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1 **Exploring needs, barriers to, and facilitators of rehabilitation exercise**  
2 **following revision hip replacement - a grounded theory study**

3

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# Exploring needs, barriers to, and facilitators of rehabilitation exercise following revision hip replacement - a grounded theory study

## Abstract

Purpose: Evidence on rehabilitation after revision total hip replacement (THR) is inadequate and development of rehabilitation interventions is warranted. Even so, little is known about patients' experiences with revision THR rehabilitation. This study aimed to explore patients' rehabilitation exercise experiences after revision THR.

Materials and methods: Using constructivist grounded theory, we conducted semi-structured qualitative interviews with twelve patients with completed or almost completed rehabilitation exercise after revision THR. Data collection and analysis were a constant comparative process conducted in three phases; initial, focused, and theoretical.

Findings: From the data, we generated a substantial theory of the participant's circumstances and ability to integrate rehabilitation exercise into their everyday life after revision THR. Four categories were constructed based on patients' experiences in different contexts: hesitance, fear avoidance, self-commitment, and fidelity.

Conclusions: This study highlighted that patients' expectations, past experiences, attitudes, trusts, engagement, and circumstances interact to influence engagement and adherence to rehabilitation exercise and described four categories relating to the integration of THR rehabilitation exercise into their everyday life. Clinicians should be aware of and account for these categories during rehabilitation exercise. Tailored individual rehabilitation exercise interventions and clinician approaches to optimize commitment and adherence are needed among patients with revision THR.

Keywords: experiences; motivation; physiotherapy; qualitative research; rehabilitation; revision total hip replacement; therapeutic relationship

## Introduction

Total hip replacement (THR) is an effective surgery that generally produces excellent outcomes. However, the implant may fail, resulting in a need for revision THR [1,2]. In fact, the 15-year survival after THR in Denmark was 86% with any revision as an endpoint [3]. A total of 31,424 patients underwent revision THR in Denmark from 1995-2021 [4].

1           Revision THR is a surgically more complex procedure than primary THR [5],  
2   with higher mortality rates [6], higher healthcare costs [7], and greater complication risks  
3   [8]. Although improvements in pain and function have been reported in patients under-  
4   going revision THR [9], these patients do obtain poorer clinical outcomes than patients  
5   undergoing primary THR [10].

6           Numerous studies have reported on the effect of therapist-led rehabilitation exer-  
7   cise after primary THR. A systematic review (15 studies) compared the effect of rehabil-  
8   itation exercise for primary THR in terms of pain, hip range of motion, strength, activities  
9   of daily living, quality of life, risk of harms, and satisfaction with care, and found no  
10   difference in the outcomes between the various rehabilitation exercise programs [11].  
11   Current Danish guidelines on rehabilitation exercise following primary THR recommend  
12   that all patients should be offered instruction in self-directed home-based rehabilitation  
13   exercise and resume activities of daily living during their hospitalization. Moreover, the  
14   guidelines recommend that patients are provided with individual rehabilitation follow-up  
15   instructions after their discharge [12]. Guidelines recognize that some patient groups  
16   have additional needs and may benefit from exercises supervised by a physiotherapist at  
17   least twice a week [12]. Studies investigating experiences with rehabilitation exercise  
18   after primary THR have been published. These studies indicated a need for flexible reha-  
19   bilitation exercise programs as some patients experienced only minor needs for close  
20   contact with a physiotherapist, whereas others experienced a much greater need for sup-  
21   port and guidance to overcome barriers such as doubts about performing exercises, lack  
22   of self-efficacy, and pain. In this context, communication, or the lack thereof, between  
23   therapist and patient played a notably significant role [13-15].

24           In contrast, no trials have investigated the effectiveness of rehabilitation exercises  
25   before or after revision THR, and no consensus exists on the content of rehabilitation

1 exercise after revision THR [16]. Furthermore, no national clinical guidelines for reha-  
2 bilitation exercise following revision THR exist. Therefore, it remains uncertain what  
3 rehabilitation exercise should consist of and what type of rehabilitation exercise serves  
4 patients best. Rehabilitation exercise following revision THR may mirror rehabilitation  
5 exercise following primary THR in clinical practice. However, additional needs may  
6 emerge for revision THR patients if the recovery process has been prolonged and char-  
7 acterized by significant pain, leading to extensive muscle strength loss. These additional  
8 needs are contingent on the specific indication for revision, such as infection, mechanical  
9 loosening, or persistent pain [17,18]. Studies on patients undergoing revision THR due  
10 to prosthetic joint infection partly examined experiences with rehabilitation and found,  
11 among others, that patients expressed a need for more supportive rehabilitation programs  
12 tailored to their specific needs with plenty of guidance to support their physical improve-  
13 ments and safety given that some felt a significant change in mobility and loss of inde-  
14 pendence [19,20]. Continued rehabilitation exercise after THR and physical activity, in  
15 general, contribute to general health, muscle mass and strength, muscle co-ordination,  
16 bone density, prosthesis fixation, mental health, and quality of life, thereby having an  
17 important preventive effect on falls, injuries, cardiac issues, subsequent surgeries, as well  
18 as reducing the risk of depression and anxiety [21-24]. This highlights the importance of  
19 integrating rehabilitation exercise into daily life after revision THR.

20 A knowledge gap exists regarding the effectiveness of and patient perspectives  
21 on rehabilitation exercise after revision THR. To date, studies examining revision THR  
22 have been mainly registry studies without rehabilitation exercise-specific information  
23 such as type and content. Thus, evidence and consensus are lacking on rehabilitation ex-  
24 ercise following revision THR and so are intervention studies, guidelines, and studies

1 examining the patient perspective in this regard. As patients obtain poorer clinical out-  
2 comes after revision THR than after primary THR and due to the uncertainty about what  
3 rehabilitation exercise should be provided, research is needed that explores rehabilitation  
4 exercise approaches that are acceptable to patients and improve their functional outcomes  
5 [10,16]. This study aimed to explore patients' rehabilitation exercise experiences after  
6 revision THR and to develop a substantial theory about factors influencing patients' use  
7 of rehabilitation exercise after revision THR.

8

## 9 **Methods**

### 10 ***Study design***

11 In this study, we adopted a constructivist grounded theory methodological framework  
12 focusing on context and experiences to theorize how meanings, actions, and social struc-  
13 tures are constructed [25]. We obtained qualitative data using semi-structured, individual  
14 face-to-face or telephone interviews. The study was implemented in the Central Denmark  
15 Region. Participants undergoing rehabilitation exercise in municipal centers after revi-  
16 sion THR were recruited by hospital-based physiotherapists from the Department of Or-  
17 thopedic Surgery at Aarhus University Hospital, Denmark, after surgery or at follow-up  
18 checks; and by municipal-based physiotherapists at the municipal rehabilitation centers  
19 during the rehabilitation exercise program.

20 The 32-item Consolidated Criteria for Reporting Qualitative Research (COREQ)  
21 were used to ensure methodological rigor [26]. Regular research meetings were held to  
22 discuss the data analysis, sampling methods, and data generation. The research team in-  
23 cluded three physiotherapists, one nurse, one psychologist, one medical doctor holding  
24 a PhD degree, and one PhD student. This study contributes to the development of a ran-  
25 domized controlled trial aiming to develop and evaluate a municipal-based rehabilitation  
26 exercise intervention targeting hip strengthening in patients undergoing revision THR.

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***Danish rehabilitation exercise practice following revision THR***

In Denmark, no clinical guidelines exist on rehabilitation exercise following revision THR. Consequently, variation in the rehabilitation exercise patients are offered is substantial. Typically, patients are assessed by hospital-based physiotherapists who determine whether the patient should be referred to municipal rehabilitation exercise or engage in self-directed exercises at home based on the patient's level of function and the region of residence. For patients referred to municipal rehabilitation exercise, exercise can be delivered both individually and in groups, depending on a clinical assessment of the patient's needs. Some patients will be instructed in performing an exercise program at home, while others will have the opportunity to perform exercises at a rehabilitation center, with or without supervision. Participants in this study were referred to municipal rehabilitation exercise. The type and frequency of exercise vary according to the patient's needs which are determined by municipal physiotherapists. As a consequence, participants have disparate experiences with rehabilitation exercise.

***Sampling and recruitment***

Participants were recruited from Aarhus University Hospital and municipal rehabilitation centers between August 2021 and May 2022. Inclusion criteria were participants who had undergone revision THR, had attended municipal rehabilitation exercise, and were aged >18 years. Exclusion criteria were individuals who were unable to speak Danish and unable or refusing to provide informed consent. No targeted sample was used for this study; instead, data were sampled theoretically in a process embracing data collection, memo writing, analysis, and testing of hunches [25]. The sampling procedure continued until saturation on a core category and categories in the substantial theory had been reached. Among 14 invited participants, 12 were sampled of whom ten were recruited

1 from Aarhus University Hospital and two from municipal rehabilitation centers. Due to  
2 personal and practical factors, two participants declined to participate in the interviews.  
3 Participants one to six were purposively sampled, and participants seven to 12 were the-  
4 oretically sampled. The theoretical sampling meant that the data guided the research pro-  
5 cess, allowing for a flexible response to emerging insights and enabling the continual  
6 refinement of the research focus in accordance with the revelations provided by the data  
7 [25]. Efforts were made to allow for variation in terms of gender, age, and cultural back-  
8 ground. E.g., in our quest for a more profound understanding of the role of support during  
9 the rehabilitation exercise program, we actively sampled participants who had received  
10 minimal support. The researcher responsible for sampling was the first author, a physio-  
11 therapist and PhD student, with no prior relationship with the participants. The first au-  
12 thor planned and gathered data pertaining to participants' rehabilitation exercise experi-  
13 ences, focusing on identifying their needs, barriers to progress, and facilitators of reha-  
14 bilitation exercise. Saturation was recognized by consensus among three of the research-  
15 ers.

16

### 17 ***Data generation***

18 Depending on the participants' preference, an appointment was arranged either for a hos-  
19 pital visit or for a telephone conversation. After having obtained informed consent, the  
20 first author conducted interviews at the hospital in an undisturbed room with only the  
21 interviewee and interviewer present. One interview was performed with each participant,  
22 and the duration of the interviews varied from 15 to 50 minutes. The interviews were  
23 conducted in conformity with a predefined interview guide developed based on a broad  
24 research question regarding the participants' rehabilitation exercise experiences. Reflect-  
25 ing the research question, we outlined relevant, broad areas of knowledge and themes



1 from which questions were developed to achieve the participants' views on various as-  
2 pects of rehabilitation exercise, e.g., previous experiences with rehabilitation exercise,  
3 content and type of rehabilitation exercise, facilitators, challenges, barriers, etc. The in-  
4 terviews started with open questions: "Please tell me about your circumstances at the  
5 moment – How are you coping with everyday life?". Subsequently, interviewees were  
6 asked, "How has the rehabilitation program worked out for you?". Participants were then  
7 asked, "Did anything stop you from making progress?". The interviewer noted initial  
8 analyses in memos and initiated dialogues with the co-authors. This produced adjust-  
9 ments to the interview guide and informed the theoretical sampling. At the outset, the  
10 interview guide encompassed ten open-ended questions concerning rehabilitation exer-  
11 cise experiences after revision THR, providing flexibility to probe beyond the predefined  
12 queries and delve deeper into responses. After having conducted four interviews, we re-  
13 vised the interview guide, which involved including nine questions, each accompanied  
14 by numerous questions designed to identify a core category. All interviews were audio-  
15 recorded and transcribed using Office 365 (Microsoft, USA) dictation and manual typing  
16 by the first author.

17

### 18 *Analysis*

19 The transcripts were imported to and coded in NVivo 13 software (QSR International)  
20 by the first author under supervision from the co-authors. Coding was established by  
21 asking central questions, e.g.: What were the participants' concerns with rehabilitation  
22 exercise, and how did they overcome them? How did the participants understand the sit-  
23 uation when participating in a rehabilitation exercise program? The researchers used a  
24 constant comparison method to compare participants' rehabilitation exercise experiences  
25 and the rehabilitation exercise context (figure 1). They conducted the coding as the data

1 were gathered [25]. This involved repeatedly listening to recordings and re-reading tran-  
2 scriptions of interviews and memos. The initial coding was inductive, and we continuously  
3 compared existing data with new data. In this process, the researchers found multiple  
4 codes circling around engagement and the participant's connection with a physiothera-  
5 pist. The second coding was more focused. Here, researchers found variations in the par-  
6 ticipants' experiences with previous rehabilitation exercise programs and that engage-  
7 ment and connection with a physiotherapist influenced their experiences. The third cod-  
8 ing deductively integrated the codes about engagement and connection from the focused  
9 coding to create theoretical concepts [25]. Based on theoretical coding, we constructed a  
10 substantial theory with a core category and four categories. The core category and cate-  
11 gories were confirmed by re-reading and discussing interpretations and data [25]. During  
12 the study, memos were written to move the analysis forward and to capture the essence  
13 [25] of participants' ability to integrate the rehabilitation exercise into their everyday  
14 lives, and any relevant circumstances affecting this ability were recorded. To gain theo-  
15 retical sensitivity, the research team interviewed patients about their rehabilitation exer-  
16 cise experiences after revision THR from multiple vantage points, made comparisons,  
17 followed leads, and delayed reading theoretical literature [25]. However, when describing  
18 the categories, the researchers did find inspiration in existing theoretical literature about  
19 motivation and the patient-therapist relationship.

20

21 [Please insert Figure 1 about here]

22

### 23 ***Ethics***

24 The randomized controlled trial of developing and evaluating an exercise intervention for  
25 patients undergoing revision THR in a municipal rehabilitation setting was approved by  
26 the Central Denmark Region Committees on Health Research Ethics (Journal No. 1-10-

1 72-134-22). In accordance with Danish legislation (Act no. 1083), qualitative research is  
2 not required to undergo an independent ethical review for approval. The participants in  
3 this study were informed of the purpose of the study. Written or oral informed consent  
4 was obtained from all participants who were informed that their participation was volun-  
5 tary and that they could withdraw from the study at any time. Complete anonymity was  
6 ensured for the participants. The research team had no contact with the participants prior  
7 to this study. This study complies with the Declaration of Helsinki II [27] and data were  
8 carefully stored according to the General Data Protection Regulation [28].

9

## 10 **Findings**

### 11 *Participant characteristics*

12 The sample comprised twelve participants who had completed or almost completed a  
13 rehabilitation exercise program after undergoing revision THR; seven women (58%) and  
14 five men (42%) aged 43-84 years (mean: 65.9 years) (table 1). All participants were eth-  
15 nic Danes except for two participants who were originally from other European countries  
16 (table 1). All participants spoke fluent Danish. Six (50%) participants were retired, nine  
17 (75%) were living with at least a partner, and eleven (92%) had completed a mandatory  
18 education or a higher education (table 1).

19

20 [Please insert Table 1 about here]

21

### 22 *Categories explaining the integration of THR rehabilitation exercise into everyday* 23 *life*

24 The analysis produced a substantial theory consisting of the core category; *Integration of*  
25 *THR rehabilitation exercise into everyday life* and four categories that elucidate the par-  
26 ticipants' process of integrating rehabilitation exercise into their everyday life following

1 revision THR. Integration of rehabilitation exercise into everyday life refers to the incor-  
2 poration of rehabilitation exercises, activities, therapies, and program elements into a  
3 person's daily routines. The four categories are as follows: (1) hesitance – having reser-  
4 vations about rehabilitation exercise, (2) fear avoidance – opting for caution with a mind-  
5 set of ‘better safe than sorry’, (3) self-commitment – recognizing that rehabilitation ex-  
6 ercise is beneficial for oneself, and (4) fidelity – not only completing the process but also  
7 pushing beyond. These four categories provide insights into the participants' experiences  
8 regarding the integration of rehabilitation exercise into their daily routines, their engage-  
9 ment for doing so, and their perceived requirements for support during the rehabilitation  
10 exercise process (figure 2). It is important to note that each participant's approach is based  
11 on their personal narratives and reflects their unique experiences. A category does not  
12 encapsulate an individual but rather represents a specific behavior based on the particular  
13 participant’s personal descriptions. Consequently, a person may exhibit behaviors that  
14 align with more than one category.

15  
16 [Please insert Figure 2 about here]  
17

### 18 *1. Hesitance*

19 The hesitance category is characterized by participants' limited engagement and connec-  
20 tion with the physiotherapist during their rehabilitation exercise program (figure 2). The  
21 challenges related to the fact that participants experienced no or little engagement or ca-  
22 pability to join the rehabilitation exercise program due to external barriers. They lacked  
23 confidence to perform exercises and to remember to exercise. The participants told that  
24 they had been through several turbulent experiences with surgeries. Thus, feeling unwell,  
25 expressed as pain and loss of function, and having negative previous experiences with

1 surgery and rehabilitation exercise affected their engagement and attitude towards per-  
2 forming the recommended exercises. Previous negative experiences had made the partic-  
3 ipants skeptical of enrolling and participating in rehabilitation exercise. One participant  
4 stated: “There is a very big difference in rehabilitation. The first time it was absolutely  
5 horrible, it was worse than nothing really.” (ID no. 2, > mean age, retired). Due to the  
6 negative experiences, the participants had reservations towards rehabilitation exercise.  
7 Although the participants faced negative experiences, they did not initially decide against  
8 adhering to the program. Their non-adherence with the prescribed rehabilitation exercise  
9 program was unintentional. One participant explained his dilemma between, on the one  
10 hand, having understood the importance of rehabilitation exercise and, on the other hand,  
11 feeling incapable and hesitant of following the program, due to functional impairment  
12 and lack of information:

13

14       When you sit at home and cannot do anything, then you know it is important to  
15       exercise, but doing it yourself, like getting it done when you, like me, have been  
16       told that you shouldn’t really walk, so you hardly really dare do anything (...)  
17       I’m very unsure of what was really going on and I’m missing some information  
18       from that time. (ID no. 3, > mean age, retired).

19

20 Another characteristic of this category was that the participants' connection with the  
21 physiotherapists was inexistent, causing a weak therapeutic alliance:

22

23       It wasn't worth anything at all [rehabilitation exercise]. I cannot understand that  
24       you cannot make eye contact [with the physiotherapists] at all, so she is talking  
25       on the phone, and she is standing around and planning something completely  
26       different from what she is working on. It doesn't work, it's not worth driving for.  
27       (ID no. 1, > mean age, part-time).

28

1 The participants experienced unmet needs for attention, dialogue, and support; some even  
2 had no real experience with therapeutic relationships, and others had only a weak thera-  
3 peutic relationship, reflecting that the exercises were not performed correctly and ade-  
4 quately because the participants did not perform their exercises due to lack of self-effi-  
5 cacy and because the exercises had not been taught properly by the physiotherapist:

6  
7       You can sit at home and do something that may go wrong. (...) It really does  
8       matter how you do the exercises. I have not used the home exercises that much.  
9       (ID no. 1, > mean age, part-time).

10

11 Participants experienced low personal resources, i.e., physical, mental, emotional, and  
12 social attributes, based on their experiences with concerns in everyday life, a feeling of  
13 being isolated, and a lack of support; all of which made them feel that they lacked auton-  
14 omy. This was summarized by a participant who stated: “You could go mentally down  
15 over it because you did not really have any information and someone you could actually  
16 turn to.” (ID no. 3, > mean age, retired). The participants often talked about comorbidi-  
17 ties, resulting in a considerable medication intake. They experienced various somatic bar-  
18 riers and a low degree of adherence to the program, and they struggled to integrate the  
19 rehabilitation exercise into their everyday lives, reflecting their reservations about the  
20 rehabilitation exercise and uncertainty regarding its intention.

21 No or little engagement, several barriers, and no connection to a physiotherapist were  
22 reflected in unmet needs, general experiences, and circumstances.

23

## 24 *2. Fear avoidance*

25 The fear avoidance category is characterized by participants' partial engagement and sub-  
26 stantial connection with the physiotherapist during their rehabilitation exercise program  
27 (figure 2). Further, it is represented by participants opting for caution with a mindset of

1 'better safe than sorry'. Participants expressed their engagement but did not feel able to  
2 complete the exercises and adhere to the rehabilitation exercise program, partly due to  
3 pain or the fear of experiencing pain. They told that they had the best intentions towards  
4 doing the exercises in the rehabilitation program but felt that they were unable to fully  
5 complete the program, due to pain and concerns. One of the participants expressed the  
6 dilemma of wanting to complete the program while opting for caution at the same time,  
7 due to fear of experiencing pain:

8

9 I still take care [of myself and my hip to prevent pain], somewhere in the con-  
10 sciousness, in the back of my mind, there is something about that you have to  
11 think about what you do when you do something, and it is still in the uncon-  
12 scious. (ID no. 11, < mean age, part-time).

13

14 Participants expressed that they needed help to break their unproductive habits and  
15 needed assistance to get started with the exercises, i.e., someone devoting them attention  
16 and support while challenging them throughout the program. The participants put this  
17 into words as follows:

18

19 When you are home alone, you think that 'we will do that a little later today  
20 instead', and I must say that I am too bad at grabbing myself by the neck and  
21 saying, 'now it must be done, now I must do these exercises today', whereas, if  
22 you had to meet somewhere and do it, well then I was there too and would get  
23 them done. (ID no. 11, < mean age, part-time).

24

25 I am definitely glad I am going there now, and I would be sorry if it ended now.  
26 Then I do not think that I must be honest to say, then I do not think I will go  
27 much further, because then I would not exercise as much as I do there. (ID no.  
28 8, > mean age, retired).

28

1 The participants experienced a good connection with the physiotherapists and greatly  
2 benefitted from this connection. They needed supervision and support from physiothera-  
3 pists to achieve satisfying adherence and compliance, i.e., follow the physiotherapist's  
4 advice and adhere to the exercise program as prescribed. The participants experienced  
5 various challenges in performing the exercises adequately. The reasons were multiple,  
6 e.g., pain, reduced mobility, activity limitations, and fear of doing something wrong dur-  
7 ing exercises. Two women explained as follows during the interview:

8

9           Pain has prevented me a lot; maybe inside myself, I would like to do more than  
10           I had done the first month, but it was because of pain that I did not do it. (ID no.  
11           9, < mean age, part-time).

12           I'm a little stressed about this situation and I am scared to do something wrong,  
13           resulting in a re-surgery or something [worse]. (ID no. 6, > mean age, retired).

14

15 The participants' experience was that they partially completed the rehabilitation exercise  
16 program under supervision from physiotherapists. However, they did not manage to con-  
17 tinue the rehabilitation exercise without the support and attention from the physiothera-  
18 pist due to a lack of capability and willingness and because of other difficulties.

19

### 20 *3. Self-commitment*

21 The self-commitment category is characterized by participants' high engagement and a  
22 deliberately limited connection with the physiotherapist during their rehabilitation exer-  
23 cise program (figure 2). Moreover, it is distinguished by participants recognizing that  
24 rehabilitation exercise is beneficial for oneself. Participants experienced high engage-  
25 ment, capability, and willingness to complete the rehabilitation exercise program, to  
26 some extent independently of physiotherapist supervision. The primary characteristics of  
27 these participants were a high level of self-determination and high health competencies,



1 such as skills, knowledge, and abilities related to managing health and participating ef-  
2 fectively in a rehabilitation exercise process:

3

4 I have been eager to exercise this time and get up and be able to move and be  
5 active as soon as possible and as much as possible. (ID no. 5, < mean age, full-  
6 time).

7 As I see this, it's just a matter of continuing to exercise, then it would get signif-  
8 icantly better. (ID no. 7, > mean age, retired).

9

10 The participants requested flexibility in attending the rehabilitation exercise program and  
11 were partly independent. They expressed comprehensive knowledge about and under-  
12 standing of the importance of rehabilitation exercise. They experienced high exercise ad-  
13 herence and compliance as they followed the instructions and recommendations provided  
14 by the physiotherapist and participated in and completed the planned exercise sessions.  
15 Their high health competencies in relation to rehabilitation exercise are illustrated in the  
16 following quote:

17

18 I got some exercises, some training exercises, to take home, which I then did like  
19 2-3 times a day, of course depending on my ability on that day, so she [the phys-  
20 iotherapist] has said that the purpose was 2-3 times a day, but of course listen to  
21 my body, depending on how much I can endure. (ID no. 5, < mean age, full-  
22 time).

23

24 The participants felt that they had the capacity and competencies to plan and set goals for  
25 their rehabilitation exercise. They understood that rehabilitation exercise does not stop  
26 when the program concludes. Rather, they need to continue doing the exercises in the  
27 longer term to achieve satisfactory results and to return to a relatively normal everyday  
28 life. A participant said: "It is necessary to continue [with rehabilitation exercise], to make  
29 it even better, on our own." (ID no. 7, > mean age, retired). These participants did not  
30 need a particularly strong connection with their physiotherapists; in fact, they preferred

1 to have less contact with the physiotherapists because they simply did not feel that they  
2 had the time or the need for more contact: “I think the combination is fine that you make  
3 it [rehabilitation exercise program] at home and then come in [to the physiotherapist] and  
4 get it checked.” (ID no. 2, > mean age, retired). The participants talked about how they  
5 completed the rehabilitation exercise program satisfactorily owing to their independence  
6 and integrated the program into their everyday life by continuing to do the exercises after  
7 the program ended.

8

#### 9 *4. Fidelity*

10 The fidelity category is characterized by participants' high engagement and substantial  
11 connection with the physiotherapist during their rehabilitation exercise program (figure  
12 2). Additionally, it is marked by participants not only completing the process but also  
13 pushing beyond. The participants experienced engagement, capability, and willingness  
14 to follow rehabilitation exercise recommendations under physiotherapist supervision,  
15 and furthermore, high level of participation in the rehabilitation exercise program and  
16 good quality in the performance of the exercises. Additionally, they experience a high  
17 level of health authority trust: “I'm happy to go to rehab, so there's someone who's keep-  
18 ing an eye on me because I want to do it.” (ID no. 4, > mean age, retired). The participants  
19 performed the exercises even with challenges. A participant stated the following in the  
20 interviews:

21

22 Firstly, she [the physiotherapist] had complete control with what I could and  
23 what I could not (...) was really ‘carrying’, she [the physiotherapist] had kept an  
24 eye on what we did and did not do at all times and gave me a level that was lower  
25 than what I had been given by the other because I have a bad opposite knee,  
26 which limits I should not have pushed too much. (ID no. 6, > mean age, retired).

27

1 The participants understood completely and were able to accomplish long-term goals and  
2 adhere to rigid rehabilitation exercise instructions. They talked about how they focused  
3 on completing the entire program. They achieved good results through guidance and su-  
4 pervision from the physiotherapists. A risk was observed in this category that participants  
5 exercised and pushed their limits too much during their rehabilitation exercise program,  
6 which may delay the rehabilitation exercise process. One participant put this as follows  
7 at the interview:

8

9 I must stop going too far because it is probably what slows me down occasion-  
10 ally; that I am going way too far. It is my own fault, that is how it is. (ID no. 8,  
11 > mean age, retired).

12

13 The participants talked about how they established a strong connection with the physio-  
14 therapist. They had a mindset driven by results and processes where they strictly followed  
15 the instructions given by the physiotherapists until they achieved both their own and the  
16 physiotherapists' desired outcome without skipping any steps or changing the program  
17 towards achieving the desired outcome. The participants talked about how they fully  
18 completed the rehabilitation exercise program with high exercise adherence and compli-  
19 ance.

20

## 21 **Discussion**

22 In this grounded theory study, we generated a substantial theory regarding the integra-  
23 tion of THR rehabilitation exercise into everyday life, comprising four predominant cat-  
24 egories. The findings showed that participants with previous negative experiences with  
25 rehabilitation exercise and activity limitations who experienced a weak therapeutic rela-  
26 tionship and a need for support were less able to integrate rehabilitation exercise into

1 their everyday lives than participants with a high level of health knowledge and under-  
2 standing and with high health authority trust. The self-commitment behavior category  
3 requested flexibility and the participants actively participated in the program and were  
4 capable of integrating rehabilitation exercise into their everyday lives.

5 Our findings resonate with other published studies concluding that supportive re-  
6 habilitation exercise programs impacting patient recovery are absent and highly needed  
7 for some patients undergoing revision THR [19,20]. Likewise, studies on primary THR  
8 patients have shown that some patients have a considerable need for support, guidance,  
9 and information [13-15]. Interestingly, contrary to previous studies of rehabilitation ex-  
10 ercise after revision THR [19,20], our findings indicated that not everyone needed contact  
11 with physiotherapists, which, to our knowledge, has not previously been reported in stud-  
12 ies on revision THR patients. However, similar experiences have been seen in patients  
13 undergoing primary THR, where some patients did not need much contact but rather re-  
14 quired a greater degree of flexibility [13]. This is in line with our self-commitment be-  
15 havior category. Even so, our findings imply, as other studies have also shown [14,19,20],  
16 that regardless of the need to have contact with a physiotherapist, it is important to have  
17 a strong therapeutic relationship with the physiotherapist to ensure that patients feel safe  
18 in performing exercises, have someone with whom to share barriers and negative emo-  
19 tions, and generally experience mutual respect in the context of shared decision making.

20 The participants' ability to integrate rehabilitation exercise into their everyday  
21 lives was generally affected by their engagement. To theoretically illuminate their en-  
22 gagement, we find it relevant to discuss our findings in the context of the self-determina-  
23 tion theory (SDT) [29]. The SDT proposes that the individual's experience of autonomy,  
24 competencies, and relatedness is essentially a prerequisite for the individual's motivation  
25 and commitment for, e.g., integrating revision THR rehabilitation exercise into everyday

1 life. Our findings revealed two categories, hesitance and fear avoidance, in relation to  
2 which the participants experienced difficulty in integrating rehabilitation exercise into  
3 their everyday life. In participants' characteristics to whom these categories apply, par-  
4 ticipants described signs of low autonomy where they experienced no independence in  
5 their rehabilitation exercise; rather, they expressed a lack of competence to perform the  
6 rehabilitation exercise and a clear need for a therapeutic relationship with the physiother-  
7 apist. In the context of the SDT, this suggests that the participants had an experience of  
8 amotivation or were driven by extrinsic motivation. Furthermore, our findings revealed  
9 two behavior categories, self-commitment and fidelity. Participants in these categories  
10 experienced that it was easier to integrate rehabilitation exercise into their everyday life.  
11 In these categories, signs were observed of substantial autonomy as the participants ex-  
12 pressed shared decision-making in their rehabilitation exercise, felt that they had the com-  
13 petencies to attend the rehabilitation exercise, and either did not need close contact with  
14 the physiotherapists or had a good therapeutic relationship with them. In the context of  
15 the SDT, this suggests that participants were more likely to be driven by intrinsic moti-  
16 vation, although the fidelity category likely was driven less by intrinsic motivation com-  
17 pared to the self-commitment category, as engagement still partly relied on external sup-  
18 port. Therefore, our findings support the importance of autonomy, competencies, and  
19 relatedness for patients' ability to integrate rehabilitation exercise into their everyday  
20 lives. Our findings also underpin the necessity of incorporating these elements into inter-  
21 ventions to increase patients' possibility of integrating rehabilitation exercise into their  
22 everyday lives.

23

#### 24 ***Strength and limitations***

25 Our findings should be seen in light of several methodological considerations. Our sam-  
26 pling strategy was adopted to sample participants in both a hospital and municipal setting.

1 This led to a sample of participants that was representative of revision THR patients from  
2 the Central Denmark Region. The participants were offered different rehabilitation exer-  
3 cise programs depending on the location of their municipal rehabilitation center. The fact  
4 that the participants were recruited from only one hospital and from municipality reha-  
5 bilitation centers only within the Central Denmark Region may potentially affect trans-  
6 ferability, as rehabilitation exercise after revision THR differs between regions and mu-  
7 nicipalities in Denmark. Even so, we believe that our sample reflected varied, compre-  
8 hensive, and representative rehabilitation exercise experiences after revision THR in  
9 Denmark. Moreover, the achievement of saturation enhances the likelihood that the find-  
10 ings are transferable to other contexts. Regardless, the findings should be understood  
11 within a Danish health context, which includes a specific rehabilitation exercise practice.  
12 In Denmark, no national clinical guidelines exist on rehabilitation exercise after revision  
13 THR, and as such every municipality may organize the rehabilitation exercise as it sees  
14 fit why type, content, and duration may vary. Furthermore, rehabilitation exercise may  
15 be delivered either individually, in groups, or at home. This may affect the external va-  
16 lidity of our findings.

17 Participants were interviewed either in a telephone conversation at home or dur-  
18 ing a hospital visit, which might have affected data as some may have felt more comfort-  
19 able at home and may therefore have provided more detailed interviews. However, the  
20 interviews were conducted based on the participants' preferences, which may imply that  
21 they felt comfortable in the setting of their choice and therefore provided the same  
22 amount of detail.

23 The study's inclusion criteria are wide, resulting in a very heterogeneous and var-  
24 ying study population. Yet, we fully acknowledge that the sparse representation of ethnic  
25 diversity in the sample may impact the categories.

1           Assessment of the quality of a grounded theory must consider four criteria. The  
2 theory should fit the data; work to explain, predict, and interpret the empirical area under  
3 study; be relevant, meaning that the theory must focus on a substantive area; and should  
4 be modifiable in response to contextual changes [30,31]. We have thoroughly adhered to  
5 the strategies of grounded theory methodology. This includes adhering to concurrent data  
6 collection, coding, and analysis, and constantly adjusting the concepts. We believe that  
7 the substantial theory fits the data from which the theory evolved and explains essential  
8 elements of how revision THR rehabilitation exercise is integrated into everyday life.  
9 Our hypothesis on the four categories works to explain different levels of integrating  
10 revision THR rehabilitation exercise into everyday life, which we consider a relevant  
11 contribution to developing rehabilitation interventions. The different levels of integrating  
12 revision THR rehabilitation exercise into everyday life mirror THR rehabilitation exer-  
13 cise in Western culture and healthcare that a one-size-fits-all rehabilitation exercise pro-  
14 gram most likely will not be as effective as a more patient-tailored program that is partly  
15 based on the patient's preferences, competencies, resources, and circumstances. In the  
16 future, this theory of integrating revision THR rehabilitation exercise into everyday life  
17 needs theoretical modification to remain in step with cultural and healthcare changes.  
18 Interpreted from a non-realist vantage point, the fit is always influenced by the situation.

19

## 20 ***Conclusions***

21 This qualitative study contributed valuable perspectives on patients' experiences with,  
22 needs for, and barriers to rehabilitation exercise after revision THR. The findings showed  
23 that patients' ability to integrate revision THR rehabilitation exercise into their everyday  
24 life largely depended on their need for support, the experience of a therapeutic relation-  
25 ship, health authority trust, physical function, and their previous rehabilitation exercise  
26 experiences. Awareness of these various perspectives should help guide clinicians in their

1 work with patients undergoing revision THR to increase the likelihood of integrating  
2 rehabilitation exercise into their everyday life and optimize patient commitment and ad-  
3 herence. Furthermore, the patients' experiences provided in this study must be included  
4 in considerations regarding the development of rehabilitation exercise interventions for  
5 and clinicians' approach to this patient group. Due to the lack of guidelines and this pa-  
6 tient group's specific needs, a substantial need exists to design intervention studies that  
7 can inform clinical guidelines. Future research should focus on designing effective reha-  
8 bilitation exercise interventions incorporating space for each patient's individual aspects,  
9 circumstances, and competencies.

10

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17

### 18 **Author contributions**

19 The study design was established as a collaborative effort counting MBS, IM, LMB, EG,  
20 ABP, and DS. MBS collected the data, and MBS and DS analyzed the data. MBS and  
21 DS prepared the manuscript after which edits were proposed by IM, LMB, EG, and ABP.  
22 Finally, all authors reviewed and approved the final version of the manuscript.

23

### 24 **Disclosure statement**

25 The authors have no potential conflicts of interest to report.

26



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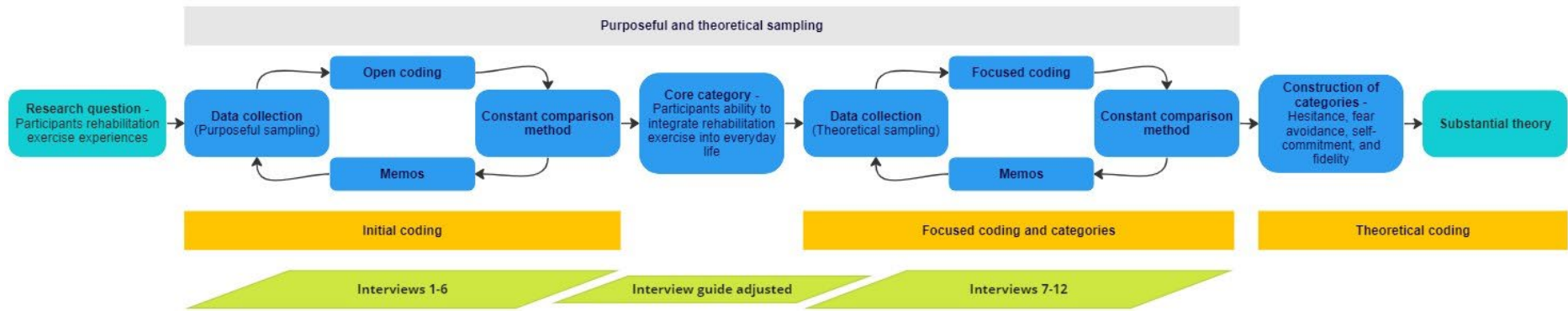
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15 reconsidered realist interpretation of the criteria: fit, work, relevance and  
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1 **Tables and figures**

2 Table 1. Participant characteristics.

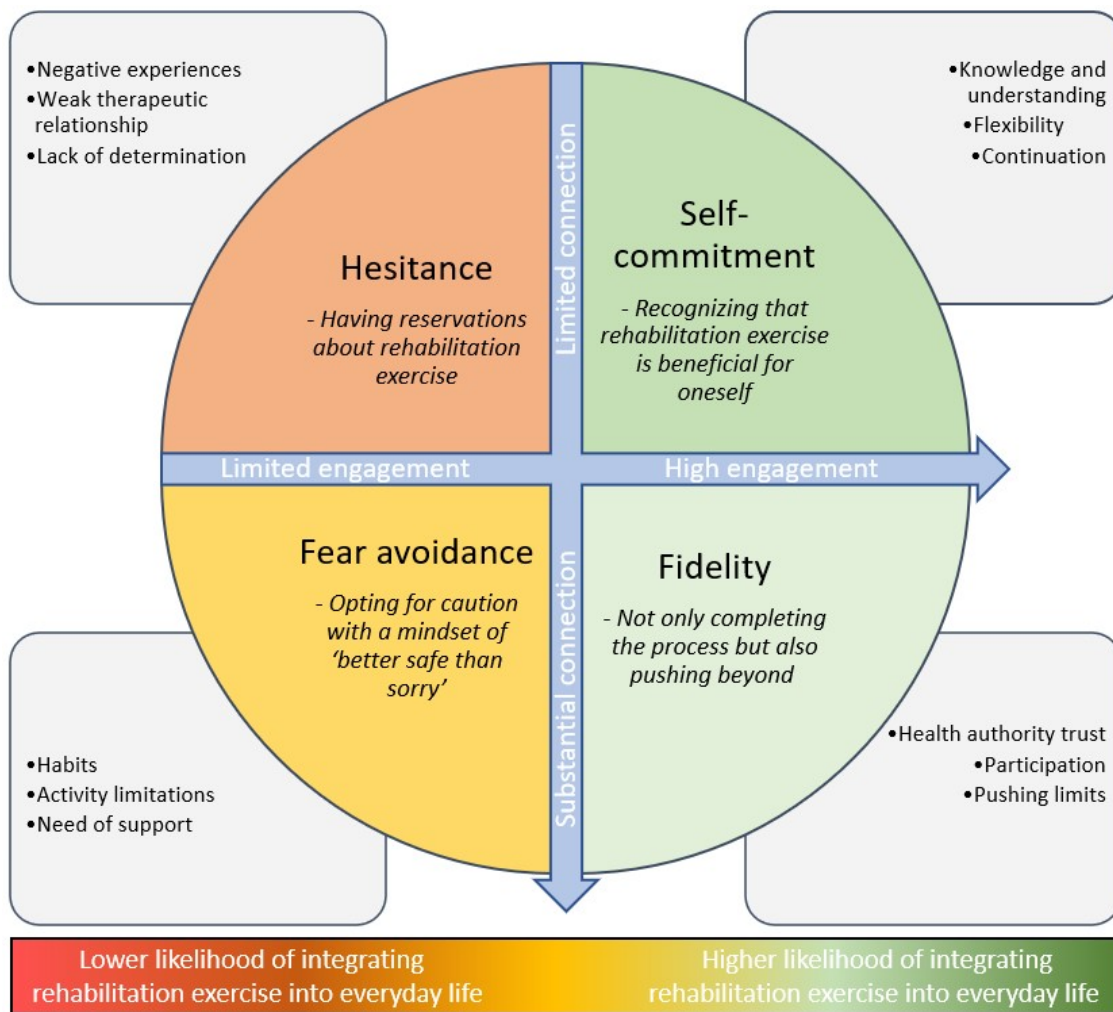
Variable	n (%), unless otherwise indicated
Age, years <sup>1</sup>	65.9 (12.8)
Sex	
Female	7 (58)
Male	5 (42)
Educational level	
Completed mandatory education	9 (75)
Completed higher ed- ucation/university	2 (17)
Other	1 (8)
Cohabiting status	
Living alone	3 (25)
Living with partner	6 (50)
Living with partner and children	3 (25)
Employment status	
Sick leave	2 (17)
Part-time	3 (25)
Full-time	1 (8)
Retired	6 (50)
Ethnicity	
Danish	10 (83)
Other	2 (17)
Registered as disabled	
Yes	2 (17)
No	10 (83)

3 <sup>1</sup> Mean (Standard deviation)



1

2 Figure 1. Grounded theory processes and methods employed in this study, encompassing initial coding, focused coding and categorization, and  
 3 theoretical coding



1

2 Figure 2. Illustration of the four categories: 'hesitance', 'fear avoidance', 'self-commitment', and 'fidelity' that provide insights into both the participants' experiences regarding integrating rehabilitation exercise into their everyday life and the categories' characteristics. The central arrows within these categories indicate the degree of engagement expressed, ranging from 'limited engagement' to 'substantial engagement'. Additionally, they convey the participants' level of connection with the physiotherapist – whether limited or substantial – and their requirements for less or more interaction, and their preferences in this regard. The color-coded scale illustrates the likelihood of integrating rehabilitation exercise into everyday life and clarifies the color gradient utilized within the categories.

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## **Implications for rehabilitation**

- Patients' rehabilitation exercise experiences after revision total hip replacement may serve as guidance for clinicians.
- A need exists to tailor individual rehabilitation interventions and clinicians' approaches to optimize patients' commitment and rehabilitation exercise adherence following revision total hip replacement.
- Clinicians can tailor rehabilitation exercise for patients with revision total hip replacement by focusing on therapeutic relationships, support needs, and physical function while incorporating insights from previous rehabilitation exercise experiences.
- An important goal of rehabilitation exercise is to enhance patient engagement, thereby facilitating the integration of rehabilitation exercises into the patients' daily lives.



## Supplementary Material - Interview guide

### Interview guide – for revision total hip replacement project

1. Tell me about your circumstances at the moment – how are you coping with everyday life?
  - *How are you coping after your hip surgery? (The most recent one)*
  - *Can you tell me about your everyday life? (Tell me about a typical day)*
  
2. To what extent are you able to carry on with your life as it was before?
  - *What is the difference between now and before this surgery?*
  - *Tell me about the activities you liked to do before your surgery?*
  - *And now, can you still do them?*
  - *Have you taken up anything new?*
  
3. Please tell me about your experiences of having your most recent hip surgery.
  - *What rehabilitation have you been offered?*
  - *How has it (rehabilitation) worked for you?*
  - *How is this rehabilitation different from last time (what are the main differences and what has it meant)?*
  
4. What kind of rehabilitation were you offered?
  - *What (exercises/training) do you do at the rehabilitation?*
  - *Which exercises/training did you like the most?*
  - *Where does it take place? – And does it matter where it takes place?*
  - *Who is present? – And does it matter who is present?*
  - *Is there an opportunity for supervision? What kind of supervision and what does it mean?*
  - *What is/was the best/worst thing about the rehabilitation (exercises)?*
  - *Is there anything you have missed?*

- *What rehabilitation would you have liked [more of]?*
  - *How much did you participate in the "rehabilitation program"?*
  - *How did you find your rehabilitation? Were you contacted or had to seek it out yourself)?*
5. Describe to me the most important things that have helped you recover from your revision hip surgery?
6. Was there anything that got in the way of your recovery – for you to feel better with your hip (for your recovery)?
- *Was there anything that prevented you from making progress?*
7. What was the role of your friends and family in your recovery after the surgery?
- *In relation to your recovery?*
  - *In relation to your rehabilitation?*
8. If you were advising someone else having a hip replacement – what would you suggest that they do?
- *Is there anything you would have liked to have done differently?*
9. Is there anything else you would like to tell me?

## Supplementary Material - example of analytic process

Quotes from interview	Initial coding	Core	Focused coding	Theoretical coding	Categories and subcategories
<p><i>"There is a very big difference in rehabilitation. The first time it was absolutely horrible, it was worse than nothing really."</i></p> <p><i>"When you sit at home and cannot do anything, then you know it is important to exercise, but doing it yourself, like getting it done when you, like me, have been told that you shouldn't really walk, so you hardly really dare do anything (...) I'm very unsure of what was really going on and I'm missing some information from that time."</i></p> <p><i>"It wasn't worth anything at all [rehabilitation exercise]. I cannot understand that you cannot make eye contact [with the physiotherapists] at all, so she is talking on the phone, and she is standing around and planning something completely different from what she is working on. It doesn't work, it's not worth driving for."</i></p> <p><i>"You can sit at home and do something that may go wrong. (...) It really does matter how you do the exercises. I have not used the home exercises that much."</i></p> <p><i>You could go mentally down over it because you did not really have any information and someone you could actually turn to."</i></p>	<p>Significant that the participants never really integrated the rehabilitation exercise.</p>	<p>Integration of THR rehabilitation exercise into everyday life.</p>	<p>Due to several turbulent programs, previous rehabilitation experiences, comorbidities, large medication intake, and lack of support, the participant has a lack of personal resources, has concerns in everyday life, and feels isolated, resulting in a minor degree of adherence.</p>	<p>Struggles to fully complete the rehabilitation exercise program.</p>	<p>Hesitance - Having reservations about rehabilitation exercise.</p> <ul style="list-style-type: none"> <li>- Negative experiences - with surgeries, pain, and rehab, affecting their motivation and attitude toward exercises.</li> <li>- Weak therapeutic relationship - weak or no relationship with their physiotherapists, leading to unmet support needs and difficulties in exercises and program adherence.</li> <li>- Lack of determination - limited motivation for the rehabilitation exercise program, lacking confidence and willingness for exercises and lifestyle changes.</li> </ul>
<p><i>"I still take care [of myself and my hip to prevent pain], somewhere in the consciousness, in the back of my mind, there is something about that you have to think about what you do when you do something, and it is still in the subconscious."</i></p> <p><i>"When you are home alone, you think that 'we will do that a little later today instead', and I must say that I am too bad at grabbing myself by the neck and saying, 'now it must be done, now I must do these exercises today', whereas, if you had to meet somewhere and do it, well then I was there too and would get them done."</i></p> <p><i>"I am definitely glad I am going there now, and I would be sorry if it ended now. Then I do not think that I must be honest to say, then I do not think I will go much further, because then I would not exercise as much as I do there."</i></p> <p><i>"Pain has prevented me a lot; maybe inside myself, I would like to do more than I had done the first month, but it was because of pain that I did not do it."</i></p> <p><i>"I'm a little stressed about this situation and I am scared to do something wrong, resulting in a re-surgery or something [worse]."</i></p>	<p>Substantial that the participants had good intentions to integrate the rehabilitation exercise but had challenges due to several reasons.</p>		<p>Due to pain, reduced mobility, activity limitations, fear of doing something wrong, stress, sick leave, and reduced health competence, the participants do not have the motivation to fully complete the rehabilitation exercise program and need safety, need to be interrupted in bad habits and need guidance to initiate the program effectively to achieve satisfying adherence and compliance.</p>	<p>Partial completion of the rehabilitation exercise program with difficulties.</p>	<p>Fear avoidance - Opting for caution with a mindset of "better safe than sorry".</p> <ul style="list-style-type: none"> <li>- Habits - struggled to break old habits hindering program completion.</li> <li>- Activity limitations - made it tough to follow prescribed exercises.</li> <li>- Need of support - relied on physiotherapist support due to fear, pain, and exercise concerns, lacking independence.</li> </ul>
<p><i>"I have been eager to exercise this time and get up and be able to move and be active as soon as possible and as much as possible."</i></p> <p><i>"As I see this, it's just a matter of continuing to exercise, then it would get significantly better."</i></p> <p><i>"I got some exercises, some training exercises, to take home, which I then did like 2-3 times a day, of course depending on my ability on that day, so she [the physiotherapist] has said that the purpose was 2-3 times a day, but of course listen to my body, depending on how much I can endure."</i></p> <p><i>"It is necessary to continue [with rehabilitation exercise], to make it even better, on our own."</i></p> <p><i>"I think the combination is fine that you make it [rehabilitation exercise program] at home and then come in [to the physiotherapist] and get it checked."</i></p>	<p>Significant that the participants had the motivation and competencies to integrate the rehabilitation exercise despite a more independent approach.</p>		<p>Due to high health competence, understanding of consequences, a generally active mindset, and understanding of the importance of physical activity, the participants completed the rehabilitation exercise program satisfactorily. Although several participants had a need for flexibility in the rehabilitation exercise and therefore were partly independent, they managed to achieve good adherence and compliance based on their own capabilities. Some have continued with exercises afterward.</p>	<p>Completion of the rehabilitation exercise program based on own independence.</p>	<p>Self-commitment - Recognizing that rehabilitation exercise is beneficial for oneself.</p> <ul style="list-style-type: none"> <li>- Knowledge and understanding - understood the importance of rehab with high health competencies.</li> <li>- Flexibility - wanted flexibility in rehab attendance and be partly independent.</li> <li>- Continuation - were willing to continue rehab independently, emphasizing long-term commitment.</li> </ul>
<p><i>"I'm happy to go to rehab, so there's someone who's keeping an eye on me because I want to do it."</i></p> <p><i>"Firstly, she [the physiotherapist] had complete control with what I could and what I could not (...) was really 'carrying', she [the physiotherapist] had kept an eye on what we did and did not do at all times and gave me a level that was lower than what I had been given by the other because I have a bad opposite knee, which limits I should not have pushed too much."</i></p> <p><i>"I must stop going too far because it is probably what slows me down occasionally; that I am going way too far. It is my own fault, that is how it is."</i></p>	<p>Significant that the participants had the motivation and ability to integrate the rehabilitation exercise.</p>		<p>Due to a high level of participation, a high level of health authority trust, a relation to the physiotherapist, a mindset driven by results and process, and exercise performed even with challenges, participants have fully completed the rehabilitation exercise program with high compliance and adherence, where some may have pushed the limits along the way.</p>	<p>Completion of the rehabilitation exercise program based on motivation and supervision.</p>	<p>Fidelity - Not only completing the process but also pushing beyond.</p> <ul style="list-style-type: none"> <li>- Health authority trust - high level of trust in particularly physiotherapists and valued their guidance and supervision.</li> <li>- Participation - actively engaged in the program with strong motivation for exercises and activities.</li> <li>- Pushing limits - were determined to achieve rehab goals, though sometimes pushing too hard, risking setbacks.</li> </ul>