies were identified based on their comments and reactions to the results. Moreover, as the data was saturated, the sample size was considered to be sufficient.

Overall, it seems that needs revealed through our research are in line with Bandholm, Wainwright, and Kehlet (2018), who predict that future interventions should be based on more detailed preoperative characterisation of patients. This will lead us to the need for a new type of personalised eHealth solution that uses Artificial Intelligence and data from health records to create different paths for different patients (considering the special needs of the risk patients in both preparation and post-operational stages of the surgeries).

Conclusion

Our qualitative research addressed the gap in the existing research by focusing on the evidence of the perceived needs of the healthcare professionals in the four main parts of the patient journey in the selected context. From the perspective of the healthcare professionals, eHealth services have huge potential for supporting the elective primary THA/TKA journey. However, it is important to acknowledge that these needs may, in practice, be very different depending on the current technological and organisational environment.

Relevance to clinical practice

More effective use of information and communication technologies is needed for organisational optimisation resulting in a streamlined pathway, better access to healthcare services, improved outcomes, and an improved patient experience. These results can be used in the development of new eHealth solutions to support surgical care journeys and patient education.

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Appendix 1. Examples of proposed eHealth needs (*n* = 20).

Main category	Generic category	Subcategory	Description
Needs related to eligibility criteria	Early access to eHealth solution	Self-care support	There is a need to motivate patients to change their lifestyle (if appropriate), patients need to receive information about eligibility criteria prior to receiving a referral. The eHealth solution could include information about eligibility criteria. It could also suggest necessary changes based on HbA1c, BMI etc. measures.
Needs related to referrals	Improved referrals	Structured referral	There is a need for more comprehensive, structured referral (e.g., BMI, medical optimisation of comorbidities/any chronic medical conditions, willingness for joint replacement, relevant contact details) with mandatory fields completed prior to sending the referral to allocate patients a specialist or resident' appointment.
	Indicated referrals	Eligibility criteria	Patients should have reached therapeutic equilibrium (e.g., sleep apnoea, diabetes, anaemia, hypertension), cessation of smoking, increase muscle strength, and lose weight (if appropriate) prior to a referral being sent from a primary to a secondary care provider. The eHealth solution could include information about smoking to encourage cessation or reduce smoking. In addition, the eHealth solution could include a checkbox to be checked when the weight, teeth, comorbidities, skin etc. are ok prior to sending a referral. It could also notify when the needed changes have been made with a green light to improve scheduling.
	Selection of patients	Risk calculator	The eHealth solution could include information about risks. It could also measure a patient's risk automatically based on HbA1c, BMI etc. measures and suggest necessary changes.
		Patient related outcome measures	The eHealth solution could send questions related to willingness for joint replacement, comorbidities (e.g., memory disease, osteoporosis, pacemaker), home medications, previous surgeries, physical functioning (e.g., pain, Harris Hip Score, Oxford Hip Score), physical performance (e.g., need for Nitro-glycerine, getting winded, risk calculator, PEF value, walking distance, carrying a shopping bag), ability to sleep, health behaviour (e.g., alcohol consumption, pack-years of smoking), home situation (e.g., stairs inside/outside with or without handrail, living alone, previous experience of walking and other aids, shopping), hobbies, motivation, and vital signs (e.g., blood pressure, heart rate, height, and weight), laboratory results (e.g., blood sugar) to reduce duplicate documentation and to evaluate eligibility and to plan care. The eHealth solution could send reminder to respond and include a checkbox to be filled when questions are responded to. The eHealth solution could send a status check questionnaire a few days prior to the surgery and quality of life and VAS e-questionnaires could be used in specialist assessment. The eHealth solution could send questions related to changes in health status after specialist assessment and current health status (e.g., recent cardiac arrythmias, chest pain, prolonged cough) three days prior to surgery. The eHealth solution could re-check bone bank eligibility from hip-patients.
Needs to meet Health Care	Scheduling	Referral status	The eHealth solution could monitor referral status ("arrived", "processing", etc.) in real time to decrease numerous phone calls.

Guarantee			
		Waiting time	The eHealth solution could include information about average processing and waiting times in real time. The eHealth solution could monitor remaining waiting time to improve preparation for surgery (e.g., home help, sick leave).
		Early appointment	There is a need for direct scheduling.
	Self-scheduling	Patient self-scheduling	There is a need to implement self-scheduling prior and post-surgery to decrease re-scheduling. The eHealth solution could include information on unsuitable times for surgery from the patient's perspective. The eHealth solution could send reminders prior to appointments.
Needs in patient flow	Preparation for surgery	Patient-related workflow tasks	The eHealth solution could include a list of medication that can be taken prior to surgery, checkbox on medications taken with timing and dosing, fasting, acquired aids, dental care, blood test, and discontinuance of medications prior to surgery. The eHealth solution could send a notification relating to essentials (e.g., skin and oral health, walking aids) to patient and family 2 – 7 days prior to surgery. In addition, the eHealth solution could send a notification if anticoagulation is not discontinued three days prior to surgery. The eHealth solution could send a reminder about fasting 1 day prior to surgery. The eHealth solution could include a digital list of medication and it could remind the patient and family to check and notify staff of possible changes in medication two weeks prior to surgery to avoid duplicate documentation on the day of surgery. The eHealth solution could include the option to chat or send text messages and pictures or video clips prior to surgery, for early management of problems to avoid cancellations. The eHealth solution could include information about relevant walking aids based on the patient's real needs (rollator vs. crutches). The eHealth solution could be used to monitor compliance with instructions. The eHealth solution could include login details to see what the patient has read.
	Preparation for discharge	Discharge criteria	The eHealth solution could monitor the fulfilment of discharge criteria (e.g., nausea, mobilization, bathroom) in a user-friendly way (e.g., check-box etc. completed by patient and/or nurse) with feedback to motivate patients to act in the target timeframe. The eHealth solution could monitor the intensity and the management of pain with visualisation prior to and post-surgery. The eHealth solution could include digital instructions related to the goal of the pain management and safe withdrawal of painkillers. The eHealth solution could monitor the wound, blood sugar, and sleep affecting recovery (e.g., secretion). The eHealth solution could help the patient acquire a new prescription when necessary.
Needs in post-discharge care	Rehabilitation	Patient's compliance	The eHealth solution could monitor compliance, encourage, remind, and include tailored targets related to physical activity and rehabilitation.
	Recovery	Patient related outcome measures	The eHealth solution could include patient-related outcome measures for pain, sleep, and wound care. The eHealth solution could send PROMs prior to and post-surgery, as well as one (1) year later. The eHealth solution could make it easy to get a new prescription. The eHealth solution could include a checklist of action points needed after discharge.
Needs in patient counselling	Resources of counselling	Counselling material	The eHealth solution could include general information (see content of counselling) and contact details in a digital format with checklist if appropriate. The eHealth solution could send reminders about discontinuance and weaning off medications, taking walking aids into hospital, check for skin condition, and follow-up visit prior to and post-surgery. Moreover, physiotherapist

			could give advanced instructions and encouragement through the eHealth solution. The eHealth solution could include video clips related to anticoagulation and rehabilitation (e.g., movement restrictions, use of walking and other aids, getting out of bed, encouragement to exercise prior to and post-surgery) and could help understand what and how to do things and encouragement for self-training.
		Gamification	The eHealth solution could include elements of gamification to aid weight loss (where appropriate). Generally, different kinds of games could also be used to lose weight and quit smoking.
	Implementation of counselling	Interaction during counselling	The eHealth solution could send encouragement and reminders to promote physical activity.
	Content of counselling	Counselling before admission	The eHealth solution could include information about health behaviour (e.g., smoking, alcohol consumption), anticoagulation dosage forms (tablet or injection), preparation for surgery (e.g., undernourishment and dental and skin care), surgical technique, complications (e.g., infections, leg length discrepancy), and bone bank.
		Counselling during hospitalization	The eHealth solution could include information about rehabilitation (e.g., painless exercises and activities after joint replacement, including getting out of bed, movement restrictions, and use of walking aids, including walking with two vs. one crutch) in chronological order.
		Counselling before discharge	The eHealth solution could include information about wound care, symptoms of wound infection, medication (e.g., dosing, timing, weaning), removal of stitches. Moreover, physiotherapist could give advanced instructions and encouragement through the eHealth solution.
Needs in communication	Information transfer	Integrations	The eHealth solution could send notifications to patients to remind them to update their medication list (if appropriate) two weeks prior to surgery. If medication has been changed, the eHealth solution could automatically update the changes in the medical records. There is a need for integrations between medical records and eHealth solutions and between primary and secondary care providers. For instance, a list of operated patients needs to be sent to the primary care provider by fax or phone. There is a need to unify and develop documentation in physiotherapy. In addition, there is a need for structural documentation.
		Consultations	The eHealth solution could be used in consultations. It should include all essential information in the same place.
		Valid contact details	The eHealth solution could include valid contact details (e.g., phone number, address).
	Non-real time communication methods	Controlled chat	The eHealth solution could make it possible to send different kinds of messages (e.g., text, messenger etc.) with and without pictures, and/or videoclips. The eHealth solution could include non-real time chat, which should be moderated (private). The eHealth solution should include an estimate of the average response time. Chat should not be available for only selected patients who need additional information or mobile robots could be used to improve communication.
		Contact request	The eHealth solution could include ready-made response options for the most frequently asked questions (e.g., lack of prescription). In addition, the eHealth solution could include ready-made phrases (e.g., "*everything went according to plan in surgery*", "*normal recovery*").

	Real-time communication methods	Remote appointments	There is a need to evaluate physical performance and check general (e.g., flu symptoms) and skin health prior to surgery. In addition, there is a need to check swelling and wound post-surgery. If appropriate, a remote visit could replace the follow-up visit in the outpatient clinic and it could be used for telerehabilitation purposes (e.g., range of motion, swelling, exercise technique). A remote appointment could be more private with easier communication than phone call. No need to queue or travel.
	Controlled discussion forum	Peer support	The eHealth solution could include a voluntary, moderated, (private or public) peer-support forum accessed with a personalised user name. The content of the discussion could be used to develop current counselling.
Needs in transparency	Unawareness of the patient journey	Confusion	The eHealth solution could include general information about joint replacement and the surgical care journey. Patients and primary healthcare providers should be better prepared and pre-informed about eligibility criteria, risks, and patient flow, including the frequency of follow-up requiring examinations afterwards. Patients could define questions prior to the pre-surgical visit. Patients should be pre-informed better about the fulfilment of discharge criteria within the target timeframe, decreased length of hospital stay, sick leave certificate, and homecare (e.g., aids and equipment, homecare, meaning and duration of movement restriction after joint replacement). There is a need to monitor the journey timeline in real-time, checklist with calendar (e.g., stick removal) to decrease paper-based guidelines, and video of the whole journey (e.g., introduction to hospital facilities, preparation for surgery, including induction and anaesthesia, recovery room, daily rounds, and number of beds on the ward).
Needs in receiving feedback	Written feedback	Targeted feedback	The eHealth solution could make it possible to receive general, anonymized feedback (with suggestions for improvement), which could be addressed in the appropriate phase of the journey. Surgeons, anaesthesiologists, and physiotherapists also desire targeted feedback. Feedback questionnaires should be short (closed questions) with the option to give freeform feedback (open question). In addition, patients' need for feedback and encouragement.