Original Article

Patient Needs for an Ambulant Dislocation Alert System Following Total Hip Arthroplasty

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Abstract

Introduction: *One of the major complications in total hip arthroplasty (THA) is dislocation of the prosthesis. To prevent early dislocation, patients are instructed with movement restrictions. The first goal in this development is to obtain insight in the movement restrictions that are reported to have low levels of self-efficacy during activities of daily life. The second goal is to reveal the design needs for an ambulant hip dislocation alert system (HipDas) and the third goal is to explore its usability among patients.*
Methods: *Patient-centered experiences with THA were explored by the use of a questionnaire and a semistructured focus group. The questionnaire was administered among* n = 32 *THA patients at 1 week preoperative and at 3 and 6 weeks postoperative. The questions addressed self-efficacy, performance and effort expectancy, and usefulness and social influence. The focus group consisted of patient journeys and scenario composition. The usability of a prototype version of the HipDas system was evaluated (*n = 5*).*
Results: *Flexion of the hip >90°, bending over while sitting in a chair, and sleeping in a supine position are the restrictions that have the lowest self-efficacy. The majority of patients (>86.6%) believe that a future HipDas is useful. Focus group outcomes suggest there is a gradual decrease in the threshold for feedback. The system is preferably used in the first 6 weeks after surgery and appeared to be usable and highly clinically relevant.*
Discussion: *HipDas is considered an interesting concept that can accelerate functional recovery of patients following THA by providing support on how to properly apply postoperative movement restrictions to prevent a dislocation.*

Keywords: *behavioral health, rehabilitation, sensor technology, home health monitoring*

Introduction

In total hip arthroplasty (THA), the hip joint is replaced by a prosthetic implant. It is a high-volume surgical procedure that reduces pain and improves function and quality of life.[1] Dislocation is a frequent and costly complication of hip arthroplasty[2] and is a substantial source of patient morbidity. The majority of dislocations occur in the first three months following surgery and the incidence of dislocation varies from 0.2% to 7% after primary THA and from 10% to 25% after revision THA.[3] To minimize the risk of these early dislocations, patients are instructed to avoid hazardous movements.[4] These movements contain deep flexion and internal rotation of the hip, crossing legs, deep crouching, and raising the knee more than 90° toward the chest. One of the prognostic factors for dislocation is the efficacy of patients to comply with postoperative movement restrictions.[5] Many patients feel anxious and insecure during their daily activities without supervision because they are aware of the risk of dislocation when incorrectly applying the movement restrictions. Consequently, patients tend to avoid or postpone these activities in the unsupervised situation of their daily lives.

An ambulant dislocation alert telemedicine system (hip dislocation alert system [HipDas]) following THA can automatically warn people when approaching critical hip angles. This will provide confidence to patients and may prevent dislocations. Moreover, one could hypothesize that by means of such technological support, patients will resume their daily activities earlier, thereby increasing the effectiveness of their functional recovery after THA.

In this study, by means of a patient-centered approach, we explored designing a prototype HipDas and we evaluated its anticipated clinical relevance and usability.

The first goal in this development is to obtain insight in the movement restrictions that are reported to have low levels of self-efficacy during activities of daily life (ADL). The second goal is to reveal the design needs of HipDas and the third goal is to explore the usability of such a telemedicine system among THA patients.

Methods

Patient-centered experiences with THA were explored through a questionnaire (phase 1), a semistructured focus

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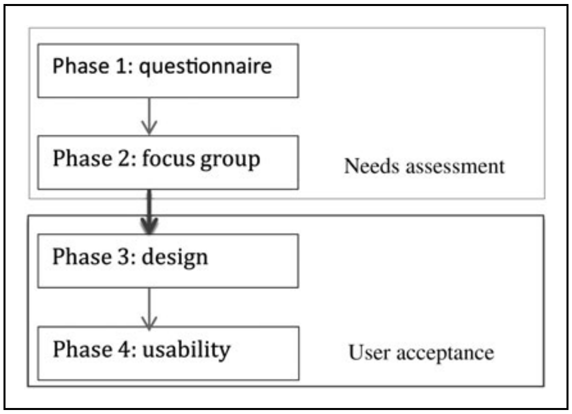

Fig. 1. Flowchart study.

group (phase 2), the design (phase 3), and a pilot usability study (phase 4) (*Fig. 1*).

All participants were recruited from the outpatient department of OCON, Centre for Orthopaedic Surgery Hengelo in The Netherlands. The researchers had access to this population. Patients received an information letter by mail at least 10 days before their consultation with the surgeon. The study was officially exempt from medical ethical assessment by the Medical Ethics Committee of the Slotervaart hospital (registered under number P1549).

The questionnaire study included 23 patients (12 female, average age: 68 ± 6.9 years) who were approached before their total hip arthroplasty. To obtain a representative sample, subjects were matched by age (age ≤70 years; age >70 years) and gender.

For the focus group, we invited three THA patients and three of their informal caregivers ($n=6$ participants). We aimed for an optimal group size of four to eight participants so they could speak freely about their treatment and care providers. Both the questionnaire study and the focus group were used to develop a general "participants' journey" regarding their self-efficacy in complying with the movement restrictions.

For the pilot usability study, patients ($n=5$) scheduled for follow-up consult with their orthopedic surgeon 6–8 weeks after THA surgery were included. They were asked to fill out a usability questionnaire after a hands-on demonstration session with a prototype HipDas. They were selected from the electronic patient file system.

PHASE 1: QUESTIONNAIRE SETUP

The questionnaire was administered at 1 week preoperative and at 3 and 6 weeks postoperative; $n=32$ THA patients were asked to fill out a questionnaire (*Fig. 2*).

The questions concerned their compliance with the movement restrictions and self-efficacy expectations of applying movement restrictions for various ADL with and without the use of HipDas. The questionnaire is designed semi-methodologically with a combination of the Attitude Social influence Self-Efficacy model and the Unified Theory of Acceptance and Use of Technology model.[6]

The first part of the questionnaire covers the understanding of the user and task requirements for which patients had to report their perceived level of self-efficacy in complying with each of the 13 movement restrictions prescribed by their surgeon and physiotherapist. The second part covers the attitude toward technological acceptance of a future HipDas, for which four key constructs were defined: (1) performance expectancy, (2) effort expectancy, (3) social influence, and (4) facilitating conditions.

PHASE 2: FOCUS GROUP SETUP

All participants provided informed consent and agreed to audio and video recording. The participants were assured that they would remain anonymous and that their decision to participate would not affect their treatment or professional position in any way. The structure of the focus group is presented in *Table 1*.

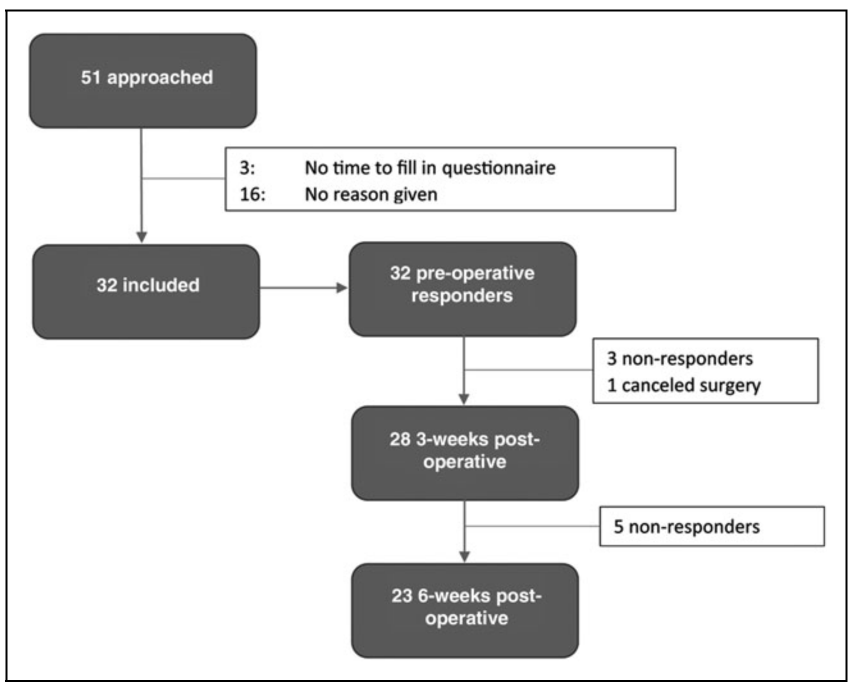

Fig. 2. Response chart questionnaire study.

Table 1. Focus Group Elements, Methods, and Aims

FOCUS GROUP ELEMENT	METHOD	AIM
Introduction	The focus group started with a presentation of the results obtained from the questionnaire round. We anticipated that it would be difficult for participants to verbalize their thoughts on a HipDas concept to increase their self-efficacy. To help them, we provided a screenshot illustrating the concept (*Fig. 3*). The screenshot shows the wirelessly connected sensors (i.e., magnetic sensors, stretch sensor integrated in a garment, and the smartphone to which the measured data are real time visualized for the patient). We used the results from the questionnaires and the screenshot as a discussion starter.	To evoke end-users' thoughts on the value of technology as part of their pre- and postoperative treatment.
Patient journeys, current and future	Individually, patients constructed their patient journey, which served as an outline of the process that an individual patient follows and indicates where lack of self-efficacy played an important role.[8] We used visual material to support this session, that is, a large sheet of paper on which the participants could draw the stakeholders surrounding their postoperative rehabilitation trajectory and write down their thoughts on the use of an ambulant dislocation alert system in the different contexts of use (i.e., living room, kitchen, bed room, outside). Participants marked down where they thought ambulant sensing and feedback of critical hip joint angles play an important role.	To gain insight in the stakeholders, difficulties patients encounter before, during, and after their surgery.
Composition of a scenario	Based on the information collected during the workshop, participants were instructed to write a scenario about their ideas on future use of HipDas. In the process of writing the scenario, they were assisted by the workshop leaders. Crucial elements to be included in the scenario were the People, Activities, Context, and Technology that were part of their story line describing the future use of HipDas.[9]	To specify the concrete use of HipDas
System buildings blocks and preferences	Different sensing modalities were shown to the participants to start a discussion on usability in real life.	To define placement of sensors, calibration of sensors, comfort of the sensor garment, feedback interface, authorization of sharing sensor and feedback information, preferred feedback modality, the content of the feedback as well as the feedback frequency.

HipDas, hip dislocation alert system.

PHASE 3: PILOT USABILITY STUDY

The patients included were patients scheduled for follow-up consult (6–8 weeks) with their orthopedic surgeon after their THA. All patients had a hands-on session, for at least 10 min, with a prototype version of HipDas.

For the prototype (*Fig. 3*), we used fabric stretch sensors (StretchSense) that were attached to the StretchSense 10 Channel SPI Sensing Circuit for measuring hip flexion and extension angles. The sensing circuit contains a Bluetooth low-energy circuit that can communicate with Android and iOS to display and record data. Data obtained from the StretchSense app are stored in a comma separated value file, in pairs of capacitance (in picofarads), and timestamp (in milliseconds). Data were sampled with a frequency of 25 Hz. The sensing zone, 90×10 mm, responds to changes in geometry by electrical charge storage (capacitance). The smartphone application contained a basic graphical user interface and Graphical User Interface (Android Studio) and it was capable to navigate

Fig. 3. Prototype version of HipDas telemedicine system.

between its two main functionalities (i.e., calibration and hip angle feedback). The user was able to choose among three ways of displaying the hip angle; a smiley face changing color, a bar filling up, or a graph to show the hip angle in real time.

Following the hands-on demonstration session, the participants were instructed to fill out the System Usability Scale (SUS) questionnaire. The SUS questionnaire is a simple, 10-item scale giving a global view of subjective assessments of usability. There are five response options; from Strongly agree to Strongly disagree. It uses selected statements covering a variety of aspects concerning usability, the need for support, training, and system complexity.[7] The following anchor question was added to examine the clinical relevance of the HipDas: Do you think this device is useful in the first weeks postsurgery? The score ranged from 1 (not useful) to 7 (highly useful).

DATA ANALYSIS

Bar graphs will present the percentage of respondents who perceived a low self-efficacy score (≤3 on the 7-point answering scale) for the different type of restrictions at different moments in time (baseline, 3 and 6 weeks post-THA surgery). Descriptive statistics (mean, standard deviation [SD]) were collected to investigate the attitude, performance expectancy, effort expectancy, social influence, facilitating conditions, and self-efficacy of HipDas to be developed. To correct for socially desirable answers, the percentage of patients who scored in the upper extreme of the answering scale (>5 on a 7-point scale; >7 on a 10-point scale; indicating a positive opinion/confidence) was presented.

During the focus group, all participants made their own visualization of a patient journey and models of sensing and feedback. Two analysts (R.H. and A.P.) grouped similar responses to identify which factors were named most often regarding issues about lack of self-efficacy and the possibilities of wireless sensor technology. Any disputes were resolved by discussion.[10] The audio recordings were analyzed on a per question basis, using inductive thematic analysis.[11] For each predefined question that was posed, similar answers were grouped. We determined whether there was no agreement, some agreement, partial agreement, or full agreement among the participants. Final analyses focused on making an inventory of the building blocks and functional requirements obtained from both the questionnaire and the focus group data. Based on the information collected, participants and their informal caregiver were instructed to write a scenario about their ideas on the future use of HipDas. In the process of writing the scenario, they were assisted by two workshop leaders. Crucial elements to be included in the scenario were the People, Activities, Context, and Technology, which were part of their story line describing the future use of HipDas.[9] A schematic architecture of a future HipDas was composed. For the SUS questionnaire, the participant's scores for each question were converted to a new number; these were added and multiplied by 2.5 to convert the original score from 0 to 40 to a score from 0 to 100. Based on previous findings, an SUS score more than 68 is considered above average and a score less than 68 below average.[7]

Results

PHASE 1: QUESTIONNAIRE STUDY

Self-efficacy lifestyle restrictions. Results show that 6 weeks after surgery, flexion of the hip >90°, bending over while sitting in a chair, and sleeping in a supine position are the restrictions that have the lowest self-efficacy for the respondents. Among the movement restrictions that are reported to be low in self-efficacy are deep squatting, crossing legs, and sitting down with the operated leg in front (*Fig. 4*).

Percentage of respondents reporting low self-efficacy per restriction rule: presurgery and 3 and 6 weeks postsurgery.

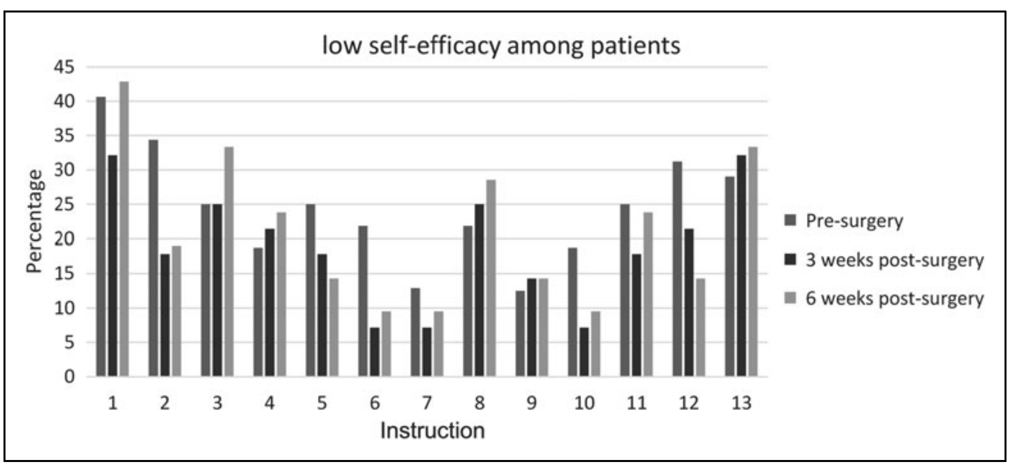

Fig. 4. Percentage of respondents reporting low self-efficacy per restriction rule: presurgery, 3 and 6 weeks postsurgery. Instruction 1 = Don't bend the hip more than 90°. 2 = Don't bend over to put on socks and shoes. 3 = Don't bend over while sitting. 4 = Don't reach over a table. 5 = Don't bend over from an upright position with parallel legs. 6 = Don't squat. 7 = Don't cross the legs. 8 = Don't initiate a turning movement on one leg. 9 = Don't sit on a low chair. 10 = Put one leg in front when getting seated. 11 = Don't rotate the upper body while seated. 12 = Turn step by step, on the uninjured leg. 13 = Sleep on your back (*n* = 32).

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Performance expectancy. Before THA surgery, the majority of patients (>87%) expected HipDas to be a highly useful device in their postoperative rehabilitation (mean 6.2, SD 1.2) (*Table 2*).

Patients are on average positive about the performance of HipDas in terms of compliance with movement restrictions, prevention of dislocation, and the accessibility of the

Table 2. Perceived Score of Hip Dislocation Alert System on Unified Theory of Acceptance and Use of Technology Components According to Patients (n = 32)

	BASELINE			3 WEEKS			6 WEEKS		
	MEAN	SD	% +	MEAN	SD	% +	MEAN	SD	% +
Performance expectancy (7 pt)									
Do you think this device is useful in the first weeks postsurgery?	6.2	1.2	87	6.3	0.8	96	6.4	0.9	95
Would this device make it easier for you to follow the restrictions?	5.8	1.4	87	5.0	1.7	77	5.1	1.9	76
Do you think less hips would dislocate after surgery when this device is used?	6.3	0.9	97	5.9	1.2	92	5.9	1.4	90
Would you like the physiotherapist to be able to follow up on the rehabilitation through this device?	5.9	1.1	93	5.0	1.6	80	5.6	1.3	95
Effort expectancy (10 pt)									
What grade would you give yourself in terms of skill in technology?	6.4	2.2	67	6.2	2.2	60	6.2	1.9	43
How hard do you expect it is to use this device?	6.0	2.1	68	6.1	1.8	64	6.3	1.9	57
Attitude (7 pt)									
Do you think using this system in the first few weeks after hip surgery is a good idea?	6.1	1.0	90	6.3	1.0	92	6.1	1.0	95
Does the device make adherence to the restrictions more interesting for you?	5.4	1.3	86	4.8	1.8	72	4.8	1.8	71
Would the device make it more fun for you to recover after hip surgery?	4.9	1.5	83	4.9	1.7	83	5.5	1.4	90
Would you like using the device to recover after hip surgery?	5.6	1.6	80	5.8	1.3	96	5.9	1.0	100
Social influence (7 pt)									
How important is the opinion of the doctor/physiotherapist in using this device?	6.3	0.8	90	5.4	1.2	76	5.6	1.2	81
How important is the opinion of the people close to you in using this device?	5.3	1.9	63	4.7	1.3	48	4.6	1.7	67
How important is the helpfulness of the surgeon/physiotherapist in using this device?	6.4	0.9	90	5.6	1.3	72	6.0	0.8	86
How important is the opinion of OCON to you in using this device?	6.4	0.9	87	5.9	1.1	80	6.1	0.6	95
Facilitating conditions (7 pt)									
Is there someone who can help you with this device?	5.3	1.9	71	4.5	2.2	52	4.0	2.1	43
Is there anything in your life that makes it impossible to use this device?	6.6	0.7	7	6.0	1.2	14	5.9	1.6	14
Self-efficacy (7 pt)									
Do you want to have the possibility to contact someone for help?	7.0	0.1	100	6.1	0.9	87	5.8	1.0	86
Do you want a built-in help function?	6.3	1.1	90	6.4	0.8	91	6.3	0.6	100

%+ = Percentage of respondents scoring on the upper extremity (indicating positive about HipDas) of the answering scale.

pt, point; SD, standard deviation.

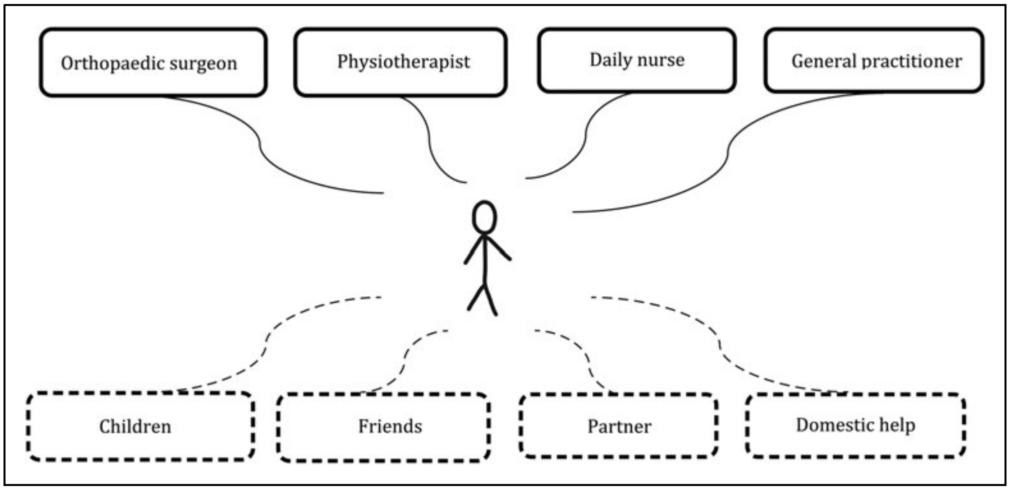

Fig. 5. Stakeholders typically involved in total hip arthroplasty trajectory of patients (informal caregivers; formal caregivers).

registered hip angles by their physiotherapist (*Table 2*). Interestingly, the expected performance of HipDas about its potential to support compliance with movement restrictions is declining at 3 and 6 weeks postsurgery (76%). Nevertheless, it is still considered relevant by the majority of patients.

Effort expectancy. A small majority of patients considered themselves "moderately" (average score 6.4 ± 2.2 on a 10-point rating scale) capable of dealing with technology in general. In addition, the perceived effort to work with HipDas in particular is rated rather similar to technology in general (6.0 ± 2.1) (*Table 2*). The time willing to spend daily setting up the system should be limited to 13–14 min.

Attitude. The majority of patients (>90%) believed using HipDas is a good idea (mean <6.1 ± 1.0). The lowest score (mean 4.8 ± 1.8; 71%) on attitude was found for the item stating whether the use of HipDas makes it more attractive to comply with movement restrictions. Scores decline in the course of the 6 weeks, suggesting that the need for HipDas is most salient in the acute period after THA surgery. The majority of patients were convinced about the fun of using HipDas (mean 4.9 ± 1.5, 83% extremely convinced) (*Table 2*).

Social influence. The majority of patients uttered the importance of positive support from their surgeon (80–95%), their physiotherapist (76–90%), and to a lesser extent their informal caregivers (48–67%) in using HipDas (*Table 2*).

Facilitating conditions and self-efficacy. A minority of patients (43%) reported to have no available assistance to support in the proper use of HipDas. The majority of patients (86%) believed that the use of the system in daily life could be hampered by comorbidities, such as visual or hearing impairment. Likewise, the majority of respondents believed their self-efficacy levels for using HipDas could be improved by a help desk or an assistance button (*Table 2*).

PHASE 2: FOCUS GROUP RESULTS

Stakeholders involved in the THA trajectory are presented (*Fig. 5*). These stakeholders are likely involved when using HipDas.

A schematic overview of the issues addressed during the focus group is presented in *Figure 6*.

In general, all participants emphasize the difficulty of translating the rather generic restrictions (i.e., "avoid deep

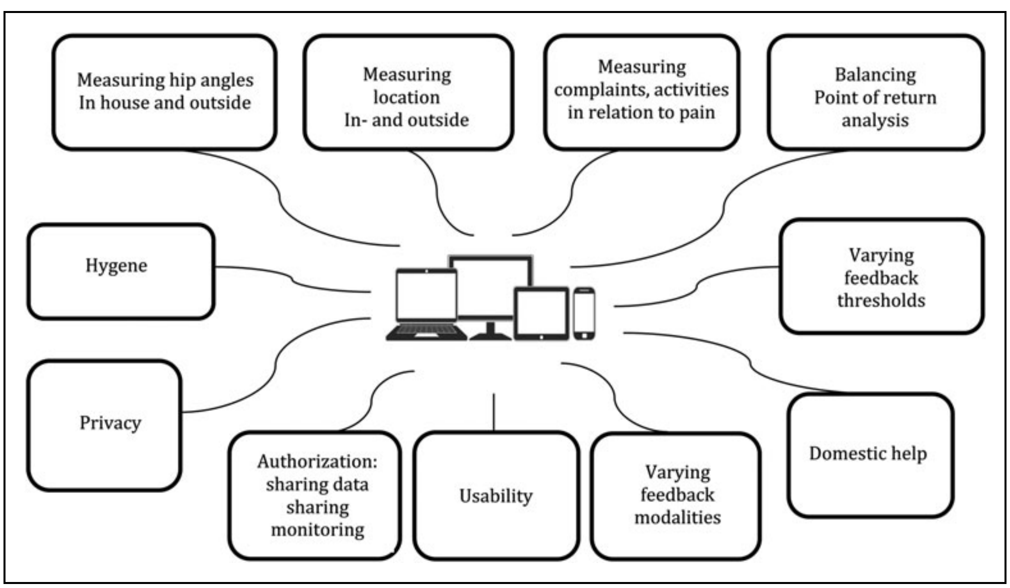

Fig. 6. Topics discussed in the focus group.

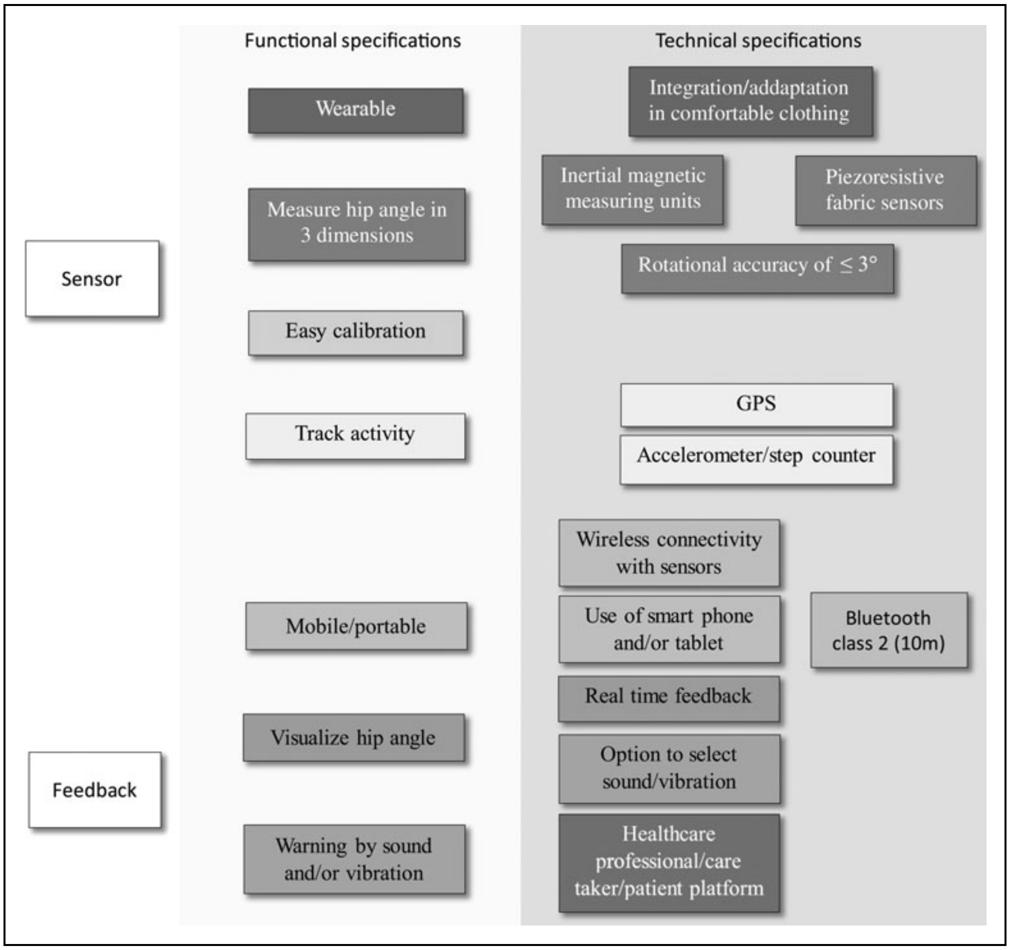

Fig. 7. HipDas building blocks.

("I have bought an elevated toilet seat in order to make sure I was not sitting too low"). The self-efficacy issues encountered by patients while going outside mostly consisted of finding a balance between under and overloading ("Before I knew it, I had walked a couple of kilometers with my dog but on the way back I perceived pain in my hip and still had to walk quite a distance"). One suggestion was to add a Global Positioning System to the system to track the route, speed and distance completed, and "map" these to a subjective rating of discomfort or pain ("So that I can learn from my mistakes of overloading, i.e., being too enthusiastic," "preferably the system is capable of identifying my optimal point of return while walking my dog"). Interestingly, informal caregivers confirmed the self-efficacy issues of patients ("I'm continuously checking my wife's movements in order to make sure she is moving safely," "I noticed the difficulties and anxiety my father encountered in executing the proper movements").

Focus group participants prefer to share the measured data with their informal caregivers and physiotherapist for therapeutic purposes. The majority of informal caregivers preferred to have access to this information about activities that

flexion") to their personal ADL situation ("will sitting on my garden bench be allowed?"). All participants, except for one, endorsed the idea of wearing a system that will actively and automatically warn in the event of an increased risk for dislocation. The participant who did not endorse this idea criticized the system for making a patient too reliant on this type of feedback (i.e., "what if the system is removed after a couple of weeks? How do you know what is and what is not a safe movement?"). Consequently, a discussion started on how to decrease a patient's dependency on the system. It was suggested to gradually decrease the threshold for feedback on critical hip angles in the course of the rehabilitation trajectory, for example, implementing different feedback algorithms ranging from "extremely safe" to "safe." In particular, all attendees reported low levels of self-efficacy in complying with the following restrictions: putting on socks, sleeping in a supine position ("In order to minimize the risk of dislocation during sleep, I slept with a pillow between my legs"), rising from the chair, hip-bending (hip flexion), sitting in a chair or on the toilet

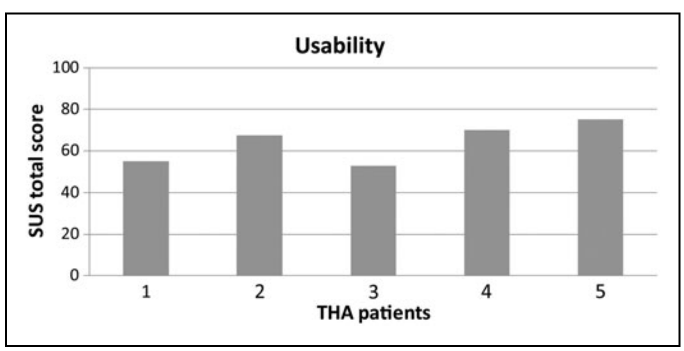

Fig. 8. Usability of prototype version of the HipDas telemedicine system.

provoked critical hip angles to be able to assist the patient in "monitoring" their own safety.

Patients preferred to use the system in the first 6 weeks after the surgery. They indicated that in the first weeks after surgery, movements are naturally restricted due to postoperative pain. However, $\sim$3 weeks after surgery, this pain disappears and patients become more active. During this phase, the pain-induced movement restrictions disappear and HipDas is considered valuable. "The first weeks following surgery I spent most of the time near my house, but after some weeks I started to visit friends again and I had to think about the suitability of the chairs in their house." Consistency existed among the focus group members regarding the feedback modalities. Given the impairments THA patients generally experience (i.e., visual problems, auditive problems), different feedback modalities should be available to meet the individual patient needs.

All participants emphasized that privacy of the measured data must be guaranteed. Data must be anonymously stored and transferred. All subjects expected technical support, preferably in person, in the event of technological difficulties. Although the issues that the patients experienced during their care are unique, there are several similarities regarding situations in which they experienced low levels of self-efficacy in preventing a hip dislocation.

PHASE 3: DESIGN

Figure 7 provides an overview of the HipDas architecture, including its building blocks (sensor, feedback) and associated functional and technical specifications. Motion sensors (i.e., inertial sensors or stretch sensors) register the hip angles and are wireless connected to an Android device on which the measured data are analyzed and presented to the patient on the visual interface. Optional interface features should be available during initial setup to personalize the level of visualization for the patient. Automated feedback will be provided to patients when approaching or entering critical joint angles of the hip. In addition, GPS tracking features and activity tracking sensors acquire data, which are sent to the Android device. A secure central server should be available to store all registered data and should be remotely accessible through personalized login credentials for the patients and their professionals.

PHASE 4: USABILITY RESULTS

The median SUS score (67.5) found in our sample suggested the prototype HipDas system to be usable. Three out of five patients even reported a usability score above the average benchmark value for the SUS (>68).

Figure 8 Usability of prototype version of the HipDas telemedicine system.

Patients reported the HipDas system to be highly useful (median 6.0).

Discussion

Movement restrictions following THA are current best practices instead of evidence based.[12] The main rationale of these guidelines is to prevent dislocation of the newly placed hip prosthesis.[4] One of the prognostic factors for dislocation is the efficacy of patients to comply with postoperative movement restrictions.[5]

The current study shows that patients tend to have a low level of self-efficacy regarding movement restrictions following THA. In particular, the guideline to avoid severe bending of the hip is rather generic and difficult to translate to the own specific home situation. Van den Akker-Scheek et al.[13] showed that a better short-term postoperative self-efficacy resulted in a higher long-term postoperative generic outcome measure such as walking speed. As such, interventions aimed at enhancing postoperative self-efficacy are strongly recommended. HipDas is an example of a self-efficacy enhancing intervention. In this study, the majority of the patients (>76%) anticipated that a future HipDas could be highly useful in preventing dislocation following THA. Results of our pilot study on usability showed that patients perceived the prototype HipDas system developed to be usable and highly clinically relevant. The HipDas is fine as a proof of concept but needs further research to prove its worth for business point of view.

Another interesting finding of the current study is the positive attitude of our patients and their informal caregivers toward the relevance and usage of HipDas. Although literature confirms that most older people have a positive attitude toward technology, the adoption rates of technologies such as mobile phones generally tend to be lower than younger adults.[14] However, a positive attitude has also shown to account for about 50% of its actual use, suggesting its importance.[6] Possibly the influence of informal caregivers, most often relatives and family, might be a key strategy to adoption of new technologies for the THA population, such as HipDas. Older adults invest more in emotional ties with family members and established friends but are less interested in forming ties with new acquaintances.[6] Grandchildren and children tend to be highly influential in the decisions that older adults make about adopting and using a new technological device, since they can help in the usage of the device.[15] In our study, THA patients were rather confident about the support from their relatives in using HipDas. This might explain why the issue of authorization in sharing sensor information with the informal caregiver was high during the focus group. In addition, it might be the explanation for the absence of a discussion about authorization with other THA patients ("strangers") during our focus group meeting.

THA patients are willing to spend a maximum of 10–15 min per day calibrating and preparing the technology for use. They prefer to have the possibility to set individually tailored feedback modalities (sound, vision) and they value appropriate hygiene protocols (i.e., for the sensor pants). Importantly, the current study shows that THA patients consider themselves "moderately" capable of dealing with technology such as HipDas emphasizing the need for proper support modalities. This might be due to the fact that our THA population, like the THA population in general, on average is typically an older population. Aging comes with physical, cognitive, and sensory impairments. This needs to be considered in terms of an older person's needs and capabilities to use when using technology or technical devices. Self-rated physical condition and cognitive ability play a major role in the use of different technologies.[16] Older adults with physical difficulties in vision, hearing, and motion use fewer technologies than people with good health. Our future HipDas system is recommended to deal with the impairments that come along with aging, by providing individually tailored feedback modalities (sound, vibration, vision) through personalization options (i.e., to set their preferred feedback modality).

The results also show that feedback thresholds should be tighter in the early phase of recovery than in the later phase to prevent dependency to the system. More research is needed on the exact thresholds and optimal timing of changing these for effective rehabilitation purposes.

Conclusion

In conclusion, the current study shows that patients' self-efficacy levels toward restrictions prescribed by orthopedic surgeons tend to be low. THA patients show receptivity toward an assistive ambulant technology in improving their self-efficacy levels and consider themselves "moderately" capable of dealing with it. The prototype HipDas system developed in the current study was considered highly clinically relevant and usable.

Disclosure Statement

No competing financial interests exist.

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