Management of fear of falling after hip fracture

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Chapter 4

Feasibility of a multicomponent cognitive behavioral intervention for fear of falling after hip fracture: process evaluation of the FIT-HIP intervention.

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ABSTRACT

Background

This study describes the process evaluation of an intervention developed to reduce fear of falling (FoF) after hip fracture, within an inpatient geriatric rehabilitation setting. This 'FIT-HIP intervention' is a multicomponent cognitive behavioral intervention, conducted by physiotherapists and embedded in usual care in geriatric rehabilitation in the Netherlands. A previous study (cluster randomized controlled trial) showed no beneficial effects of this intervention when compared to usual care. The aim of this study was to gain insight into factors related to the intervention process that may have influenced the effectiveness of the intervention.

Methods

This process evaluation was conducted using an observational prospective study design. Based on quantitative and qualitative data derived from session logs, evaluation questionnaires and interviews, we addressed: 1] recruitment and reach; 2] performance according to protocol; 3] patients' adherence; and 4] opinions of patients and facilitators on the intervention. Participants in this study were: a) patients from 6 geriatric rehabilitation units, who were invited to participate in the intervention (39 adults aged ≥65 years with hip fracture and FoF) and; b) intervention facilitators (14 physiotherapists and 8 psychologists who provide coaching to the physiotherapists).

Results

Thirty-six patients completed the intervention during inpatient geriatric rehabilitation. Apart from cognitive restructuring and telephonic booster (which was not provided to all patients), the intervention was performed to a fair degree in accordance with protocol. Patients' adherence to the intervention was very good, and patients rated the intervention positively (average 8.1 on a scale 0-10). Although most facilitators considered the intervention feasible, a limited level of FoF (possibly related to timing of intervention), and physiotherapists' limited experience with cognitive restructuring were identified as important barriers to performing the intervention according to protocol.

Conclusions

The FIT-HIP intervention was only partly feasible, which may explain the lack of effectiveness in reducing FoF. To improve the intervention's feasibility, we recommend selecting patients with maladaptive FoF (i.e. leading to activity restriction), being more flexible in the timing of the intervention, and providing more support to the physiotherapists in conducting cognitive restructuring.

Trial registration

Netherlands Trial Register: NTR5695 (7 March 2016)

Key words

Process evaluation, Feasibility, Fear of falling, Hip fracture, Cognitive behavioral intervention, Geriatric rehabilitation

BACKGROUND

Many older adults who have sustained a hip fracture will go through an extensive and generally challenging process of rehabilitation.[1,2] During this recovery process, a substantial number of patients will experience concerns about falling (once) again.[3,4] This fear of falling (FoF), is defined as '*a lasting concern about falling that leads to an individual avoiding activities that he/she remains capable of performing*'.[5] Prevalence rates of up to 63% have been reported for FoF in inpatient geriatric rehabilitation after hip fracture.[4] As a consequence of the activity restriction associated with FoF, deterioration in physical functioning and a decline in social participation and quality of life can occur.[3,6] FoF may even have more effect on functional recovery after fracture than pain and depression.[7] Hence, FoF appears to be an important risk factor for impaired recovery,[3,8,9] which could possibly be addressed by treatment.

Patients with a recent hip fracture differ from the general population of community-dwelling older adults in that they experience a sudden impairment of their gait function and consequently become dependent in (basic) activities of daily living.[2] In the Netherlands, approximately half of all older patients with a hip fracture follow an inpatient multidisciplinary rehabilitation program after surgical repair of the fracture. These '*geriatric rehabilitation*' services are specialized in the medical care for frail older adults.[10] Therapy is aimed at optimizing the patient's physical condition and restoring (gait) function.[11] Physical therapy focuses on training balance and muscle strength, and practicing activities of daily living.[12] At present there are no treatment programs aimed specifically at reducing FoF after a recent hip fracture. However, for community-dwelling older adults, various evidence-based interventions have been developed to reduce FoF.[13-18] Particularly the treatment programs that combine exercise with cognitive behavioral approaches have been found to be effective in reducing FoF.[16-18] In the Netherlands, two of these evidence-based programs using cognitive behavioral approaches have been nationally implemented (based on *'A Matter of Balance'*[19]).[15,20] However, in their current format (community- or home-based), these established programs are not suitable for the therapeutic setting of inpatient geriatric rehabilitation. The cognitive behavioral approaches used in these programs were therefore adjusted to an individualized treatment program that fits the (physio) therapeutic setting within rehabilitation services. This *Fear of falling InTervention in HIP fracture geriatric rehabilitation* (FIT-HIP intervention) was designed to reduce FoF and consequently to improve functional outcome in inpatient geriatric rehabilitation after hip fracture.[21] However, a recent cluster randomized controlled trial evaluating the effects of the FIT-HIP intervention showed the program was not effective in reducing FoF or improving functional outcome after hip fracture.[12]

The aim of this process evaluation therefore is to gain insight into factors that may have influenced the effectiveness of the intervention. Subsequently, findings from this study can provide

insight into opportunities to improve both the intervention itself and its implementation in clinical practice. In this study we assessed the feasibility of the FIT-HIP intervention in clinical practice based on the following aspects of the intervention process: 1] recruitment and reach; 2] performance according to protocol (*dose delivered and fidelity*); 3] adherence (*dose received exposure*); and 4] opinion on the intervention provided by patients and facilitators (*dose received satisfaction and context*). These items are based on the framework of Saunders and colleagues.[22,23] This model for process evaluation is frequently used within health care innovations and is based on the widely acknowledged principles of Steckler et al (2002).[24]

METHODS

Study design

This process evaluation has an observational prospective design, combining qualitative and quantitative research methods. It was conducted in conjunction with the cluster randomized controlled trial that evaluated effectiveness of the FIT-HIP intervention.[12] Ethical approval was provided by the Ethics Committee of the Leiden University Medical Center (LUMC) and the study was registered in the Netherlands Trial Register (NTR5695). Patients were recruited between March 2016 and January 2017 from 11 post-acute geriatric rehabilitation units in the Netherlands. For the present study we focused on the patients and intervention facilitators from the six units that were allocated to the FIT-HIP intervention.

Intervention

The FIT-HIP intervention is an individualized, multicomponent intervention based on cognitive behavioral approaches. It aims to reduce FoF in inpatient geriatric rehabilitation after hip fracture. The intervention is conducted by physiotherapists from the participating units and is integrated in usual care in geriatric rehabilitation (i.e. physical therapy sessions). The following cognitive behavioral elements are embedded in the intervention: 1] guided exposure to feared activities; 2] cognitive restructuring; 3] psychoeducation; 4] relapse prevention (*Staying Active Plan* and telephonic booster); and 5] motivational interviewing. These elements are combined with regular exercise training in rehabilitation. The physiotherapists are counseled by psychologists (from participating units) during daily practice. This coaching is organized as (on-site) monthly meetings and interim consultation at the request of the physiotherapists.

The study protocol published previously[21] and Table 1 provide detailed information on the rationale and schedule of the various items within intervention. The intervention, which is integrated in the regular geriatric rehabilitation treatment, starts directly after admission and lasts for the duration of the inpatient rehabilitation (in general six to seven weeks).[10] First, patients have an intake interview with the physiotherapist, to assess which circumstances cause

concerns of falling, and to determine treatment goals. Next, based on this information, the physiotherapist puts together a tailor-made treatment plan for the application of the guided exposure (i.e. the *FIT-HIP fear ladders*). Guided exposure is considered the core element of the FIT-HIP intervention and is applied within the regular physical therapy sessions as long as the FoF persists. Guided exposure may not be necessary in all sessions (in the event the FoF has subsided). Cognitive restructuring is also tailored to the patient's needs. The frequency will depend on whether the patient has unrealistic thoughts and on the patient's receptiveness to such an approach. Cognitive restructuring is practiced at least twice during the inpatient rehabilitation treatment (including a homework assignment) and can be repeated as needed. Psychoeducation is provided in the initial stage of rehabilitation (first three weeks) and in the final stage when discharge is being planned. In both stages the information is provided during at least one session. The psychoeducation in the final stage is integrated in the relapse prevention plan (i.e. *Staying Active Plan*), a reference book given to the patient at discharge. A topic list of the psychoeducation is provided in Additional file 1. The telephonic booster six weeks after discharge (one session) is the final element of the intervention. Motivational interviewing does not have a fixed schedule in the intervention, as it is applied by the physiotherapists during the entire FIT-HIP program, in order to assess and relate to the patient's intrinsic and extrinsic motivation for rehabilitation.

Participants

Patients were older adults (≥ 65 years) with fear of falling, admitted to inpatient geriatric rehabilitation following hip fracture. FoF was assessed using the following one-item question with a 5-point Likert scale, '*Are you concerned to fall?*' (answer options: *never - almost never - sometimes - often - very often*). Eligible for participation were patients who reported concerns about falling at least 'sometimes'. Exclusion criteria included conditions interfering with learnability [dementia; a score >1 on the Hetero-anamnesis List Cognition (HAC)[25] (suggestive for premorbid cognitive disabilities); or major psychiatric disease]; furthermore, a pre-fracture Barthel index score <15; pathologic hip fracture; life expectancy <3 months; and insufficient mastery of the Dutch language. All patients provided written informed consent for participation in the study. Thirty-nine patients were included in the present study.

The intervention providers, from here forward entitled *facilitators*, were physiotherapists working in the participating intervention units (two per unit), and psychologists. The physiotherapists were actively engaged in the multidisciplinary geriatric rehabilitation team and had experience in the field of (orthopedic) rehabilitation for frail older adults. One psychologist from each unit was involved for the on-site coaching of physiotherapists. Most participating units were specialized in orthopedic rehabilitation and the patient volume of these units varied from [19-34]. Initially facilitators from six units were trained, but due to a limited inclusion rate after four months, we included an additional unit (affiliated to one of the participating units).

Table 1. Overview of the FIT-HIP intervention

Element	Description
Guided exposure – *rationale*	Guided exposure is the graded and repeated exposure to situations that give rise to fear (of falling). As recurrent exposure to the feared situation or activity is performed under supervision and in a manner that is predictable and controllable, this leads to the positive experience that the fear gradually fades out as the activity is practiced more often. After the fear for this specific situation has subsided, the exposure can be extended to the 'next level', practicing the activity in a manner that leads to a greater level of fear (fear hierarchy for graded exposure). For fear of falling (FoF), the feared activities will be situations concerning physical activity. In the rehabilitation after hip fracture, this will predominantly be basic activities in daily living, such as transferring, standing and walking.
Implementation in the FIT-HIP intervention	In the FIT-HIP intervention the physiotherapist helps the participant assess situations that give rise to FoF (within the first week of admission to geriatric rehabilitation (GR)). For each 'feared' activity the physiotherapist and participant draft a fear hierarchy, designed as a 'fear ladder' (template example published in protocol).[28] The FIT-HIP fear ladder consists of six 'steps', each step representing a functional goal. The functional goal describes in which manner the activity is practiced/performed. The goals are ranked with an increasing level of FoF as the activity gets more complex (or has to be performed with less assistance). The FIT-HIP fear ladders are the guiding principle for the multidisciplinary approach to apply guided exposure for all aspects of mobilization. The physiotherapist evaluates the fear ladders with the participant weekly and the fear ladders are revised on the basis of progress (reduction of FoF).
*Intervention provider(s)**	Physiotherapists during physical therapy sessions. As applicable, by nursing staff when assisting patients in basic activities of daily living that give rise to FoF. Nursing staff assisting participants in practicing 'fearful' activities as 'homework assignments' after physical therapy.
Schedule	Incorporated in all physical therapy sessions (and nursing care activities) for the duration of inpatient multidisciplinary GR as long as FoF persists.
Cognitive restructuring - *rationale*	Thoughts (and associated beliefs) influence how a person feels and accordingly how a person appraises and responds to a situation. Excessive concern to fall (fear of falling) can be based on unrealistic thoughts and beliefs with regard to (risk of) falling. This excessive FoF may lead to avoidance of (physical) activity and consequently fortify the FoF. Cognitive restructuring is a technique used to explore thoughts and beliefs and therefore to identify, challenge and modify unrealistic thoughts. In the FIT-HIP intervention participants are coached to explore their thoughts concerning physical activity and fall risk. In doing so they are encouraged to identify maladaptive and unrealistic thoughts and in turn formulate and apply more realistic thoughts. The principle of (un)realistic thoughts is also incorporated into the relapse prevention plan (see below).
Implementation in the FIT-HIP intervention	Physiotherapists are trained to guide the participant in exploring their thoughts concerning physical activity and (risk of) falling. A worksheet is used to structure the process of cognitive restructuring and to provide the participant insight in this process (analyzing the situation and the associated thoughts, feelings, behavior and consequences and subsequently formulating more realistic thoughts).
*Intervention provider(s)**	Physiotherapists. A psychologist is trained as a 'buddy' to coach the physiotherapists in these principles as when additional help is needed.
Schedule	During at least one physical therapy session the cognitive restructuring is applied and practiced with the participant. Subsequently, the participant is encouraged to fill in the worksheet as a 'homework assignment'. This is reviewed and discussed during the next therapy session. These 'key' thoughts can briefly be recapitulated in situations when the FoF is noticeable in the physical therapy sessions. The process of cognitive restructuring can be repeated as needed (when the FoF persists).

Table 1. Overview of the FIT-HIP intervention	
Psychoeducation - *rationale and implementation in the FIT-HIP intervention*	The psycho-education is used to reinforce the various elements of the FIT-HIP intervention. In the initial phase of GR the participant receives information on anxiety, (consequences and treatment of) FoF and the rationale and background of guided exposure and cognitive restructuring. In the final phase of GR, when discharge home is being planned, the psycho-education focusses on home safety. The information on home safety is also processed in the relapse prevention plan (see below). For detailed information of the psychoeducation, see the topic list presented in Additional file 1
*Intervention provider(s)**	Physiotherapists discuss the information with the participant.
Schedule	During at least two physical therapy sessions (one in the initial phase of rehabilitation; the other preceding the discharge home). As applicable, the psycho-education can additionally be incorporated in the therapy sessions, related to situations occurring during therapy (for example fall prevention).
Relapse prevention - *rationale*	The relapse prevention is aimed at helping the participant to anticipate and cope with relapse to FoF.
Implementation in the FIT-HIP intervention	In the FIT-HIP intervention the relapse prevention is designed to optimize the transition to predominantly independent living circumstances after discharge home. For this purpose, a 'relapse prevention plan' is composed together with the participant. This '*Staying Active Plan*' aims at preparing the participant for challenging situations in which there is a risk for relapse to FoF and activity restriction. The '*Staying Active Plan*' consists of (information on) 1. General home safety and fall prevention; 2. Individualized advice for safe ambulation and how to stay active; 3. Preventing, recognizing and dealing with a relapse (including notice of (mal)adaptive) thoughts). The information is discussed together with the participant and presented in writing as a reference book. In addition, a telephonic booster is conducted six weeks after discharge from GR. The telephonic booster is aimed at evaluating the FoF (and activity restriction). If necessary advice is given how to deal with FoF, in addition to the prior advice formulated in the '*Staying Active Plan*'.
*Intervention provider(s)**	Both the '*Staying Active Plan*' and telephonic booster are conducted by physiotherapists.
Schedule	During at least one physical therapy session during GR ('*Staying Active Plan*') and one telephonic booster session after discharge home.
Motivational interviewing	Physiotherapists are trained* in motivational interviewing techniques to assist the participant in the process of behavior change. These techniques help the physiotherapist gain insight into the participant's extrinsic and intrinsic motivation and explore which rehabilitation goals are important for the participant, in order to personalize treatment goals in the FIT-HIP intervention.

Notes: This table was published in *Journal of the American Medical Directors Association.* 2019;20(7):857-865.e852. Scheffers-Barnhoorn MN, van Eijk M, van Haastregt JCM, et al. Effects of the FIT-HIP Intervention for Fear of Falling After Hip Fracture: A Cluster-Randomized Controlled Trial in Geriatric Rehabilitation. Copyright of Elsevier (2019)

*Physiotherapists received two training sessions (four hours each); psychologists one 4-h session (together with physiotherapists). Nursing staff was briefed on the background and rationale of guided exposure, in order to help them incorporate these principles in their work and to adhere to the '*FIT-HIP fear ladders*' (45-60 min). Training was provided by the researcher (MSB) together with a cognitive behavioral therapist (BB; furthermore a health care psychologist and teacher). After training and start of the trial, the researcher (MSB) had regular telephonic sessions with the facilitators to discuss recruitment procedures and questions regarding the treatment protocol.

In total, 14 physiotherapists (12 female) and eight psychologists (all female) were involved in the FIT-HIP program, and all were trained to perform the FIT-HIP intervention. For training details: see Table 1.

Data collection

Table 2 presents an overview of the measurement instruments used to assess information for this process evaluation. Patients received a self-administered evaluation questionnaire at discharge from geriatric rehabilitation; and again at three and six months after discharge. We applied purposive sampling for the qualitative interviews with patients,[26] and aimed to conduct interviews with a selection of patients from all participating units and representing both sexes, until data saturation occurred. Patients were approached by telephone for the interviews. Physiotherapists were asked to fill in session logs for all therapy sessions, providing information on attendance, therapy content (which FIT-HIP elements were performed), reasons to deviate from protocol and the duration of therapy. Adherence was assessed using the *Pittsburg Rehabilitation Participation Scale* (PPRS) to score participants' active engagement during therapy. The PPRS is a 6-point Likert scale ranging from '*none*' (patient refused therapy) to '*excellent*'. The physiotherapists were approached for a semi-structured site-specific group interview, and psychologists for a telephone interview. They also received an evaluation questionnaire. As physicians and nursing staff are also involved in the general rehabilitation process, they were approached to fill in a short evaluation questionnaire (five questions), to assess the extent to which they had been informed of or involved in the patients' FIT-HIP treatment.

Interviews were conducted after the six-month follow-up. They were performed by the author MSB and recorded on audiotape (with the exception of the telephone interviews).

Data analysis

Quantitative data from the questionnaires and the session logs was analyzed by means of descriptive statistics using IBM SPSS Statistics version 23. The qualitative data from open-end questions in the questionnaires, session logs and the interviews, were transcribed and categorized based on content by author MSB. Telephone interviews were summarized and categorized.

Table 2. Outcome measures and associated measurement instruments used for the FIT-HIP process evaluation

	Registration forms		Evaluation questionnaires			Interviews		Other
	Physiotherapy session log	Telephonic booster log	Patient (T1,2,3) *	Facilitator †	GR team ‡	Patient	Facilitator †	Log researcher §
Recruitment								
Barriers to recruitment							X	X
Maintaining patient engagement							X	X
Performance according to protocol								
Intervention items conducted	X	X						
Reasons to deviate from protocol	X						X	
Patient adherence								
Active participation during physical therapy	X							
Reasons for not attending physical therapy	X							
Adherence to homework			X					
Use of *'Staying Active Plan'*			X					
Opinion on the intervention								
Overall opinion on the intervention			X			X	X	
Opinion of the value of the intervention (benefit)			X	X	X	X	X	
Perceived burden of the intervention			X			X		
Feasibility to perform the intervention				X			X	
Barriers to performing or implementing the intervention				X			X	X
Suggestion for improvement of the intervention			X	X	X	X	X	X

Notes: GR= inpatient Geriatric Rehabilitation. *T1 = at discharge from GR, T2 = 3 months after discharge from GR, T3 = 6 months after discharge from GR; † Facilitator = physiotherapist and psychologist; ‡ GR team = elderly care physician and nursing staff. § Log researcher = log of additional data recorded by research (assistants), including reasons for dropout and information from informal evaluations with facilitators during study.

Interviews performed by author MSB (clinician - trainee elderly care physician + PhD student, not involved in clinical care for the participants of the study). Setting: patient interviews in participant's home. Facilitator interviews in clinic. Duration interviews: one hour.

RESULTS

Recruitment, reach and response

Enrollment of patients per unit varied from 1-11 (Additional file 2). Thirty-nine patients were assigned to the FIT-HIP intervention, 34 of whom were female (87.2%). Age varied from 65-98 years (mean: 83.7 ± 7.3) and the majority lived alone prior to the fracture (n=27; 69.2%). At baseline one-third of the patients experienced concerns to fall (very) often, and the mean FES-I score (*Falls Efficacy Scale-International*) was 33.9 (SD:9.9); see also Additional file 3. The flow chart presented in Figure 1 shows recruitment, reach and response for both patients and facilitators. The timing of enrollment for the study (first week of rehabilitation) was regularly experienced as inconvenient by patients, as it was difficult for them to anticipate and oversee both the rehabilitation (treatment program) and participation in the study. The main challenge for maintaining patient engagement in the study was poor health. Thirty-six of the 39 patients completed the intervention during inpatient rehabilitation. Two patients did not receive the intervention and one withdrew from treatment in the final stage of rehabilitation due to health problems.

Based on patients that were actively enrolled in the study at the various assessments, the response rate for the patients' evaluation questionnaires was 58.8% (n=20) at discharge; and 92% (n=23) and 95.8% (n=23) at three and six months follow-up. We conducted interviews with nine patients; three patients declined to be interviewed. All units were represented within the interviews, with the exception of unit 4 (n=1 patient enrolled; Additional file 2). We excluded one session log from data analysis, as data were largely missing.

Two physiotherapists and one psychologist discontinued participation (Figure 1). One of these physiotherapists had treated one patient according to the FIT-HIP intervention, the other had no FIT-HIP patients. Ten of the 14 physiotherapists and six of the seven psychologists participated in the interviews. Response rates for health care professionals' evaluation questionnaires were: N=6 for physiotherapists (42.9%; representing four units); N=4 for psychologists (50.0%; representing three units); N=4 for physicians (44.4%; representing three units) and N=4 for nursing staff (representing two units).

Performance according to protocol

The FIT-HIP intervention was conducted during inpatient geriatric rehabilitation and in our study the length of stay varied from 21-98 days (median: 42). From study inclusion until discharge, patients on average received 30.7 physiotherapy sessions (range: 8-105), accounting for 15.7 hours of physiotherapy (range: 3.9-52.5).

Figure 1. Flow diagram of the FIT-HIP process-evaluation

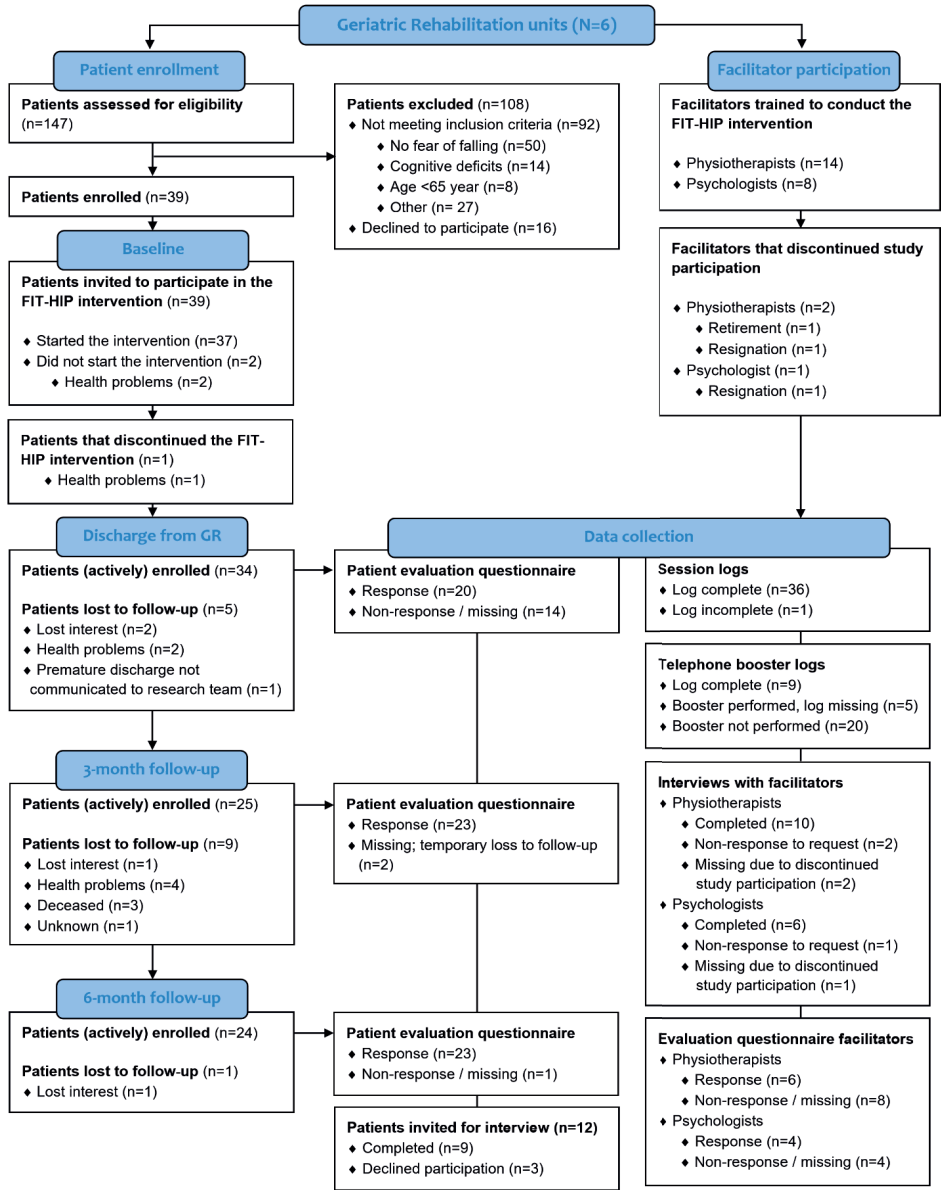

Table 3 provides an overview of the dose delivered per FIT-HIP intervention element. The FIT-HIP intake was carried out for all patients. Guided exposure, the key element of the intervention, was delivered to 97.2% of the patients (n=35). Lack of FoF after enrollment was the reason for not using guided exposure (n=1). On average, guided exposure was incorporated in 56.6% of all physiotherapy sessions (ranging from 5-100%; tailored to patient's needs and response

Table 3. Performance according to protocol

	Patients from all units (n=36)*		
	n	%	Min-max
FIT-HIP intake			
Number of patients who received the FIT-HIP intake	36	100	†
Guided exposure			
Number of patients with ≥ 1 session(s) of guided exposure	35	97.2	†
Mean number of sessions with guided exposure per patient‡; mean (SD)	18.9 (18.3)	†	1-95
Percentage of therapy sessions with guided exposure‡; mean (SD)	†	56.6 (28.3)	5-100
Psychoeducation			
Number of patients with ≥ 1 session(s) of psychoeducation within the first 3 weeks of study participation	34	94.4	†
Mean number of sessions with psychoeducation within the first 3 weeks of study participation per patient‡; mean (SD)	1.9 (1.3)	†	1-7
Cognitive restructuring (homework)			
Number of patients with ≥ 1 session(s) with cognitive restructuring	26	72.2	†
Mean number of sessions with cognitive restructuring per patient‡; mean (SD)	3.5 (1.9)	†	1-8
Number of patients who received ≥ 1 homework assignment for cognitive restructuring	18	50.0	†
Mean number of sessions registered for cognitive restructuring homework per patient‡; mean (SD)	1.8 (1.2)	†	1-6
Staying Active Plan			
Number of patients who received a *Staying Active Plan*	34	94.4	†
Mean number of sessions registered for the *Staying Active Plan* per patient ‡; mean (SD)	2.0 (1.0)	†	1-4
Telephonic booster			
Number of patients who received the telephonic booster after discharge	14	38.9	†

Notes: * All patients who (in part) received the FIT-HIP intervention (n=37); data missing from n=1 patient. † Not applicable. ‡ Based on patients who have received that element of the FIT-HIP intervention.

to treatment). Cognitive restructuring was performed according to protocol less frequently; 26 patients (72.2%) had this element within their treatment program. On average cognitive restructuring was incorporated in 3.5 ± 1.9 sessions. Eighteen patients (50.0%) received homework assignment(s) for cognitive restructuring. With regard to reasons for deviating from protocol for cognitive restructuring, lack of FoF was mentioned for three patients, and for the remaining seven patients the reason was unknown. The telephonic booster was carried out for 38.9% of the patients (n=14; of which n=9 were registered in booster log), resulting in this being the intervention element that was most frequently not performed according to protocol. Facilitators from unit 3 forgot to perform the booster (n=11 patients), one patient was repeatedly not available, and for the remaining patients who did not receive the booster, the reason was unknown.

Regarding the coaching of physiotherapists provided by psychologists, interviews revealed that the frequency of meetings decreased over time. At the start of the study, meetings were initiated and the intervention protocol was reviewed again within the team. However, during the course of the study there were few consultation requests from the physiotherapists and consequently the meetings did not take place each month.

Adherence

Based on the PRPS, active participation during the intervention sessions was very good to excellent for the majority of patients (56%; n=20). One patient's participation was rated as 'fair', the remaining 15 (41.2%) as 'good'. Patients reported their adherence to homework (including physical exercises) as follows: during rehabilitation they performed their homework *'sometimes'* (11.1%; n=2), *'most of the time'* (55.6%; n=10) or *'always'* (33.3%; n=6). Time spent on homework varied from 30-420 minutes per week. Three months post-discharge eight patients (42.1%) had *'never'* used the *Staying Active Plan;* three patients (15.8%) *'seldom or sometimes'* and eight patients *'most of the time'*. The reported adherence for the *Staying Active Plan* at six months was comparable.

Opinion on the intervention

Patient opinions

In general, patients had a positive opinion about the treatment provided by physiotherapists and rated this with a mean of 8.1 (scale 0-10 with higher scores indicating a more favorable opinion) (range 6-10; n=19). Ninety percent of the patients (n=18) evaluated quality of the facilitators as being (very) good. A large majority of the patients would recommend this treatment for fear of falling to other patients (88.2%; n=15). In general, the perceived burden of the physical effort during physiotherapy was rated as being *'just right'* (65.0%; n=13), yet 25.0% experienced it as *'too much'*. Using a 5-point Likert scale we assessed the perceived benefit of the intervention. At discharge from rehabilitation, half of the patients reported that the intervention was (very) helpful to reduce fear of falling and none reported having experienced no benefit from the intervention. The reported benefit after discharge decreased to 39.1% (n=9) at three months, and 33.4% (n=6) at six months. Patients reported most benefit from the *Staying Active Plan* (75.1%), guided exposure (62.5%) and psychoeducation (55.6%) (Table 4). After discharge, the reported benefit of the *Staying Active Plan* decreased to 35.7% and 36.4% after three and six months. The telephonic booster was considered least beneficial.

Interviews showed the patients were positive about the physiotherapists. The patient-therapist relationship was mentioned as an important facilitator for recovery. Patients specified the following key factors within this patient-therapist relationship: 1] trust in the competence of the therapist; 2] calm and supportive personality of the therapist; 3] personal attention for the patient during therapy; and 4] the continuity in treatment - provided by that specific therapist.

The fact that therapy was provided on a daily basis - sometimes multiple sessions - was helpful to (re)gain self-confidence. Additionally, patients experienced that having other patients as a reference during group sessions was supportive for recovery.

Table 4. Patients' perceived benefit of the FIT-HIP intervention

	Assessment		
	Discharge	3 months follow-up	6 months follow-up
This intervention item was (very) helpful to reduce the fear of falling*	n (%)	n (%)	n (%)
Psychoeducation (n=18)	10 (55.6)	†	†
Guided exposure (n=16)	10 (62.5)	†	†
Cognitive restructuring (n=16)	7 (43.8)	†	†
Cognitive restructuring homework (n=15)	6 (40.0)	†	†
Staying Active Plan (in general) (n= 16 / n=14 / n=11)	12 (75.1)	5 (35.7)	4 (36.4)
Telephonic booster (n=11)	†	1 (9.1)	†

Notes: * Based on a 5-point Likert scale with answer categories: *not at all; barely; a little; a lot; very much*. The last two answer categories (a lot; very much) describe that the intervention was (very) helpful to reduce fear of falling. † Not applicable

Care professionals' opinions

The majority of the physiotherapists (70%, n=7, representing four units) had a favorable opinion of the intervention and stated it was a good intervention for the treatment of FoF. These seven physiotherapists mentioned that intervention items such as psychoeducation, guided exposure and to some extent cognitive restructuring are already part of their (physiotherapy) treatment, but receive more attention and are offered in a more structured manner because of the intervention. Preferences for type of cognitive behavioral approach did, however, differ among these physiotherapists (guided exposure n=4; cognitive restructuring n=1; use of guided exposure or cognitive restructuring tailored to patient's response to these approaches n=2). Both physiotherapists and psychologists mentioned that this cognitive restructuring can be challenging for physiotherapists, depending on prior experience with psychosocial interventions. All facilitators questioned to what extent patients would use the *Staying Active Plan* after discharge.

For the physiotherapists with a less favorable opinion of the intervention, time constraints were an important barrier to performing the intervention according to protocol. They felt that treatment of fear (of falling) was more appropriate for psychologists and doubted the added value of the guided exposure principles over current usual care. Physiotherapists with positive attitudes toward the intervention (n=7), on the other hand, did not perceive time as a barrier to implementing the intervention (for future purposes). Although (mild) cognitive impairment was regularly observed in the study population, this was usually not perceived to be a barrier to applying treatment principles. Additional file 4 presents an overview of all challenges, barriers

and suggestions for improvement that were mentioned in this process evaluation; the main suggestions are highlighted below.

Suggestions for improvement

First, physiotherapists observed that after enrollment, the level of FoF among patients appeared to be limited, which consequently hindered the execution of the intervention according to protocol. To improve the efficiency and feasibility of the intervention on that account, it may be helpful to reconsider the selection of the target group (i.e. screening), and initiate treatment at a later stage of geriatric rehabilitation (i.e. if the FoF persists). Second, physiotherapists indicated that having more flexibility to tailor the treatment protocol to the individual patient would be helpful. In their experience, some patients were more receptive to guided exposure and others to cognitive restructuring. Hence, it would be useful to choose the most appropriate element for each individual patient, for example based on their treatment response and anxiety trait(s).

The third suggestion was to intensify the collaboration (and coaching function) between psychologists and physiotherapists, specifically with regard to cognitive restructuring. Although most physiotherapists felt they were capable of (partly) performing cognitive restructuring (as appropriate, with additional training and experience), they suggested it would be helpful if the psychologist routinely observed a physiotherapy session (for example once every week or two weeks). This would provide the opportunity to give additional advice to the physiotherapist, but also to monitor whether additional (psychological) treatment is required. To promote an interdisciplinary approach to addressing FoF, it was also recommended to train nursing staff in early recognition of FoF.

DISCUSSION

This study assessed the feasibility of a multicomponent cognitive behavioral intervention for FoF after hip fracture, integrated in usual care in inpatient rehabilitation. To a fair degree the intervention was performed according to protocol, but cognitive restructuring and the telephonic booster were not provided to all patients. Patients rated the intervention positively and half of them reported that the intervention was (very) helpful in reducing FoF. Most facilitators were positive about the intervention and considered it feasible. However, this study also identified barriers that may have affected this feasibility, and these should be addressed to improve the intervention. Two important barriers were the limited level of FoF after enrollment (possibly related to timing of the intervention), and the fact that physiotherapists, having limited experience with such approaches, perceived cognitive restructuring as challenging.

A considerable body of evidence demonstrates that programs based on cognitive behavioral approaches (preferably combined with physical exercise) are effective to reduce FoF in older adults with fall risk.[16-18,27] However, despite the benefit perceived by patients, the FIT-HIP intervention was not effective in reducing FoF when compared to usual care.[12] It is therefore crucial to reflect on the intervention process, in particular cognitive restructuring as this was not administered to all patients and was considered the most challenging element for facilitators. First, the dose of cognitive restructuring within the intervention does not differ significantly from other programs,[14,28,29] and this does not explain the absence of effect. However, in our study fewer patients received cognitive restructuring according to protocol (72.2% in the FIT-HIP study versus 83.4% in the home-based program for FoF in community-dwelling older adults).[30] This may have contributed to the lack of effectiveness.

The fact that cognitive restructuring is perceived as challenging does not by definition imply it is not feasible in practice or not suitable for frail older adults. Literature on nurse-led programs for FoF in community-dwelling older adults confirms the finding that cognitive restructuring can be challenging for facilitators and participants, yet these programs - despite the perceived difficulties - proved to be effective.[14,15,20] Regarding the appropriateness of cognitive restructuring for frail older adults, facilitators in our study acknowledged that even in cases of mild cognitive impairment, this approach still had potential short-term effects (during the therapy session), enhancing the rehabilitation process.

In a broader perspective, we could question whether it is appropriate for physiotherapists to apply cognitive restructuring. In the past years, interest in incorporating a biopsychosocial approach to physiotherapy practice to enhance the rehabilitation process has increased.[31] Research illustrates that overall, physiotherapists have positive attitudes and beliefs regarding psychosocial interventions.[31] Common barriers to implementation of psychosocial interventions in clinical practice include lack of knowledge, time constraints (including the perceived need to prioritize physical care) and the scope of practice (role clarity and public perceptions of traditional physiotherapist role).[31,32] These factors were also identified in our study, but rather than the lack of knowledge, the facilitators mentioned a desire for more experience. The current literature concerning psychosocial interventions with physiotherapists as facilitators recommends that, in order to ensure treatment fidelity, psychologists should provide comprehensive training and mentoring to the physiotherapists, including performance feedback.[32,33] Effectiveness of such an approach is supported by a recent study that showed positive effects of a physiotherapist-led in-home intervention to reduce FoF and activity avoidance, including cognitive restructuring and exposure therapy, in community-dwelling older adults.[18] The physiotherapists received weekly supervision by a psychologist, based on video tapes of the therapy sessions. Likewise, the *'Step by Step intervention'* aimed at reducing FoF after hip- or pelvic fracture, performed by physiotherapists who received weekly supervision by clinical

psychologists, also had favorable effects on reducing FoF.[27] In our intervention protocol the supervision by psychologists was limited to monthly team meetings and individual coaching on request. In practice this supervision occurred less frequently. This is therefore an area of attention for the future.

Reflecting on the *therapy intensity* in our intervention, thus comparing the individual intervention items to various effective multi-component interventions for FoF, is not straightforward, as this is not always described in detail in the available literature. Also, tailoring of the intervention to the specific needs of the patients can complicate insight in the therapy intensity. The core element of the FIT-HIP intervention is guided exposure to feared activities, which is integrated in most of the therapy sessions. In other intervention programs this element was generally limited to one or two therapy sessions.[28,33] Only the ABLE intervention, an in-home intervention for community dwelling older adults with excessive FoF, incorporated the exposure as a more elementary part of the program.[29] To the best of our knowledge, based on the intervention protocols, all programs had comparable frequency of delivery for psychoeducation on home safety and relapse prevention. Comparable to our program, the ABLE program included psychoeducation on the background on anxiety consequences and rationale for treatment.[28,29,33] The only other treatment program for FoF in this specific target group, the *'Step by Step intervention'* includes problem-solving and relaxation techniques as additional items as compared to the FIT-HIP intervention.[33] The intended therapy intensity of cognitive therapy in this program was similar to our intervention. Hence, the therapy intensity of the individual FIT-HIP intervention items, in the form of *therapy frequency*, does in itself not clearly explain the lack of effectivity of the FIT-HIP intervention.

Regarding the feasibility of the telephonic booster (six weeks after discharge): this element proved to be easily forgotten, as the physiotherapist was no longer involved in the patient's treatment after discharge. We incorporated the booster in the intervention based on lessons learned from the programs based on a *'Matter of Balance '*[30,34], and the insight that (increase in) FoF is common after discharge from geriatric rehabilitation.[35] We can, however, question whether a telephonic booster is useful for our target group, as patients who received the booster reported no benefit from this intervention element. Perhaps it would be more appropriate to extend the treatment for FoF to an ambulatory rehabilitation setting (in-home).[27,36]

An important barrier to acknowledge is the limited level of the FoF reported after enrollment in the study (i.e. selection of the target population). Facilitators pointed out that during screening (first week of rehabilitation), patients were mainly sedentary. Once patients started the process of mobilization (i.e. walking during therapy), in clinical practice the FoF appeared to decrease. The timing of the intervention in relation to the timeline after fracture may be a relevant factor to consider in the selection of the target group. Current literature illustrates

that FoF present 2-4 weeks after fracture is not associated with negative effects on long-term functional outcomes, contrary to FoF present 6-12 weeks post-fracture.[7,8] Provided that the fear is not *disproportionate* and does not lead to significant avoidance behavior (activity restriction), this could imply that FoF shortly after fracture can in some cases be a normal or adaptive process which does not require treatment. Unfortunately, for this specific group of patients, it is currently unknown what a *disproportionate level* of FoF is as measured with established instruments such as the FES-I. We can question whether the standard cut-off values are appropriate for this target group, especially because the FES-I appears to be more closely related to functional performance than to psychological concepts such as anxiety.[37] Patients with hip fracture experience a sudden impairment of the lower body function, and a certain level of 'caution' in relation to an increased fall risk in the early stage of recovery after fracture, may be an appropriate response. For clinical practice it seems relevant to monitor the course of FoF. Findings from a cohort study of hip fracture patients show three distinct patterns of FoF evolving from 4-12 weeks after fracture; i] patients with consistently low levels of FoF; ii] patients with high levels of FoF at 4 weeks that continue to increase; iii] patients with high levels of FoF at 4 weeks which decrease at 12 weeks post-fracture.[38] It is currently unknown how these distinct trajectories relate to avoidance behavior. However, it is plausible that especially those patients that have increasing levels of FoF are more susceptible to develop activity restriction as a consequence of FoF. Accordingly this may be an important group to address by means of intervention.

Another factor to consider when screening for FoF, is the (mediating) role of anxiety (traits) in the development of maladaptive or dysfunctional fear of falling.[18,39,40] Findings from Bower et al. show that patients with higher scores for neuroticism were more likely to have high levels of FoF.[38] Also, the previously mentioned in-home cognitive behavioral program for FoF that was conducted by physiotherapists and showed positive effects on reducing FoF and activity restriction, was aimed at patients with *disproportionate* FoF; as defined as high fear and low to moderate objective fall risk and functional impairment because of FoF.[29] The majority of participants had a psychiatric disorder, most frequently a pre-existing anxiety disorder.[18] In contrast, the FIT-HIP study population reported low scores for anxiety, had a lower level of FoF at baseline (Falls Efficacy Scale-International); and we excluded patients with generalized anxiety.[12,21] It may therefore be useful to incorporate screening for more generalized anxiety symptoms and also specifically include patients with anxiety for treatment.

Limitations

This process evaluation has several limitations. First, we cannot rule out the possibility of socially desirable answers given by patients and facilitators. To reduce the risk of such bias, we informed patients that data would be handled confidentially by the research team (not involved in treatment). For facilitators, we emphasized that their input was essential to improve the

intervention for future purposes. Second, the timing of the interviews may have led to recall bias among facilitators and patients. However, facilitators had no trouble recalling the intervention and were able to identify barriers and suggest improvements. Additionally, we collected information on barriers from the regular informal contact with physiotherapists (researcher log) during the course of the study. We therefore have extensive information concerning the intervention's feasibility, especially from the facilitator's perspective. A third limitation is the relatively low response for the evaluation questionnaires from patients at discharge from rehabilitation. Physiotherapists coordinated this assessment, as the date of discharge could occasionally be brought forward. They sometimes forgot to hand out the questionnaires. Despite additional postal 'follow-up' in these cases, the response rate remained limited. Finally, data on performance according to protocol (including fidelity), was limited to self-report measures (session logs and interviews), which can lead to more favorable responses in comparison to more objective measures. However, video recording of the physiotherapy sessions was considered to be too intrusive for the patients. The strength of this process evaluation is that the results are based on extensive quantitative and qualitative information obtained from patients and facilitators (both physiotherapists and psychologists). This was analyzed within a well-established framework for process evaluations (Saunders)[22] and provided a good insight into the feasibility of the FIT-HIP intervention, possible barriers to implementation and suggestions for improving the intervention.

Recommendations for improvement

First, in order to select an appropriate target population that can benefit from treatment, it is crucial to select patients with maladaptive FoF. Currently we do not know how to accurately quantify *disproportionate* levels of fear of falling for this specific target group. However, factors such as anxiety and avoidance behavior may contribute to the development of maladaptive FoF, and may aid the process of determining which patients require treatment. We therefore recommend screening patients for FoF, related activity restriction and comorbid anxiety at the start of the rehabilitation, and every time the rehabilitation treatment is evaluated. To assess activity restriction related to FoF, an instrument such as SAFE (Survey of Activities and Fear of Falling in the Elderly) could prove to be useful.[41] Treatment of FoF does not by definition have to be initiated directly at the start of rehabilitation, but treatment is advised when avoidance behavior for physical activities is observed. We also recommend treatment for FoF in the event the FoF is progressive or persists, which implies treatment in later stages of rehabilitation.

Second, to improve the feasibility of the FIT-HIP intervention we recommend the following adjustments regarding the content and organization of the intervention. 1] Intensify collaboration between physiotherapists and psychologists to (a form of) collective treatment, in order to support performance feedback for the physiotherapists and to enable timely identification when treatment is required from psychologist. We advise that psychologists observe the patient

during a physiotherapy session once a week. Furthermore, within each individual team, there should be clear agreements regarding the extent to which cognitive restructuring is provided by the physiotherapist (based on prior experience and the preferences of the physiotherapist), and which indications require referral to the psychologist. 2] We support the idea of a more tailored approach to applying guided exposure and cognitive restructuring. Based in part on the presence of anxiety traits, facilitators observed that some patients were more receptive to guided exposure and others to cognitive restructuring. We propose that physiotherapists continue to initiate treatment with both approaches and that the (most) appropriate treatment is determined during the joint treatment with psychologists. 3] More attention to cognitive restructuring in the training of facilitators may also be beneficial, as this element was perceived as most challenging. 4] Last, the telephonic booster can be eliminated from the intervention, due to lack of both feasibility for the facilitators and perceived benefit of the patients.

CONCLUSION

This process evaluation shows that the FIT-HIP intervention was only partly feasible, which may have contributed to the lack of effectiveness of the intervention. To improve feasibility and effectiveness, we recommend a number of adjustments to the intervention. These include selecting patients with *maladaptive* FoF (specifically in the context of avoidance behavior for physical activities), being more flexible with regard to the timing of the intervention (initiating treatment at a later stage of rehabilitation), and providing more support to the physiotherapists with regard to the cognitive restructuring. Although the FIT-HIP intervention in its current form was not effective, and only partly feasible, there is sufficient evidence that cognitive behavioral therapy is a feasible and effective approach to reduce FoF in older adults. We therefore expect that, with the proposed improvements, the FIT-HIP intervention has the potential to effectively reduce FoF. However, further research is needed to prove whether the suggested adjustments result in improved feasibility and effectiveness of the intervention.

DECLARATIONS

List of abbreviations

FES-I= Falls Efficacy Scale-International
FoF = Fear of Falling
FIT-HIP = Fear of falling InTervention in HIP fracture geriatric rehabilitation
LUMC = Leiden University Medical Center

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Authors' contributions

All authors were involved in the design of the study. MS was responsible for the data acquisition. MS and JvH performed the data analysis. All authors were involved in the interpretations of the findings. MS drafted the manuscript; all authors contributed to the manuscript and provided approval for the final submitted version of the manuscript.

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Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Ethics approval and consent to participate

Ethical approval was provided by the Ethics Committee of the Leiden University Medical Center (LUMC); reference number P15.212 (09-09-2015). All participants provided written informed consent to participate in the FIT-HIP study.

Consent for publication

Not applicable

Competing interests

The authors declare that they have no competing interests.

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APPENDIX

Additional file 1. Topic list for psychoeducation within the FIT-HIP intervention

Part	Main topic(s)	Subtopics
1	Fear in general	Background on the function of fear. Dysfunctional forms of fear. Consequences of fear (on behavior); short term - relief of feelings of anxiety; long term - tendency to keep avoiding the situation. Leading to reduced self-efficacy.
	Fear of falling	Background on fear of falling - definition, symptoms, prevalence. Behavioral consequences: activity restriction; avoidance of physical activities with consequences for muscle strength, condition, balance. Increased risk of falling. Impact on social participation. Reduced quality of life.
	Perspective	Treatment possibilities – a guided approach to help stay active. Practicing physical activity under supervision in a controllable manner.
2	Guided exposure	Background on behavioral therapy. Interaction between behavior, cognition (thoughts) and emotion (feelings). Behavior influences emotional state. Behavioral therapy addresses behavior; evaluating how to alter the behavior to more functional forms. Background on guided exposure. Gradual, graded exposure to fearful situations: repeated mild anxiety response in controlled setting, eventually leading to reduction or extinction of fear. FIT-HIP fear ladders, illustrating the 'stepped' approach to the graded exposure to feared situations.
3	Cognitive therapy	Background on cognitive therapy. Interaction between cognitions (thoughts), emotion (feelings) and behavior. Thoughts and/or cognitions can be affect how we feel. And this can in turn influence our behavior. Automatic thoughts. Background on cognitive behavioral therapy: analyzing cognitions. Are they helpful? And if not, how can we address this to formulate more helpful cognitions.
4	General-prevention: *physical activity*	Stay active to keep muscles strong and supple. This will help reduce fall risk and in the event of accidental fall, aid in getting up easier. Thirty minutes of activity a day is helpful; for example walking, cycling, or house-hold chores.
	General fall-prevention: *home-safety*	Awareness for: sufficient lighting, potential hazards in home (cables, rugs, doorsteps), sufficient passageway for walking with walking aids. Alert systems. Occupational therapy: home-safety evaluation
	Fall-prevention: *other*	Awareness for: footwear, vision, medication
5	Personalized fall-prevention	Personalized advice regarding walking aids. Personalized advice regarding physical activity; with suggestions for exercises to perform. How to integrate exercise in the day schedule. Physical activity 'buddy'. Personalized advice regarding home safety.
6	Relapse prevention	Involve significant others (friends, family) to help stay active (physical activity buddy). Personal advice on how to recognize a relapse (which behavior, which feelings, which non-helpful thoughts). Advice how to address the non-helpful thoughts Ask help, discuss FoF with others (for example GP)

Additional file 2. Enrollment of and data on patients and facilitators per Geriatric Rehabilitation unit

	All units	GR unit 1	GR unit 2	GR unit 3	GR unit 4	GR unit 5*	GR unit 6
Patients (n)							
Included in the study	39	5	5	11	1	9	8
Who received the intervention	37	5	5	11	1	7	8
With completed evaluation questionnaire at discharge	20	3	3	5	0	3	6
With completed evaluation questionnaire at 3-month follow up	23	3	4	7	0	3	6
With completed evaluation questionnaire at 6-month follow up	23	4	4	6	0	4	5
Participating in patient interviews	9	2	1	3	0	1	2
Physiotherapists (n)							
Trained to conduct the FIT-HIP intervention	14	2	2	2	2	4	2
Completing study	12	2	1	2	2	3	2
Participating in evaluation interview	10	2	1	2	0	3	2
Psychologists (n)							
Involved in the FIT-HIP intervention	8	1	1	1	1	3	1
Completing study	7	1	1	0	1	3	1
Participating in evaluation interview	6	1	1	0	1	2	1

Note: * Geriatric Rehabilitation unit with a co-location included and trained 4 months after start of the trial.

Additional file 3. Fear of falling and associated activity restriction				
	Baseline (n=39)	Discharge (n=34)	3 month FU (n=24)	6 month FU (n=25)
Falls-Efficacy Scale International (FES-I) total score* Range 0-64; mean (SD)	33.9 (9.9)	32.8 (11.0)	35.1 (13.9)	36.5 (12.1)
Level of fear of falling measured with the VAS-score†* Range 0-100; mean (SD)	54.0 (17.4)	46.3 (24.2)	52.1 (28.8)	48.6 (28.1)
Fear of falling measured with the 1-item question‡ *'Are you concerned to fall?'*				
Number of participants with this response (%)			**	**
Never	0	3 (8.8)	0	1 (4.2)
Almost never	3 (7.7)	6 (17.6)	3 (13.0)	3 (12.5)
Sometimes	24 (61.5)	17 (50.0)	10 (43.5)	12 (50.0)
Often	10 (25.6)	6 (17.6)	6 (26.1)	5 (20.8)
Very often	2 (5.1)	2 (5.9)	4 (17.4)	3 (12.5)
Activity restriction measured with the 1-item question‡; *'Do you avoid activities due to fear of falling?'*				
Number of participants with this response (%)			**	**
Never	§	21 (61.8)	3 (13.0)	6 (25.0)
Almost never	§	7 (20.6)	6 (26.1)	5 (20.8)
Sometimes	§	5 (14.7)	7 (30.4)	9 (37.5)
Often	§	1 (2.9)	4 (17.4)	3 (12.5)
Very often	§	0	3 (13.0)	1 (4.2)

Notes: FU= follow up. *Lower scores indicate less fear of falling. †VAS = Visual analogue scale. VAS-FoF: '*On a scale of 0-100, with 0 being no concerns and 100 exceptionally high levels of concerns about falling,* how would you rate your concern about falling?' ‡ Based on a 5-point Likert scale with answer categories: *never; almost never; sometimes; often; very often*. § Not applicable **Numbers do not add up to final numbers due to missing data.

Additional file 4. Feedback and suggestions for improvement of the intervention provided by facilitators

Intervention element	Feedback	Suggestions for improvement
FIT-HIP intervention (as a whole)	1] Limited level of fear of falling (FoF) was perceived as a barrier to performing the intervention.	1 a] Improve the assessment of FoF, to determine those forms that require treatment (maladaptive FoF). 1 b] Consider starting treatment at a later stage of the inpatient rehabilitation.
FIT-HIP intake	1] Patients brought up few goals regarding (social) participation.	1] -
	2] In the current format, insight into the coping strategies used by patients is lacking	2] Consider adding the concept of illness beliefs to the intake. This provides insight into coping strategies.
Guided exposure	1] Patients may experience difficulty in formulating goals for fear ladders, due to cognitive impairment or lack of practical insight and understanding of the recovery process and rehabilitation goals.	1] Facilitators may need to provide (more) assistance in formulating goals for the fear ladders.
	2] Limited level of FoF can be a barrier to employing guided exposure.	2] Use fear ladders/guided exposure on indication. (tailoring intervention)
	3] The use of fear ladders for patients with more generalized forms of anxiety may enhance their fear and therefore be less appropriate.	3] Use fear ladders/guided exposure on indication. (tailoring intervention)
	4] It can be challenging to involve the entire health care team to support the guided exposure.	4] Involve the nursing staff and physician in drawing up the treatment plans for guided exposure.
Psychoeducation	1] Time and (re)sources to embed psychoeducation in care as usual are limited and can be perceived as a barrier to conducting it.	1 a] Consider embedding the psychoeducation into group sessions (with other target groups than hip fracture patients). 1 b] Consider a handout with information instead of psychoeducation provided by physiotherapist.
	2] Patients and other health care professionals may have different expectations regarding the content of physical therapy sessions (i.e. more physical exercises, less cognitive therapy).	2] The facilitators who perceive patients' expectation of the physiotherapist's role to be a barrier, suggest that psychoeducation be provided by a psychologist.

Additional file 4. Feedback and suggestions for improvement of the intervention provided by facilitators		
Cognitive restructuring including homework	1] Limited level of FoF can be a barrier to conducting the cognitive restructuring.	1] Use cognitive restructuring on indication (tailoring intervention).
	2] Cognitive restructuring can be time-consuming due to limited experience of the physiotherapist.	2] Perform cognitive restructuring together with psychologist (mentoring), to gain more experience.
	3] Cognitive restructuring can be difficult to perform. Not a role for physiotherapists.	3] The physiotherapists who state that cognitive restructuring is not part of a physiotherapist's role/ work, suggest that cognitive restructuring is performed by psychologists.
	4] Patients and other health care professionals may have different expectations regarding the content of physical therapy sessions (i.e. more physical exercises, less cognitive therapy).	4] Those facilitators who perceive patients' expectation of the physiotherapist's role to be a barrier, suggest the cognitive restructuring be conducted by a psychologist.
	5] One physiotherapist mentioned that the template for cognitive restructuring is difficult to use in this target group.	5] Simplify the template for cognitive restructuring.
	6] Cognitive impairment can make cognitive restructuring more challenging to perform.	6] Short-term effects (during the therapy session) can still be achieved. Application of cognitive restructuring can therefore still be appropriate.
Staying Active Plan	1] All physiotherapists questioned the long-term benefit of the Staying Active Plan.	1] -
	2] There is a limited input/ contribution from the patient (regarding personalized goals).	2] Facilitators may need to provide (more) assistance in formulating personalized goals.
	3] It is difficult to involve informal care givers (often children who work).	3] -
Telephonic booster	1] If problems occur after discharge, they will be present soon after discharge.	1] Perform the booster shortly after discharge.
	2] Reimbursement for inpatient geriatric rehabilitation stops after discharge. Therefore, there is no financing for the booster.	2] -
Motivational interviewing	1] Some facilitators had limited prior experience with motivational interviewing.	1] Provide additional training to facilitators with limited experience in motivational interviewing.

ADDITIONAL FILE 5. EVALUATION QUESTIONNAIRES (ENGLISH)

Seven different evaluation questionnaires were used to assess feasibility of the FIT-HIP intervention for patients, facilitators (physiotherapists and psychologists) and other health-care professionals in geriatric rehabilitation (nursing staff, elderly care physician). The questionnaires have been translated from the original language (Dutch) to English. The questionnaires are summarized below.

ADDITIONAL FILE 5 - QUESTIONNAIRE 1

Patient evaluation questionnaire – T1. Discharge from inpatient geriatric rehabilitation

Background

In the past few weeks you have participated in the FIT-HIP trial, a study aimed at evaluating the treatment of fear of falling after hip fracture. The inpatient rehabilitation treatment program you were following has recently ended (or will soon finish). We are interested in your experience with the treatment for fear of falling provided within the rehabilitation program. We therefore kindly ask you to answer the following questions. In this questionnaire we focus on treatment provided by physiotherapists and, if applicable, psychologists.

The data will be handled confidentially, only the research team has insight into this information (the therapists do not have insight into your answers).

Physiotherapy

1. On a scale of 1-10, how satisfied are you with the treatment provided to you during the physiotherapy sessions?
   - o I would rate the physiotherapy sessions: … [0-10]

2. What is your general opinion about the (quality of) the physiotherapist(s)?
   - o Very poor
   - o Poor
   - o Sufficient / average
   - o Good
   - o Very good

3. Was the physiotherapy treatment helpful to reduce the level of fear of falling?
   - o No, not at all
   - o No, barely
   - o Yes, a little
   - o Yes, a lot
   - o Yes, very much

4. What do you think of the physical effort expected of you during physical therapy?
   - o Far too much
   - o Too much

- o Just right
- o Not (quite) enough
- o Not nearly enough

5. Was the following content of physiotherapy treatment helpful to reduce the level of fear of falling?

a. Information about fear of falling and fall-risk
- o No, not at all
- o No, barely
- o Yes, a little
- o Yes, a lot
- o Yes, very much
- o Not applicable

b. Guided exposure to physical activity, based on your FIT-HIP treatment plan
- o No, not at all
- o No, barely
- o Yes, a little
- o Yes, a lot
- o Yes, very much
- o Not applicable

c. Challenging your thoughts about falling
- o No, not at all
- o No, barely
- o Yes, a little
- o Yes, a lot
- o Yes, very much
- o Not applicable

d. Home work: physical exercise
- o No, not at all
- o No, barely
- o Yes, a little
- o Yes, a lot
- o Yes, very much
- o Not applicable

e. Home work: challenging thoughts about falling
- o No, not at all
- o No, barely
- o Yes, a little
- o Yes, a lot

- o Yes, very much
- o Not applicable

f. Composing the 'Staying Active Plan' with your therapist
- o No, not at all
- o No, barely
- o Yes, a little
- o Yes, a lot
- o Yes, very much
- o Not applicable

6. Did you do the homework (physical exercises) provided to you?

o Never
o Seldom
o Sometimes
o Usually
o Always

7. On average, per week, how much time did you spend on the homework (physical exercises) [….minutes] / week

8. Did you use the worksheet '*Challenging Thoughts*' for homework assignment(s)?
- o No
- o Yes, I used this worksheet [….] time(s)

Treatment provided by a psychologist

9. Did you receive treatment from a psychologist, specifically for the fear of falling?
- o No à you may continue with question 13
- o Yes à you may continue with question 10

10. On a scale of 1-10, how satisfied are you with the treatment provided to you by the psychologist?
- o I would rate the treatment provided by the psychologist: … [0-10]

11. What is your general opinion about the (quality of) the psychologist?
- o Very poor
- o Poor
- o Sufficient / average
- o Good
- o Very good

12. Was the treatment provided by the psychologist helpful to reduce the level of fear of falling?
    - o No, not at all
    - o No, barely
    - o Yes, a little
    - o Yes, a lot
    - o Yes, very much

Inpatient rehabilitation treatment program

12. Would you recommend this treatment program for fear of falling, provided within the inpatient rehabilitation, to friends or family?
    - o No
    - o Yes

13. Do you have any additional remarks regarding the treatment program?

ADDITIONAL FILE 5 - QUESTIONNAIRE 2

Patient evaluation questionnaire – T2. Three months after discharge from geriatric rehabilitation

Background

In the past few months you have participated in the FIT-HIP trial, a study aimed at evaluating the treatment of fear of falling after hip fracture. Three months ago you were discharged from inpatient geriatric rehabilitation. We are interested in the perceived benefit of the treatment program to reduce fear of falling, specifically after discharge home. We therefore kindly ask you to answer the following questions.

Rehabilitation treatment program

1. Was the inpatient geriatric rehabilitation treatment program helpful to reduce the level of fear of falling in the past three months?
   - o No, not at all
   - o No, barely
   - o Yes, a little
   - o Yes, a lot
   - o Yes, very much

2. As a result of the inpatient geriatric rehabilitation treatment program, in the past three months,:

a. I am less concerned to fall
   - o Disagree
   - o Agree

b. I have avoided less activities
   - o Disagree
   - o Agree

Telephonic consultation with physiotherapist

3. Was the telephonic consultation with the physiotherapist, a few weeks after discharge from inpatient geriatric rehabilitation, helpful to reduce the level of fear of falling?
   - o No, not at all
   - o No, barely
   - o Yes, a little
   - o Yes, a lot
   - o Yes, very much
   - o I did not receive a telephonic consultation with the physiotherapist

Staying Active Plan

4. Has your '*Staying Active Plan*' been helpful to reduce the level of fear of falling in the past three months?
   - o No, not at all
   - o No, barely
   - o Yes, a little
   - o Yes, a lot
   - o Yes, very much
   - o I do not have a '*Staying Active Plan*'

5. Your '*Staying Active Plan*' contains suggestions for physical exercises. Have you practiced these suggested exercises in the past three months?
   - o Never
   - o Seldom
   - o Sometimes
   - o Usually
   - o Always

6. Your '*Staying Active Plan*' discusses situations which can trigger fear of falling, and gives suggestions what can be helpful to do in such circumstances. Have the suggestions been helpful to reduce the level of fear of falling in the past three months?
   - o No, not at all
   - o No, barely
   - o Yes, a little
   - o Yes, a lot
   - o Yes, very much
   - o I do not have a '*Staying Active Plan*'

7. Do you have any additional remarks?

ADDITIONAL FILE 5 - QUESTIONNAIRE 3

Patient evaluation questionnaire – T3. Six months after discharge from geriatric rehabilitation

Background

In the past few months you have participated in the FIT-HIP trial, a study aimed at evaluating the treatment of fear of falling after hip fracture. Six months ago you were discharged from inpatient geriatric rehabilitation. We are interested in the perceived benefit of the treatment program to reduce fear of falling, specifically after discharge home. We therefore kindly ask you to answer the following questions.

Rehabilitation treatment program

1. Was the inpatient geriatric rehabilitation treatment program helpful to reduce the level of fear of falling in the past three months?
    - o No, not at all
    - o No, barely
    - o Yes, a little
    - o Yes, a lot
    - o Yes, very much

2. As a result of the inpatient geriatric rehabilitation treatment program, in the past three months:

a. I am less concerned to fall
    - o Disagree
    - o Agree

b. I have avoided less activities
    - o Disagree
    - o Agree

Staying Active Plan

3. Has your '*Staying Active Plan*' been helpful to reduce the level of fear of falling in the past three months?
    - o No, not at all
    - o No, barely
    - o Yes, a little
    - o Yes, a lot
    - o Yes, very much

- o I do not have a '*Staying Active Plan*'

4. Your '*Staying Active Plan*' contains suggestions for physical exercises. Have you practiced these suggested exercises in the past three months?
   - o Never
   - o Seldom
   - o Sometimes
   - o Usually
   - o Always

5. Your '*Staying Active Plan*' discusses situations which can trigger fear of falling, and gives suggestions what can be helpful to do in such circumstances. Have the suggestions been helpful to reduce the level of fear of falling in the past three months?
   - o No, not at all
   - o No, barely
   - o Yes, a little
   - o Yes, a lot
   - o Yes, very much
   - o I do not have a '*Staying Active Plan*'

6. Do you have any additional remarks?

ADDITIONAL FILE 5 - QUESTIONNAIRE 4

Evaluation questionnaire FIT-HIP intervention – physiotherapist(s)

Background

The FIT-HIP trial, aimed at evaluating the treatment of fear of falling after hip fracture, has been performed within your health care organization. In the past few months, you have conducted the FIT-HIP intervention. We are interested in your experience with the intervention, and would like to gain insight into the feasibility of the intervention. We therefore kindly ask you to answer the following questions.

General opinion of the FIT-HIP intervention

1. On a scale of 1-10, what is your general opinion of the FIT-HIP intervention?
    - o I would rate the FIT-HIP intervention: … [0-10]

Feasibility of the FIT-HIP intervention

2. To what extent were you able to adequately apply the following elements of the FIT-HIP intervention?

a. Provide psycho-education (concerning fear of falling and fall-risk)
    - o Insufficiently
    - o Barely
    - o Reasonably
    - o Well
    - o Very well

b. Perform the FIT-HIP intake interview
    - o Insufficiently
    - o Barely
    - o Reasonably
    - o Well
    - o Very well

c. Compose the individual FIT-HIP treatment plan (FIT-HIP fear ladders)
    - o Insufficiently
    - o Barely
    - o Reasonably
    - o Well
    - o Very well

d. Guided exposure (using the individual FIT-HIP treatment plan)
    - o Insufficiently
    - o Barely

- o Reasonably
- o Well
- o Very well

e. Assess fear of falling with VAS-scale
- o Insufficiently
- o Barely
- o Reasonably
- o Well
- o Very well

f. Cognitive restructuring (challenging thoughts)
- o Insufficiently
- o Barely
- o Reasonably
- o Well
- o Very well

g. Motivational interviewing techniques
- o Insufficiently
- o Barely
- o Reasonably
- o Well
- o Very well

h. Compose the 'Staying Active Plan'
- o Insufficiently
- o Barely
- o Reasonably
- o Well
- o Very well

i. Conduct the telephonic consultation (booster after discharge)
- o Insufficiently
- o Barely
- o Reasonably
- o Well
- o Very well

3. Is time-constraint a barrier to any future application of the FIT-HIP intervention ?
- o No
- o Yes

Perceived benefit of the FIT-HIP intervention

4. In your opinion, have patients had benefit of the FIT-HIP intervention?
    - o No, not at all
    - o No, barely
    - o Yes, a little
    - o Yes, a lot
    - o Yes, very much

5. In your opinion, have patients had benefit of the following elements of FIT-HIP intervention?

a. Psycho-education (concerning fear of falling and fall-risk)
    - o No, not at all
    - o No, barely
    - o Yes, a little
    - o Yes, a lot
    - o Yes, very much

b. Guided exposure
    - o No, not at all
    - o No, barely
    - o Yes, a little
    - o Yes, a lot
    - o Yes, very much

c. Cognitive restructuring (challenging thoughts) regarding (fear of) falling
    - o No, not at all
    - o No, barely
    - o Yes, a little
    - o Yes, a lot
    - o Yes, very much

d. Motivational interviewing techniques
    - o No, not at all
    - o No, barely
    - o Yes, a little
    - o Yes, a lot
    - o Yes, very much

e. The 'Staying Active Plan'
    - o No, not at all
    - o No, barely
    - o Yes, a little
    - o Yes, a lot

- o Yes, very much

f. Telephonic consultation (booster after discharge)
- o No, not at all
- o No, barely
- o Yes, a little
- o Yes, a lot
- o Yes, very much

Specific instruments and methods

6. Was the use of the Goal Attainment Scale helpful?
- o No, not at all
- o Yes, a little
- o Yes, very

7. Was the use of the VAS-scale for assessing fear of falling during the guided exposure helpful?
- o No, not at all
- o Yes, a little
- o Yes, very

8. Was the use of the worksheet *'Challenging Thoughts'* helpful for the patients?
- o No, not at all
- o Yes, a little
- o Yes, very

9. Was the monthly coaching with psychologists helpful?
- o No, not at all
- o Yes, a little
- o Yes, very

10. Did you have sufficient material to perform the FIT-HIP intervention. If not, please could you explain.
- o Yes,
- o No, namely…[….]

Suggestions for improvement

11. Do you have suggestions for improvement for the following elements of the FIT-HIP intervention:

a. Psycho-education (concerning fear of falling and fall-risk)

b. FIT-HIP intake interview

c. The individual FIT-HIP treatment plan (*FIT-HIP fear ladders*)
d. Guided exposure (using the *individual FIT-HIP treatment plan*)
e. Assessment of level of fear of falling with VAS-scale
f. Cognitive restructuring (*challenging thoughts*)
g. Motivational interviewing techniques
h. The '*Staying Active Plan*'
i. The telephonic consultation (booster after discharge)

12. Do you have additional remarks, or ideas to improve the intervention?

ADDITIONAL FILE 5 - QUESTIONNAIRE 5

Evaluation questionnaire FIT-HIP intervention – psychologist

Background

The FIT-HIP trial, aimed at evaluating the treatment of fear of falling after hip fracture, has been performed within your health care organization. In the past few months you have been involved in the FIT-HIP intervention. We are interested in your experience with the intervention, and would like to gain insight into the feasibility of the intervention. Therefore we kindly request you to answer the following questions.

The role of psychologist within the FIT-HIP intervention

1. Have you, in the context of the FIT-HIP trial:

a. Coached physiotherapist(s)
   - o No
   - o Yes

b. Treated FIT-HIP patients for fear of falling
   - o No
   - o Yes

2. If you did provide treatment for fear of falling to FIT-HIP patients, what was the content of the therapy:

a. Psycho-education
b. Cognitive restructuring
c. Guided exposure
d. Other, namely …[….]

3. In your opinion, was the monthly coaching session helpful for the physiotherapists
   - o No, not at all
   - o Yes, a little
   - o Yes, very

Feasibility of the FIT-HIP intervention

4. In your opinion, are there certain elements of the FIT-HIP intervention that are challenging for a physiotherapist to perform. What are possible reasons for this?
    - o No
    - o Yes, namely:
    - o Psycho-education …[….]
    - o Guided exposure …[….]
    - o Other, namely …[….]

5. In your experience, do patients with fear of falling have specific characteristics, which would indicate treatment by a psychologist (in addition to or instead of a physiotherapist)
    - o No,
    - o Yes, namely …[….]

General opinion of the FIT-HIP intervention

6. On a scale of 1-10, what is your general opinion of the FIT-HIP intervention?
    - o I would rate the FIT-HIP intervention: … [0-10]

Perceived benefit of the FIT-HIP intervention

7. In your opinion, have patients had benefit of the following elements of FIT-HIP intervention, provided by physiotherapists?

a. Psycho-education (concerning fear of falling and fall-risk)
    - o No, not at all
    - o No, barely
    - o Yes, a little
    - o Yes, a lot
    - o Yes, very much
    - o I don't know

b. Guided exposure
    - o No, not at all
    - o No, barely
    - o Yes, a little
    - o Yes, a lot
    - o Yes, very much
    - o I don't know

c. Cognitive restructuring (challenging thoughts) regarding (fear of) falling
   - o No, not at all
   - o No, barely
   - o Yes, a little
   - o Yes, a lot
   - o Yes, very much
   - o I don't know

d. Motivational interviewing techniques
   - o No, not at all
   - o No, barely
   - o Yes, a little
   - o Yes, a lot
   - o Yes, very much
   - o I don't know

e. The 'Staying Active Plan'
   - o No, not at all
   - o No, barely
   - o Yes, a little
   - o Yes, a lot
   - o Yes, very much
   - o I don't know

f. Telephonic consultation (booster after discharge)
   - o No, not at all
   - o No, barely
   - o Yes, a little
   - o Yes, a lot
   - o Yes, very much
   - o I don't know

Suggestions for improvement

8. Do you have suggestions for improvement for the following elements of the FIT-HIP intervention:

a. Guided exposure (using the individual FIT-HIP treatment plan)
b. Cognitive restructuring (challenging thoughts)
c. Motivational interviewing techniques

9. Do you have additional remarks, or ideas to improve the intervention?

ADDITIONAL FILE 5 - QUESTIONNAIRE 6

Evaluation questionnaire FIT-HIP intervention – Elderly Care Physician

Background

The FIT-HIP trial, aimed at evaluating the treatment of fear of falling after hip fracture, has been performed within your health care organization. In the past few months your patients (with hip fracture and fear of falling) have received the FIT-HIP intervention.

We would like to gain further insight into the feasibility of the intervention, for patients and health-care professionals. Therefore we kindly request you to answer the following questions.

Individual FIT-HIP treatment plan

1. Were you informed about the content of the individual FIT-HIP treatment plans?
    - o For all the FIT-HIP patients
    - o For the majority of the FIT-HIP patients
    - o For about half of the FIT-HIP patients
    - o For the minority of the FIT-HIP patients
    - o For none of the FIT-HIP participants patients

2. In your opinion, did the whole team of rehabilitation professionals adhere to/ follow the individual FIT-HIP treatment plan?
    - o Always
    - o Usually
    - o Sometimes
    - o Barely
    - o Never

Perceived benefit of the FIT-HIP intervention

3. In your opinion, have patients had benefit of the FIT-HIP intervention?
    - o No, not at all
    - o No, barely
    - o Yes, a little
    - o Yes, a lot
    - o Yes, very much

General opinion of the FIT-HIP intervention

4. On a scale of 1-10, what is your general opinion of the FIT-HIP intervention?
   - o I would rate the FIT-HIP intervention: … [0-10]

Suggestions for improvement

5. Do you have additional remarks, or ideas to improve the intervention?

ADDITIONAL FILE 5 - QUESTIONNAIRE 7

Evaluation questionnaire FIT-HIP intervention – Nursing Staff

Background

The FIT-HIP trial, aimed at evaluating the treatment of fear of falling after hip fracture, has been performed within your health care organization. In the past few months your patients (with hip fracture and fear of falling) have received the FIT-HIP intervention.

We would like to gain further insight into the feasibility of the intervention, for patients and health-care professionals. Therefore we kindly request you to answer the following questions.

Individual FIT-HIP treatment plan

1. Were you informed about the content of the individual FIT-HIP treatment plans?
    - o For all the FIT-HIP participants
    - o For the majority of the FIT-HIP participants
    - o For about the half of the FIT-HIP participants
    - o For the minority of the FIT-HIP participants
    - o For none of the FIT-HIP participants

2. How often were changes to the individual FIT-HIP treatment plans or progress discussed with the nursing staff (by the physiotherapist)?
    - o Every day
    - o Several times a week
    - o Once a week
    - o Once every two weeks
    - o Once a month
    - o Never

3. Did the nursing staff adhere to/ follow the individual treatment plans?
    - o Always
    - o Usually
    - o Sometimes
    - o Barely
    - o Never

Perceived benefit of the FIT-HIP intervention

4. In your opinion, have patients had benefit of the FIT-HIP intervention?
    - o No, not at all
    - o No, barely
    - o Yes, a little
    - o Yes, a lot
    - o Yes, very much

General opinion of the FIT-HIP intervention

5. On a scale of 1-10, what is your general opinion of the FIT-HIP intervention?
    - o I would rate the FIT-HIP intervention: … [0-10]

Suggestions for improvement

6. Do you have additional remarks, or ideas to improve the intervention?