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Enhancing Orthopedic Care with Telemedicine: Assessing Feasibility and Patient Engagement in Early Discharge Pathways

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Abstract

Background: To investigate the feasibility of telemedicine-enabled functional assessments using a patient-reported outcome questionnaire based on the International Classification of Functioning Disability (ICF) and Health in elderly subjects following a program of early home discharge for femur fracture. **Design:** A questionnaire consisting of 59 items associated with the appropriate ICF categories and including the condition of functioning, activity and participation, and relevant contextual factors was developed to define the patient function profile one month after hospital discharge. **Subjects/Patients:** Elderly patients who underwent surgery for femur fracture were recruited from an orthopedic unit of the hospital. **Methods:** The questionnaire, together with an assessment of patients' satisfaction, was administered through a telemedicine platform. **Results:** Only 75.9% (22 subjects, age = 79 ± 9.7 years, 73% female) of the recruited participants completed the questionnaire within the designated timeframe. Walking impairments and difficulty in climbing stairs were reported as the most affected activities. Regarding the patients' satisfaction, most of the patients were satisfied with the proposed tele-evaluation, although 73% were against further remote evaluation. **Conclusions:** The findings emphasize the challenges of elderly patients' adherence to tele-evaluation, highlighting difficulties in the use of new technologies within specific patient cohorts.

Keywords: international classification of functioning; disability and health; telemedicine; telerehabilitation; femoral fractures; physical therapy modalities; rehabilitation

Academic Editors: Lidia Bajenaru and Virginia Sandulescu

Received: 26 May 2026
Revised: 8 July 2026
Accepted: 14 July 2026
Published: 19 July 2026

1. Introduction

With the increasing average life expectancy, healthcare must adapt by implementing personalized, citizen-centered care models and exploiting technological innovations to meet the needs of fragile patients [1–3]. In older adults recovering from hip fracture surgery, telerehabilitation has progressively emerged as a promising model of care, enabling remote interaction between patients and healthcare professionals through digital technologies [4]. By delivering structured rehabilitation support in home or community settings, it addresses key limitations of traditional in-person care while improving accessibility, particularly for older patients with reduced mobility or those living in rural and underserved areas. In

these patients, in addition to telerehabilitation interventions, functional outcomes might also be assessed remotely, facilitating the timely identification of rehabilitation needs without relying on assistive measures or in-person evaluations. In the metropolitan area of Bologna, Italy, specific pathways of care and programs that integrate social and health responses (i.e., diagnostic and therapeutic care pathways [DTCPs]) for high-frequency conditions, such as femoral fracture in the elderly, have been established. These DTCPs are conceived to ensure continuity of care and facilitate the transition between hospital and community [5]. Managing the care of elderly and fragile patients effectively in challenging [6,7], and options to reduce hospital stay are being explored. Early Supported Discharge (ESD) pathways are a viable solution, facilitating the transition of patients to home-based rehabilitative treatments immediately after discharge [8,9]. Notably, home-based rehabilitation programs are proven to reduce disability [4] and secondary falls after hip fractures [10]. Despite its benefits, implementing ESD pathways is challenging due to issues like patient compliance, caregiver support, and quality of remote care, necessitating reliable methods to monitor patient outcomes post-discharge [11,12]. Telerehabilitation services align with the recent directives of the Italian National Health Service and local regulations stemming from the Next Generation EU program. Specifically, the 2021 National Recovery and Resilience Plan [13] includes the digitalization of public sectors, representing an organizational innovation in care processes, and enhancing the continuity of care, representing a transformative approach to healthcare, especially in the management of chronic and acute conditions. However, telemedicine feasibility and effectiveness within the ESD need thorough evaluation. For orthopedic patients, particularly those recovering from femur fractures, receiving continuous care without the need to remain hospitalized improves their recovery experience and outcomes [14].

Although telemedicine and early supported discharge pathways are relatively recent developments in Italy, similar approaches have already been investigated in several countries. Previous studies suggest that telehealth interventions may facilitate continuity of care after hip fracture surgery; however, issues related to digital literacy, caregiver support, and patient adherence remain important challenges, particularly among older adults [15,16]. Evidence regarding the feasibility of self-administered remote assessments following early discharge is still limited and warrants further investigation [15,16].

Therefore, the objectives of this study were: (1) to evaluate the feasibility of remote administration of a clinical questionnaire in patients with femur fractures who had undergone ESD; (2) to develop from the administered questionnaire an International Classification of Functioning, Disability and Health (ICF) [17,18] profile to gain insights on the problems, barriers and facilitators experienced one month after discharge; (3) to provide insights into how telemedicine can enhance patient engagement and satisfaction.

2. Materials and Methods

2.1. Study Design and Ethical Approval

The reporting of this prospective observational study followed the STROBE checklist for cohort studies [19]. This study was conceived as an exploratory pilot feasibility study aimed at evaluating the practicality and acceptability of a telemedicine-based self-assessment approach rather than producing results generalizable to the wider population of older adults with femoral fractures. Therefore, consecutive sampling was adopted and no formal sample size calculation was performed. This study protocol was approved by the Ethics Committee of the IRCCS Istituto Ortopedico Rizzoli, Bologna (CE AVEC 1062/2021/Oss/IOR). Patients signed a written informed consent before any study-related procedures.

2.2. Subjects

Subjects were recruited consecutively from an orthopedic unit of the IRCCS Istituto Ortopedico Rizzoli, Bologna, Italy, between July 2022 and July 2023 if they met the following inclusion criteria: aged ≥65 years who underwent surgery for a proximal femur fracture due to fragility and completed home rehabilitation with continuity in the territorial rehabilitation network within the ESD. Subjects were excluded if they presented bed rest prior to the surgery, had severe comorbidities (e.g., cognitive impairment) that could interfere with the rehabilitation, did not have a caregiver to support home-based rehabilitation or had previous placement in a nursing home or protected facility.

All participants began the rehabilitation program on the first post-operative day, unless prevented by medical complications. The program consisted of two 30-min physical rehabilitation sessions per day.

2.3. Procedures

Demographic (i.e., age, sex), clinical (i.e., type of surgery, an entity of load at discharge, length of hospitalization, length of stay, defined as the number of days between the day of surgery and discharge) and functional (i.e., premorbid Standard Audit of Hip Fracture in Europe (SAHFE) score [20], Iowa Level of Assistance Scale (ILOA) [21] Rehabilitation Complexity Scale–Extended (RCS-E) [22], Barthel Index (BI) [23], Cumulative Illness Rating Scale (CIRS) [24], 6-Item Cognitive Impairment Test (CIT-6) [25]) data were collected.

2.4. Outcomes

2.4.1. Questionnaire Feedback

The feasibility of administering our telemedicine-based questionnaire was defined as the proportion of patients who completed the questionnaire within the designated timeframe. Participants were asked to complete the questionnaires within approximately one month after receiving the web link. The endpoint for this outcome was set at 80%.

2.4.2. Assessment of Functioning and Environmental Factors

The developed questionnaire consisted of 59 items and was administered 1 month after discharge. These items have been derived from the following instruments:

- Model Disability Survey (MDS) [26];
- Barthel Index (BI) [27];
- World Health Organization Disability Assessment Schedule II, 12-item version (WHO-DAS II-12) [28];
- Nottwil Environmental Factors Inventory (NEFI) [29].

Using standard International Classification of Functioning, Disability and Health (ICF) linking techniques, the items of this questionnaire have been associated with the appropriate ICF categories to describe the condition of functioning, activity and participation, and relevant contextual factors. Its purpose was to develop a patient function profile in accordance with the ICF. The items in the administered questionnaire explore the "b" (body functions), "d" (activity and participation) and "e" (contextual factors) components of the ICF. Based on the MDS item format ("how much of a problem is it for you to perform this activity?"), the response scoring for these items used was a 5-point Likert scale (i.e., 0 = no problem, 1 = mild problem, 2 = moderate problem, 3 = serious problem, 4 = extreme problem). This question-and-response format was extended to all items from the other scales, standardizing the entire questionnaire to facilitate completion. For questions investigating the "e" component (contextual factors), the values ranged from −4 to 4 points (−4 = extreme facilitation, −3 = important facilitation, −2 = moderate facilitation, −1 = mild facilitation, 0 = neither problem nor facilitation, 1 = mild problem, 2 = moderate

problem, 3 = serious problem, 4 = extreme problem). For items in the questionnaire that are not applicable to the respondent's life conditions (e.g., participation in work activities for a retired person), code 9 (=not applicable) was used. The availability of the ICF category and the first qualifier for each question allows for the generation of an ICF code that describes the patients' disability experience from their perspective regarding the considered concept. Organizing the generated ICF codes into a specific graphical format, a "patient ICF profile" was created. This profile enables a quick assessment of the patient's disability experience and the contextual factors impacting it from the patient's (or caregiver's) perspective. This questionnaire was administered through telemedicine and was aimed at evaluating the patient's functional and disability profile approximately one month after hospital discharge.

2.4.3. Assessment of the Patient's Satisfaction

This questionnaire was developed based on the conceptual constructs of the Telehealth Usability Questionnaire (TUQ) [30] with the objective of investigating the patient's satisfaction and difficulties in filling out the form. Along with the items regarding satisfaction and future use (items A, B, E, and F), we have added a question on the ease of use (item C) and one on the reliability component (item D) of the TUQ. The patient could be required to express their own degree of disagreement or agreement with some statements concerning (i.e., the difficulty in filling out the questionnaire, satisfaction with the tele-evaluation compared to the traditional visit and willingness to repeat in the future). The scoring of these items is composed of a 4-point Likert scale (1 = totally in disagreement, 2 = partially in disagreement, 3 = partially in agreement, 4 = totally in agreement). Data were collected online via the HealthMeeting® telemedicine platform (Version 2.0, Wezen Technologies s.r.l., Bologna, Italy), ensuring accessibility and ease of use for patients. The HealthMeeting® software was utilized for the tele-evaluation. The software was customized to include electronic versions of the questionnaires, links for patients to complete the questionnaires, and tools for generating an ICF profile based on the patient's responses. Telemedicine was used exclusively for the remote administration of the functional and satisfaction questionnaires. After discharge, participants received a web link to access the HealthMeeting® platform and were asked to complete the questionnaires within one month. No scheduled teleconsultations, video calls, or tele-rehabilitation sessions were included.

2.5. Data Analysis

Descriptive statistics were used to describe the collected variables. Particularly, mean ± standard deviation (SD), frequency with absolute percentage, and median with first and third quartiles were computed for interval, categorical and ordinal variables, respectively. For the development of the median ICF profile, the scores of each item were described using the median with the first and second quartiles; moreover, the count for each score of each item was calculated. All statistical analyses were performed with SPSS software (Version 20 for Windows; SPSS Inc., Chicago, IL, USA).

3. Results

3.1. Feasibility

About 109 eligible patients, 29 of them (26.6%) agreed to participate in the study and of those, 22 (75.9%) completed the questionnaire. The mean age was equal to 79.2 ± 9.7 years, and the majority was female (72.7%). Most subjects had a hip replacement (45.5%) and had a partial load at discharge (81.8%). All participants included in the early supported discharge pathway completed a structured home-based rehabilitation program within the territorial rehabilitation network. The subject's demographic and clinical characteristics are

shown in Table 1. Data regarding rural or urban residence and hospital readmission after discharge were not collected systematically in this study.

Table 1. Demographic, clinical and functional characteristics of the included subjects (n = 22).

Variable	N (%)	Mean ± SD	Median (1°, 3° Quartile)
Age (*years*)		79.2 ± 9.7	
Sex			
Female	16 (72.7)		
Male	6 (27.3)		
Type of surgery			
Hip arthroplasty (THA, endoprosthesis)	11 (50.0)		
Intramedullary nail	8 (36.4)		
Other (osteosintesis, revision)	3 (13.6)		
Entity of weight-bearing at discharge			
Partial weight-bearing, 30–50%	18 (81.8)		
Non-weight-bearing	3 (13.6)		
Minimal weight-bearing, 0–30%	1 (4.6)		
Post-operative LoS (*days*)		9.3 ± 3.0	
Pre-operative LoS (*days*)		2.0 ± 0.9	
SAHFE			1.0 (1.0, 2.0)
BI			71.0 (64.3, 8.3)
RCS-E			6.6 (4.0, 9.0)
CIRS			1.3 (1.2, 1.5)
ILOA at five days			35.0 (31.5, 37.8)

Abbreviations: N, number; %, percentage; SD, standard deviation; THA, total hip arthroplasty; LoS, length of stay; SAHFE, Standardized Audit of Hip Fracture in Europe; BI, Barthel Index; RCS-E, Rehabilitation Complexity Scale–Extended; CIRS, Cumulative Illness Rating Scale; ILOA, Iowa Level of Assistance. Notes: Post-operative LoS (length of stay) was calculated from the date of surgery to discharge. Pre-operative LoS (length of stay) was calculated from the date of admission to surgery.

3.2. Functioning and Environmental Factor Profile

The median ICF profile of the included subjects obtained from questionnaires for the body functions, activities participation, and contextual factors are reported in Tables 2 and 3, respectively (see also Supplementary Material S1 for detailed description).

Table 2. Median ICF profile of the included subjects obtained from the questionnaire for functions and activities. For each score category (no problem, mild problem, moderate problem, serious problem, extreme problem), the frequencies of the responses of each subject are reported. Furthermore, in the last three columns, the median with the first and third quartiles for the responses to each item is reported. Finally, the yellow cell corresponding to the highest score represents the median.

	N	ICF Cat	Content	Item	No Problem	Mild Problem	Moderate Problem	Serious Problem	Extreme Problem	1° Q	Med	3° Q
					0	*1*	*2*	*3*	*4*			
Mental functions	1	b1300	Energy level	How much of a problem is it for you to feel tired and lacking energy?	0	1	17	4	0	2	2	2
	2	b1302	Appetite	How much of a problem is loss of appetite or increased appetite for you?	2	11	8	1	0	1	1	2
	3	b134	Sleep functions	How much of a problem is it for you not being able to sleep or sleeping badly?	1	0	7	13	1	2	3	3
	4	b140	Attention functions	How much of a problem is poor concentration or distractibility for you?	0	3	6	13	0	2	3	3
	5	b144	Memory functions	How much of a problem is the lack of memory for you?	1	2	2	15	2	2.8	3	3
	6	b1522	Range of emotion (sadness and depression)	How much of a problem is it for you to feel sad or depressed?	3	3	4	11	1	1	3	3
	7	b1522	Range of emotion (nervousness and worry)	How much of a problem is it for you to feel nervous or worried?	1	9	11	1	0	1	2	2
	8	b164	Higher-level cognitive functions	How much of a problem is it for you to find solutions to problems in everyday life?	12	6	2	2	0	0	0	1

https://doi.org/10.3390/fi18070375

Table 2. *Cont.*

	N	ICF Cat	Content	Item	No Problem	Mild Problem	Moderate Problem	Serious Problem	Extreme Problem	1° Q	Med	3° Q
					0	*1*	*2*	*3*	*4*			
Sensory functions and pain	9	b21000	Binocular acuity of distant vision	How much of a problem is it for you to see from afar?	2	7	13	0	0	1	2	2
	10	b21002	Binocular acuity of near vision	How much of a problem is it for you to see up close (for example, at arm's length)?	2	9	7	4	0	1	1.5	2
	11	b230	Hearing functions	How much of a problem is it for you to hear what another person says while conversing with them?	7	6	9	0	0	0	1	2
	12	b240	Vestibular functions	How much of a problem is dizziness for you?	9	4	6	3	0	0	1	2
	13	b280	Sensation of pain	How much of a problem is pain for you in your daily life?	1	1	16	4	0	2	2	2
Motor functions	14	b755	Involuntary movement reaction functions	How much of a problem is losing balance for you?	4	4	6	7	0	1	2	3
Learning and applying knowledge	15	d160	Focusing attention	How much of a problem is it for you to concentrate on doing something for ten minutes?	8	8	6	0	0	0	1	2
	16	d155	Acquiring skills	How much of a problem is it for you to learn new things, like, for example, learning to get to a new place?	11	6	4	1	0	0	0.5	1.3

Table 2. *Cont.*

	N	ICF Cat	Content	Item	No Problem	Mild Problem	Moderate Problem	Serious Problem	Extreme Problem	1° Q	Med	3° Q
					0	*1*	*2*	*3*	*4*			
Mobility	17	d415	Maintaining body position	How much of a problem is it for you to stand for a long time, as 30 min?	3	8	8	3	0	1	1.5	2
	18	d420	Transferring oneself	How much of a problem is it for you to transfer from bed to wheelchair and vice versa?	7	8	5	2	0	0	1	2
	19	d450	Mobility	How much of a problem is it for you to walk at least 50 m?	4	10	5	3	0	1	1	2
	20	d450	Walking	How much of a problem is it for you to walk a long distance, as a mile?	1	4	10	5	2	1.8	2	3
	21	d455	Moving around	How much of a problem is stair climbing (going up and down a flight of stairs) for you?	6	9	2	5	0	1	2	3.3
	22	d465	Moving around using equipment	How much of a problem is it for you to use the wheelchair (making turns, changing direction, approaching the table, the bed, the toilet, etc.)?	12	3	6	1	0	0	0	2
Activities of daily living	23	d510	Washing oneself	How much of a problem is it for you to take a bath or shower?	3	12	5	2	0	1	1	2
	24	d510	Washing oneself	How much of a problem is it for you to wash your whole body?	3	9	9	1	0	1	1	2

Table 2. *Cont.*

	N	ICF Cat	Content	Item	No Problem	Mild Problem	Moderate Problem	Serious Problem	Extreme Problem	1° Q	Med	3° Q
					0	*1*	*2*	*3*	*4*			
Activities of daily living	25	d520	Caring for body parts	How much of a problem is it for you to take care of your personal hygiene (for example, washing your hands, face, teeth, combing your hair, etc.)?	7	9	6	0	0	0	1	2
	26	d530	Toileting	How much of a problem is it for you to go to the bathroom and use the toilet (sit on the toilet, take off and put on your clothes again without getting dirty, use toilet paper)?	8	10	3	1	0	0	1	1
	27	d5300	Regulating urination	How much of a problem is it for you to check your urine?	12	7	1	2	0	0	0	1
	28	d5301	Regulating defecation	How much of a problem is it for you to check your stool?	14	6	1	1	0	0	0	1
	29	d540	Dressing	How much of a problem is it for you to get dressed (put on all clothing, including shoes and corsets or prosthetics if you use them)?	5	13	3	1	0	0.8	1	1
	30	d540	Dressing	How much of a problem is getting dressed for you?	9	9	3	1	0	0	1	1
	31	d550	Eating	How much of a problem is eating for you?	20	1	1	0	0	0	0	0
	32	d560	Drinking	How much of a problem is drinking for you?	21	0	1	0	0	0	0	0

Table 2. *Cont.*

	N	ICF Cat	Content	Item	No Problem	Mild Problem	Moderate Problem	Serious Problem	Extreme Problem	1° Q	Med	3° Q
					0	*1*	*2*	*3*	*4*			
Activities of daily living	33	d570	Looking after one's health	How much of a problem are your emotions for you in relation to your health?	15	5	2	0	0	0	0	1
Social participation	34	d698	Other specified domestic life	How much of a problem is it for you to take care of your home and family as far as it is your responsibility?	5	6	8	1	2	0.8	1.5	2
	35	d730	Relating with strangers	How much of a problem is it for you to interact with people you do not know?	19	2	1	0	0	0	0	0
	36	d750	Informal social relationships	How much of a problem is it for you to maintain a friendship?	20	1	1	0	0	0	0	0
	37	d839	Education, other specified and unspecified	How much of a problem is it for you to carry out daily study activities?	21	0	0	1	0	0	0	0
	38	d845	Acquiring, keeping and terminating a job	How much of a problem is it for you to carry out your daily work activities?	18	4	0	0	0	0	0	0
	39	d999	Community, social and civic life, unspecified	How much of a problem is it for you to participate in community activities (e.g., parties, religious or other activities) like everyone else?	20	1	0	1	0	0	0	0

Table 3. Median ICF profile of the included subjects obtained from the questionnaire for contextual factors. For each score category (extreme facilitation, important facilitation, moderate facilitation, mild facilitation, neither problem nor facilitation, mild problem, moderate problem, serious problem, extreme problem), the frequencies of the responses of each subject are reported. Furthermore, in the last three columns, the median with the first and third quartiles for the responses to each item is reported. Finally, the yellow color of cell corresponding to the highest score represents the median.

	N	ICF Cat	Content	Item	Facilitation				Neutral	Problem				1° Q	Med	3° Q
					Extreme	Imp.	Mod.	Mild		Mild	Mod.	Serios	Extreme			
					−4	*−3*	*−2*	*−1*	*0*	*1*	*2*	*3*	*4*			
Products and technology	40	e110	Products or substances for personal consumption	How much do the drugs you take regularly make your life easier or more difficult?	4	5	11	2	0	0	0	0	0	−3	−2	−2
	41	e115	Products and technology for personal use in daily living	If you regularly use consumables for care (for example, diapers, catheters, etc.), how much do they make your life easier or more difficult?	0	3	6	5	7	0	1	0	0	−2	−1	0
	42	e1200	General products and technology for personal indoor and outdoor mobility and transportation	How much does public transport make your life easier or more complicated?	0	0	1	5	15	0	0	0	0	−1	0	0
	43	e1201	Assistive products and technology for personal indoor and outdoor mobility and transportation	If you use walking aids such as a walker or wheelchair, how much do they make your life easier or more difficult?	2	4	6	4	6	0	0	0	0	−3	−2	0
	44	e1201	Assistive products and technology for personal indoor and outdoor mobility and transportation	How much do the wheelchair and walking aids you use make your life easier or more difficult?	3	3	7	1	8	0	0	0	0	−3	−2	0
	45	e125	Products and technology for communication	How much do the communication products you use make your life easier or more complicated?	0	0	3	2	17	0	0	0	0	−0.3	0	0

Table 3. *Cont.*

	N	ICF Cat	Content	Item	Facilitation				Neutral	Problem				1° Q	Med	3° Q
					Extreme	Imp.	Mod.	Mild		Mild	Mod.	Serios	Extreme			
					−4	*−3*	*−2*	*−1*	*0*	*1*	*2*	*3*	*4*			
	46	e150	Design, construction and building products and technology of buildings for public use	How much do the ways of accessing public places make your life easier or more complicated?	0	0	1	3	17	1	0	0	0	0	0	0
	47	e155	Design, construction and building products and technology of buildings for private use	How much do the methods of access to private places (for example, family or friends' homes) facilitate or complicate your life?	0	0	0	2	18	2	0	0	0	0	0	0
	48	e165	Assets	How much does the amount of economic resources you have to make your life easier or more difficult?	0	5	12	2	2	0	1	0	0	−2.3	−2	−1.8
Natural environment and human-made changes to the environment	49	e225	Climate	How much do climatic conditions make your life easier or more complicated?	0	1	2	3	16	0	0	0	0	−1	0	0
Support and relation-ships	50	e310	Immediate family	How much does your immediate family make your life easier or more difficult?	2	10	8	1	1	0	0	0	0	−3	−3	−2
	51	e320	Friends	How much do your friends make your life easier or more complicated?	0	0	2	4	16	0	0	0	0	−1	0	0
	52	e340	Personal care providers and personal assistants	How much does the staff who provide help or assistance make your life easier or more difficult?	2	4	5	2	9	0	0	0	0	−3	−1.5	0

Table 3. *Cont.*

	N	ICF Cat	Content	Item	Facilitation				Neutral	Problem				1° Q	Med	3° Q
					Extreme	Imp.	Mod.	Mild		Mild	Mod.	Serios	Extreme			
					−4	*−3*	*−2*	*−1*	*0*	*1*	*2*	*3*	*4*			
Attitudes	53	e410	Individual attitudes of immediate family members	How much do the individual attitudes of your immediate family make your life easier or more difficult?	0	8	4	2	8	0	0	0	0	−3	−2	0
	54	e420	Individual attitudes of friends	How much do your friends' individual attitudes make your life easier or more complicated?	0	0	2	2	18	0	0	0	0	0	0	0
	55	e425	Individual attitudes of acquaintances, peers, colleagues, neighbors and community members	How much do the individual attitudes of colleagues make your life easier or more complicated?	0	0	0	0	22	0	0	0	0	0	0	0
	56	e460	Societal attitudes	How much do society's attitudes make your life easier or more complicated?	0	0	0	2	19	1	0	0	0	0	0	0
Health services, systems and policies	57	e570	Social security services, systems and policies	How much do social and welfare support services make your life easier or more complicated?	0	1	0	6	15	0	0	0	0	−1	0	0
	58	e580	Health services, systems and policies	How much do supportive health services make your life easier or more difficult?	0	2	7	9	4	0	0	0	0	−2	−1	−1
	59	e595	Political services, systems and policies	How much do national, regional or local legal rules make your life easier or more complicated?	0	0	2	10	10	0	0	0	0	−1	−1	0

3.3. Patients' Satisfaction

Out of the twenty-two recruited patients, twenty completed the satisfaction questionnaires. Figure 1 displays the frequency distribution of the responses. About half of the patients (n = 10, 47.6%) partially agreed and partially disagreed that they were equally satisfied with telemedicine and a traditional visit (item#A). Most of the patients (n = 17, 81.0%) felt comfortable and relaxed during the telemedicine evaluation (item#B). Most of the patients (n = 13, 61.9%) partially disagreed that filling out the questionnaire was easy (item#C). Sixteen (76.2%) patients partially agreed that the information in the questionnaire could be useful to the clinician for a better understanding of their health status (item#D). Sixteen (76.2%) patients disagreed (partially or totally) that they were willing to fill out the questionnaire again in a subsequent evaluation (item#E). Finally, 12 (57.1%) subjects partially agreed that they were satisfied with the telemedicine evaluation (item#F), while 8 (38.1%) patients disagreed. These results were analyzed using a chi-square test, resulting in a statistical significance value ($p < 0.0001$, $\chi^2 = 60.35$, df = 15).

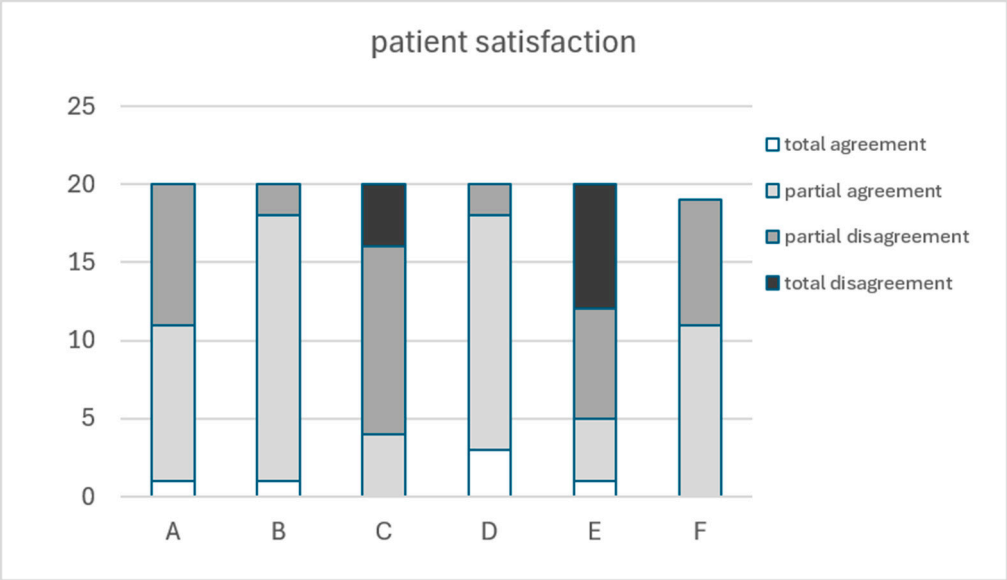

Figure 1. Results regarding the patients' satisfaction. Legend: (**A**) Compared to the traditional visit with outpatient access in presence, I am equally satisfied; (**B**) during the visit I felt comfortable and relaxed; (**C**) filling out the questionnaire was easy; (**D**) I think the information provided in the questionnaire was useful for the physician in better understanding my health problems; (**E**) I am available to fill in the questionnaire again in the future for a face-to-face visit and/or a tele-evaluation; (**F**) overall, I am satisfied with today's remote evaluation.

4. Discussion

In the present study we have investigated the feasibility of a remote assessment of functional information using a questionnaire based on ICF. We reported that in a specific population of elderly patients who underwent surgery for femur fracture and were discharged home, only 75.9% of the recruited participants completed the questionnaire within the designated timeframe failing the minimum target for feasibility. Several factors may have contributed to this outcome. The effectiveness of technology in healthcare and rehabilitation also relies on the end user, and digital literacy, caregiver involvement, and technical or physiotherapist support are relevant particularly for seniors. Unlike other studies on telerehabilitation after hip fracture surgery in the elderly [4,31,32] which included motivational feedback or physiotherapist guidance, patients in our study did not receive reminders or follow-up contact to complete the form. We believe this aspect could

have affected our results and that in future studies an automatic phone reminder or a protocol-based follow-up call should be improved. The questionnaire we have developed is in line with the ICF categories previously identified to tailor post-hip fracture surgery rehabilitation programs [33]. The questionnaire provides a multidimensional framework of a selected population of aged patients recovering from femur fractures. Indeed, since the patient cohort in this study was enrolled in specific pathways designed to ease the transition between hospital and community care, our focus encompassed both physical functioning (activity and participation aspects) and environmental contextual factors. The mental function categories are considered essential components in post-hip fracture rehabilitation [33] since 42% of aged patients with femur fractures are cognitively impaired [34]. Although cognitively impaired subjects (6-CIT > 7) were excluded from the present study, patients declared serious problems with attention (item#4), memory (item#5), and sleep (item#3). They complained of depressive mood (item#6), reporting the questionnaire's worst scores in these areas. Hospitalization, decreased mobility, loss of self-sufficiency, and social isolation following femur fracture place stress on mental functions and contribute to the decline of age-related cognitive function. These aspects have a greater impact on the quality of life of the patients. Answers to item#13 (pain) and item#14 (balance) showed that both aspects represent a problem in these patients, in most cases, moderate. Proper control of pain is a central point in rehabilitation to gain the recovery of hip range of motion and ambulation. Correct balance is linked to the recovery of lost muscle mass and walking ability, providing a means to evaluate rehabilitative progress while also assessing the risk of future falls. Notably, acquiring new skills (item#16) was perceived as a minor challenge, allowing patients to follow rehabilitation programs successfully. According to the literature, the most frequently reported positive outcomes in hip fracture rehabilitation are associated with measures of ambulatory ability and mobility [35]. As expected, most of our patients reported moderate difficulty, specifically walking long distances (item#20) and stair climbing (item#21), in line with the timing of recovery from a femur fracture (i.e., medium term). Patients reported the restoration of walking abilities and activities of daily living, including postural transitions and transfers, dressing and personal hygiene care. The mobility dataset is particularly valuable when compared to the information and measurements gathered at recruitment and prior to discharge (BI, RCS-E, SAHFE and ILOA), as it aids in monitoring outcomes within this patient group. Regarding social participation, the subjects rated taking care of the family and the home as a moderate challenge. This finding may seem unexpected, but it reflects a selected older population, primarily composed of women who were largely independent prior to their femur fracture. Analyzed contextual factors were never rated as a problem; indeed, patients perceive family and caregivers as moderate to extreme facilitators. Notably, all the patients have had a solid social context since they returned home with family members or caregiver assistance. Also, technology for mobility (item#43, item#44) is considered a moderate facilitator. Only a few patients reported encountering barriers when accessing public or private buildings. Regarding satisfaction, half of the patients were pleased with the proposed remote evaluation, while the other half were not. Additionally, more than half of the patients reported difficulty in completing the computer-based questionnaire. Overall, the responses suggested that patients were satisfied with the proposed tele-evaluation, even in comparison to traditional visits, indicating that they felt they had sufficient attention and were comfortable and at ease during self-assessment. Nevertheless, aged patients reported difficulties in completing the questionnaire. Their unfamiliarity with the technology and the effort needed to answer the 59 questions negatively affected their willingness to participate in future telemedicine evaluations (item#E). In its current format, envisioning a monitoring system reliant on administering evaluation questionnaires via telemedicine is challenging, especially for this

group of elderly patients. Indeed, patients stated that they would be unwilling to complete the questionnaire or engage in a tele-visit in the future. Conversely, a previous study on breast cancer patients in a clinical setting reported high acceptability of using computer-based questionnaires for self-assessing health conditions and quality of life [36] and similar findings were reported for telemedicine follow-up in endometrial cancer patients [37]. Our observation also differs from other studies in which the telemedicine visit was considered a valid alternative [38,39]. A possible explanation could be that, in these studies, the subjects affected by cancer, who typically require ongoing care, likely appreciated the chance to avoid frequent hospital visits. In contrast, the enrolled patients experienced an acute event and needed only one or a few standard follow-up visits. Another reason for the observed differences may be the older mean age of the patients in the present study (78.5 years), as they are generally less familiar with new technologies compared to the patients in the other studies.

Several factors may explain the low participation and completion rates observed in this study. Participants were very old adults recovering from an acute event and were required to independently complete a 59-item online questionnaire after discharge. Limited digital literacy, inconsistent caregiver support, and the absence of reminder calls or other engagement strategies may have negatively affected adherence. Therefore, the low response rate should not necessarily be interpreted as a lack of interest in telemedicine itself, but rather as the result of technological and practical barriers in this frail population.

We found low engagement of patients in the proposed research. Only 26.6% of patients who met the inclusion criteria (among others, with no cognitive impairment) agreed to participate in the study, and 7 of them did not complete the questionnaire. However, the primary challenge arises from the use of technology and the self-administered questionnaire, which requires the activation of an internet-connected electronic device and, more critically, maintaining focused attention for approximately 15 min. Regarding the patient satisfaction [30], the proposed service of tele-evaluation was appreciated. However, either the technology or the layout of the questionnaire represented a barrier for the cohort of aged patients under study. Notably, the response to item#D indicates that even a remote approach fosters a sense of continuity in care. As telemedicine services are increasingly being considered within community-based care pathways, particularly to support continuity of care and reduce the need for unnecessary hospital access, easier and more user-friendly tools should be developed for older and frail patients. The present findings should be interpreted with caution. This exploratory pilot study was conducted in a single center and involved a small sample, limiting the representativeness and generalizability of the results. Furthermore, no specific strategies aimed at improving adherence were implemented, and the relatively long self-administered questionnaire, together with inconsistent caregiver support, may have negatively affected participation. Finally, the limited sample size precluded subgroup analyses. Larger multicenter studies are needed to confirm these preliminary findings.

5. Conclusions

The present exploratory pilot study suggests that telemedicine-based self-assessment may represent a potentially useful strategy for supporting continuity of care after early discharge following femoral fracture. However, substantial barriers to patient engagement were identified. Advanced age, limited digital literacy, inconsistent caregiver availability, and the burden associated with completing a relatively long self-administered questionnaire appeared to negatively influence adherence.

Therefore, these findings should be considered preliminary and interpreted with caution. Future studies involving larger and more representative populations should

investigate whether simplified questionnaires, clearer interfaces, reminder systems, and caregiver- or clinician-assisted completion strategies may improve feasibility and patient engagement. Such developments could facilitate the integration of telemedicine into post-discharge orthopedic pathways for older adults.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/fi18070375/s1, Supplemental Material S1 (SMS1): Detailed results for the functioning and environmental factor profile.

Author Contributions: Conceptualization: D.P., R.T. and F.L.P.; methodology: D.P., S.O., A.O.M., G.M.F. and F.L.P.; formal analysis: D.P., R.T., G.M.F. and L.P.; data collection: R.T. and D.P.; writing—original draft preparation: D.P., F.V. and R.T.; writing—review and editing: D.P., R.T., L.B. and F.L.P.; supervision: D.P. All authors have read and agreed to the published version of the manuscript.

Funding: Italian Ministry of Health 5X1000 fund "anno 2022 (redditi 2021)" to IRCCS Istituto Ortopedico Rizzoli, Bologna; FONDAZIONE CARISBO ID 19143-2020.

Institutional Review Board Statement: This study protocol was approved by the Ethics Committee of the IRCCS Istituto Ortopedico Rizzoli, Bologna (Number: CE AVEC 1062/2021/Oss/IOR; Date of approval 16 February 2022).

Data Availability Statement: All data of present work are preserved by Prof. Daniela Platano and could be available upon request to the corresponding author.

Acknowledgments: We dedicate this paper to the memory of Maria Grazia Benedetti, who recently passed away, in recognition of her contributions to much of the work presented here, as well as her invaluable scientific support and expertise in research. She was the Director of the Physical Medicine and Rehabilitation Unit, IRCCS Rizzoli Orthopedic Institute, and Full Professor in Physical and Rehabilitation Medicine at Alma Mater Studiorum, University of Bologna.

Conflicts of Interest: The authors declare no conflicts of interest.

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