



# Robot-Assisted Physical Exercise in Acutely Hospitalised Geriatric Patients: Insights From the ROBUST RCT – A Case Report

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**Introduction and Purpose:** Hospitalised older patients are at high risk of functional decline due to prolonged inactivity. Gerontechnology, including robot-assisted physical exercise, may support early mobilisation, but its use in acute hospital settings remains underexplored. This case report provides an in-depth insight into robot-assisted physical exercise in an older patient admitted to a geriatric department, reflecting the clinical setting of geriatric care during acute hospitalisation and highlighting real-world challenges related to engagement and adherence.

**Method and Materials:** As part of an ongoing randomised controlled trial (RCT), this case report includes a 98-year-old woman randomised to active robot-assisted physical exercise. The intervention was offered twice daily during hospital stay. A structured, semi-guided interview was conducted at discharge to explore the patient's experiences, motivation, and perceived impact of the exercise. This report presents a detailed description of the intervention including exercise, progression, adherence and the patient's experience.

**Results:** The patient described the exercise as engaging, mood-lifting, and beneficial. However, fatigue impacted adherence, resulting in 50% adherence. Functionally, the patient demonstrated increased independence, reflected by an improvement in Barthel Index (0–100, higher scores indicate greater independence) from 57 at admission to 69 at discharge. Chair stand test performance did not change.

**Conclusion:** Based on this single case, robot-assisted physical exercise was positively perceived, even by a frail, hospitalised older patient. However, fluctuating energy levels highlight the need for flexible, patient-centred strategies. This case provides early insight into feasibility, motivation, and real-world adherence, contributing to understanding how robotic rehabilitation may support early mobilisation. Further evidence from the ongoing RCT will clarify its effectiveness in improving outcomes in this population.

**Trial Registration:** ClinicalTrials.gov NCT05782855.

**Keywords:** Case report, geriatrics, robot-assisted physical exercise, acute hospitalisation

## Introduction

One of the major global challenges in healthcare is an aging population, as the growing number of older adults places increasing demands on healthcare systems worldwide.<sup>1</sup> Older people are frequently hospitalised and are particularly vulnerable to hospital-related risks, including immobility and functional decline, which are both associated with longer hospital stays and increased institutionalisation.<sup>2</sup> Low in-hospital mobility is directly linked to functional deterioration at discharge and during post-discharge follow-up.<sup>2</sup> Studies have shown that one in five older patients who do not meet the

criteria for sarcopenia at baseline develop it within one week of hospitalisation or by discharge.<sup>3</sup> Additionally, strength loss during hospitalisation disproportionately affects the lower limbs, with an average reduction of 11% in knee-extension strength.<sup>4</sup> Consequently, many older patients struggle to regain their pre-hospitalisation functional level and independence, making it critical to implement strategies that counteract this process.<sup>5</sup>

Despite this, most hospital settings remain poorly adapted to meet the rehabilitation needs of older patients, and efforts to minimise hospital-related inactivity are needed.<sup>3</sup>

Gerontechnology, a multidisciplinary field merging aging and technology, has gained recognition for its potential to enhance care and improve quality of life for older adults and their caregivers.<sup>6</sup> By harnessing technological solutions, it aims to prevent, delay, or compensate for perceptual, cognitive, and physical decline associated with aging,<sup>7</sup> offering promising innovations to counteract the challenges of inactivity during hospitalisation.

In particular, robotic exercise systems are gaining attention in the field of rehabilitation and mobility support due to their potential to facilitate early mobilisation and reduce the physical demands placed on healthcare staff.<sup>8</sup> Compared to conventional manual exercise, robot-assisted rehabilitation may deliver greater consistency, durability, and precision, allowing for intensive and repetitive exercise sessions that are essential for effective recovery.<sup>9</sup>

However, the integration of robotic assistance systems into clinical settings remains complex, requiring a clear description of interventions to advance physical therapy research and improve the implementation of evidence-based rehabilitation.<sup>8,10</sup>

This case report is part of a large randomised controlled trial (RCT) investigating the effects of robot-assisted physical exercise on older geriatric patients during acute hospitalisation.<sup>11,12</sup> While the RCT includes more than 400 patients, the aim of this case report is to focus on one patient receiving active robot-assisted physical exercise in order to provide in-depth insights into the intervention and patient experience within this setting.

## Method

This case report provides a detailed description of the intervention, using descriptive tables to illustrate baseline characteristics, outcomes, patient admission timeline, adherence and progression.

Additionally, the case report incorporates patient perspectives from a structured interview conducted during hospitalisation, offering insight into the patient's individual, person-centered experience with robot-assisted physical exercise.

The structured interview was transcribed verbatim, and quotes were reviewed by two researchers (ASB and LM) and categorised into themes emerging from the material.

Baseline characteristics and outcome data were collected through structured outcome assessments at baseline (within a maximum of 48 hours from admission to the Department of Geriatric Medicine) and on the day of discharge.

The case was selected as a convenience sample during hospitalisation. The patient was included because she was willing and able to participate in both the interview and the case report and because she provided complete outcome data for the hospital stay. Her age, frailty, and clinical presentation were broadly representative of the ROBUST RCT population. In this report, the term "geriatric patient" refers specifically to individuals admitted to the geriatric department, reflecting the clinical setting in which the intervention was delivered. The case report is designed with inspiration from the CARE guideline on reporting case reports<sup>13</sup> and the study was conducted in accordance with the Declaration of Helsinki.

## Outcome Measures

### Baseline Measures

Demographic data was collected at baseline: age, gender, civil and living status, body mass index (BMI), use of daily medications, C-reactive protein (CRP) blood sample (mg/L) (as an indicator of acute illness severity), historic Barthel Index 100 (14 days before hospital admission), and reason for hospital admission.

### Primary and Secondary Outcomes

Primary outcome was functional status defined as activities of daily living (ADL) measured by Barthel Index 100<sup>14–16</sup> and 30-second chair stand test<sup>17</sup> from baseline to the day of discharge. ADL characterise the capability of a person to do

every day routine activities. The current study uses Barthel Index-100, which is a recognised and simple scoring instrument used to evaluate basic ADL functions, the level of physical performance, and the intensity of needed care.<sup>14,18</sup> The Barthel Index is a sum score across ten domains of ADL and the total score ranges from 0 (completely dependent) to 100 (completely independent).<sup>16</sup>

Secondary outcomes assessed at baseline and discharge included Barthel Index 100, 30-second chair stand test, discharge destination, quality of life (EQ-5D VAS score),<sup>19</sup> concern about falling (Short Falls Efficacy Scale International (short FES-I)),<sup>20</sup> cognitive function (The Mini-Mental State Examination (MMSE<sup>®</sup>)),<sup>21</sup> mood status (The Geriatric Depression Scale (GDS)),<sup>22</sup> and length of hospital stay.

See the protocol paper for a complete and detailed description of primary and secondary outcomes in the ROBOST RCT.<sup>11</sup>

## Overall Intervention

As the intervention is central to understanding the patient's experience, a detailed description of the ROBUST training protocol is included here to support interpretation of the case findings.

## The Hospital Setting

The study took place at the Department of Geriatric Medicine at Odense University Hospital, Svendborg, Denmark. All patients were acutely admitted and the department serves an intake area representative of other hospital intake areas in Denmark.<sup>11</sup> The staff managing the robot were employed health-care-students entitled as “trainers” in the following section.

## Timeline

Patients were enrolled within a maximum of 48 hours from admission to the Department of Geriatric Medicine. After enrolment and baseline outcome tests, patients were randomly allocated to either active or passive robot-assisted physical exercise twice daily, including weekends and public holidays, with a minimum of three hours between daily sessions until discharge.

## Robot Technology

The robot-assisted physical exercise was performed using an innovative exercise robot (ROBERT<sup>®</sup>). The robot was able to hold the patient's leg and perform extension movements of the hip and knee while the patient was lying in bed, with the exercises performed on one leg at a time. This approach enabled even very frail or bedridden patients to participate in the exercises (Figure 1). In the active intervention group, the movement was performed actively by the patient using muscular power to stretch the leg while the robot provided low/moderate resistance. In the passive control group, the robot moved the patient's leg through hip and knee extension without requiring any active muscle engagement from the patient.

## The Exercise Setting and Movement Programming

The robot was equipped with four wheels, and one person could easily roll the robot into the patient's hospital room and positioned it next to the hospital bed. With the patient situated supine in bed the robot was connected to the patient's leg with a brace on the foot and lower leg. The brace was attached to the robot, which would lift and hold the patient's leg. Exercise was conducted on one leg at a time in random order.

The patient's leg was positioned with the hip flexed at 70–80°, the knee at 120°, and the ankle in a neutral position (0°). The trainer initially held the patient's leg and guided it through a hip and knee extension while programming the number of sets and repetitions on the robot's screen. The robotic system provided weight support throughout, reducing physical strain on the trainer and eliminating the need for manual lifting. Once the movement was demonstrated by the trainer, the robotic system memorised it and carried out the remainder of the exercise session with the patient, without requiring further physical involvement from the trainer. The movement extended both the knee and hip to 0°, ensuring maximum range without hyperextension. In the active intervention group, the robot provided resistance based on adjustable levels, ranging from Level 1 (easiest) to Level 10 (maximum resistance).



**Figure 1** Active robot-assisted extension of the Hip and knee while motivated by staff trainer.

## Initiating Movement, Acclimatization, and Warm-up

All exercise sessions began with the robot moving the patient's leg in the programmed motion once, allowing the patient to become accustomed to the movement. Following that, a light warm-up was initiated in the active exercise group with five repetitions of the hip and knee extension movement with lowest resistance (level 1) to help the patient engage actively in the exercise. There were no warm-up in the passive group.

## The Active Robot-Assisted Physical Exercise

In the active group, each exercise session comprised three sets of active hip and knee extensions with verbal encouragement from the trainers to perform maximum numbers of repetitions. All sets were carried out on each leg to ensure symmetrical lower-limb loading. Training intensity was set at 65–100% of the patient's maximal capacity, with a 60-second rest period between each training set.

The Borg Scale was used to assess perceived exertion, providing a subjective measure of physical effort on a scale from 0 (no exertion) to 10 (maximum exertion).<sup>23</sup>

As default, resistance exercise started at the highest intensity setting (level 10). If pre-assessment indicated that the patient could not complete at least eight repetitions with proper execution of the movement at level 10, a lower level was selected based on clinical judgment. The first set of every exercise session served as a maximum test, guiding the intensity of subsequent sets, where patients had to achieve at least 65% of their recorded maximum repetitions. The patient then performed the next two sets to fatigue while maintaining proper technique. Exercise progression was ensured by evaluating resistance at each session. If the patient completed at least eight repetitions, the resistance level was increased and maintained for reassessment in the next exercise session. However, an increase in resistance level was always contingent on the patient's ability to perform the exercise correctly maintaining proper technique. If a patient reached level 10, further progression was achieved by increasing the number of repetitions.

Throughout the exercise sessions, both the patient and the trainer could monitor performance via a screen displaying the power output of the hip and knee extension in kilograms, along with a "power bar" indicating whether the full range of movement had been completed (Figure 1).

## Passive Robot-Assisted Physical Exercise

In the passive exercise group, a passive robot-assisted physical exercise session consisted of three sets of eight repetitions, during which the robot passively moved the patient's leg through hip and knee extensions, with a 60-second rest period between sets. The passive extension movements were performed on each leg separately, with sets repeated for both sides. Because the robot executed the movements, no active effort was required from the patient. This allowed participation even among the frailest patients, including those who occasionally fell asleep during the sessions.

## Protein Supplements

Following each exercise session, all participants in both groups were offered nutritional drinkable protein supplements (125–250 mL) each containing a minimum of 18 to 26 gram of protein per serving.<sup>24,25</sup>

## Definition of Robot-Assisted Physical Exercise

A successful robot-assisted physical exercise was defined as the completion of a minimum of three exercise sessions during their entire hospital stay at Department of Geriatric Medicine. A exercise session was complete if at least one set was performed in both legs.

## Fidelity and Adherence

To ensure high fidelity, all robot trainers received comprehensive exercise under the guidance of a certified instructor, who had completed the exercise module provided by the robot manufacturer. Furthermore, workshops helped the trainers practice alongside a certified instructor to reinforce their skills and ensure consistency in exercise delivery.

Appointed research staff and trainers were present in the department every day to encourage patients to continue their exercise and to improve adherence and furthermore collect data on amount of robot exercise performed. This practice ensured daily motivation for continued participation. Participation in each session was voluntary, and patients could decline exercise at any time; all encouragement provided by staff was supportive and never coercive.

## Adverse Event Procedures

To ensure patient safety, adverse event procedures were in place throughout the intervention. As part of the standard protocol, trainers were required to document each exercise session, specifically noting whether any adverse events occurred or if the session had to be interrupted. In cases where exercise was stopped, trainers were instructed to provide detailed documentation explaining the reason, ensuring transparency and enabling appropriate follow-up.

An example of when an exercise session might be paused was if the patient experienced discomfort, such as temporary numbness in the toes or skin redness from the brace being too tight. In such cases, the exercise was immediately halted, and the brace was adjusted or loosened. The session would only resume if the patient reported feeling comfortable and safe to continue.

## Findings

### Patient Characteristics and Outcomes

The included patient was a 98-year-old woman living alone prior to hospitalisation. She was randomised to active robot-assisted physical exercise. Her data are summarized in [Table 1](#). Thus, she was admitted with a stable vertebral fracture due to osteoporosis and used six daily medications at admission. Her BMI was 19.3 kg/m<sup>2</sup>, and her muscle mass was 19.5 kg.

Upon admission, she exhibited functional decline, reflected in a Barthel Index score of 57, compared to her historical score of 100.

The patient stayed for six days in the Department of Geriatric Medicine and completed five exercise sessions, corresponding to 50% adherence. She was discharged to her private residence.

Her functional status showed slight improvements at discharge, with her Barthel Index increasing from 57 to 69. Her Geriatric Depression Scale (GDS) score improved from 5 to 4 (Scores of 0–4 are considered normal). Her Mini-Mental

**Table 1** Patient Characteristics and Outcomes

<b>Sex</b>	Woman
<b>BMI</b>	19.3
<b>Muscle mass (kg) (Bioimpedence (BIA) by InBodySI0®)</b>	19.5
<b>Age at inclusion</b>	98
<b>Baseline CRP mg/L</b>	43
<b>Civil living situation</b>	Alone
<b>Daily medications at admission (n)</b>	6
<b>Length of stay (LOS) at department of Geriatric Medicine (days)</b>	6
<b>Completed training sessions (n) / Percentage of completed training sessions</b>	5/50%
<b>Place of home</b>	Private residence
<b>Discharge destination</b>	Home
<b>Primary reason for admission</b>	Osteoporosis with vertebral fracture
<b>Functional Status measured by Barthel 100<sup>a</sup>: Historical / Baseline / Discharge</b>	100 / 57 / 69
<b>Functional Status measured by 30-second chair stand test<sup>b</sup>, No.: Baseline / Discharge</b>	3* / 3*
<b>Life Quality measured by EQ-5D VAS score<sup>c</sup>: Baseline / Discharge</b>	n/a
<b>Cognitive Function measured by MMSE<sup>d</sup>: Baseline / Discharge</b>	23 / 21
<b>Mood Status measured by GDS<sup>e</sup>: Baseline / Discharge</b>	5 / 4
<b>Concern about falling measured by FES-I<sup>f</sup>: Baseline / Discharge</b>	9 / 15

**Notes:** <sup>a</sup>The Barthel Index ranges from 0 (severe functional dependence) to 100 (functional independence). <sup>b</sup>Number of full repetitions in 30 seconds with use of armrests. <sup>c</sup>Quality of life EuroQol VAS. Measured using the visual analog scale of the EuroQol Questionnaire–5 Dimensions, with the score ranging from 0 (worst health state imaginable) to 100 (best health state imaginable). <sup>d</sup>The Mini-Mental State Examination ranges from 0 (worst) to 30 (best). <sup>e</sup>The Geriatric Depression Scale ranges from 0 (best) to 15 (worst). Scores of 0–4 are considered normal, 5–8 indicate mild depression; 9–11 moderate depression; and 12–15 indicate severe depression. <sup>f</sup>Short Falls Efficacy Scale International. Higher scores = greater concern about falling (7–8 = low concern; 9–13 = moderate concern; ≥14 = high concern). **Abbreviations:** BMI, body mass index (calculated as weight in kilograms divided by height in meters squared); EQ-VAS, Quality of life EuroQol visual analogue scale; FES-I, Falls Efficacy Scale International; GDS, Geriatric Depression Scale; MMSE, Mini-Mental State Examination.

State Examination (MMSE<sup>®</sup>) score decreased slightly from 23 to 21 (A score of 25 or higher is classed as normal) and her Falls Efficacy Scale-International (FES-I) score increased from 9 to 15, indicating a higher concern about falling at discharge compared to admission and her chair stand test performance did not improve from baseline to discharge (3 repetitions with arm support). Patient characteristics and outcomes are shown in [Table 1](#).

No adverse events or harms were observed.

### Patient Admission timeline, Exercise Adherence, and Exercise Progression

The patient was acutely admitted to the Emergency Department at 7 pm and transferred to the Department of Geriatric Medicine shortly after noon the following day. Late in the morning, she was enrolled in the study on her second day in the department, during which she also completed her first exercise session at 18.15 pm.

As illustrated in [Table 2](#), initial fatigue led her to decline the first scheduled session (Session Day 1, session A); however, she participated later the same day (Session Day 1, session B), completing fewer sets than outlined in the protocol (two sets on right leg and only one set on left leg). Over the following days, she showed signs of progression, increasing both the number of sets, repetitions and resistance levels. By Session Day 3, she completed more repetitions (from 8 to 9 to 10–12) at higher resistance (from 6–7 to 7–8) while reporting lower exertion on the Borg Scale (from 8–9 to 5–6), suggesting improved strength. However, she declined all exercise on Session Days 4 and 5, and was discharged on Day 6.

**Table 2** Illustration of Adherence and Progression to the Robot-Assisted Intervention

			Set	Repetitions (n)	Level	Borg Scale	
Session day 1 (day of inclusion)	Session A						
	Session B	Right leg	1	8	6	8	
			2	9	6	8	
			3				
		Left leg	1	9	6	9	
			2				
			3				
	Session day 2	Session A	Right leg	1	10	7	8
				2	9	7	8
3							
Left leg			1	10	7	8	
			2	10	7	8	
			3				
Session B		Right leg	1	10	7	9	
			2	10	7	10	
			3				
		Left leg	1	10	7	8	
			2	10	7	9	
			3				
Session day 3	Session A	Right leg	1	10	7	5	
			2	12	7	6	
			3	12	7	10	
		Left leg	1	10	7	8	
			2	10	7	8	
			3	10	7	8	
		Session B	Right leg	1	10	7	5
				2	12	8	6
				3	12	8	6
	Left leg		1	12	8	6	
			2	12	8	6	
			3	12	8	7	

(Continued)

**Table 2** (Continued).

	Set	Repetitions (n)	Level	Borg Scale
Session day 4	Session A			
	Session B			
Session day 5	Session A			
	Session B			

**Notes:** The patient was offered two daily training sessions (A and B) with a minimum of three hours between session A and session B until day of discharge. Green: Successfully completed exercise session, Red: Not completed exercise session – patient declined. The table also show amount of set and repetitions along with level (resistance). The Borg Scale was used to express level of exhaustion (score 0 = no exertion; score 10 =maximum exertion).

### Patient Perspective

The structured patient interview revealed nuanced insights into the patient’s experience with robot-assisted physical exercise during hospitalisation. Quotes are categorised into three themes emerging from the material: (1) hospitalisation and perceived health benefits, (2) experience with robot-assisted physical exercise, and (3) motivation and engagement.

The patient described herself as functionally limited upon admission, requiring assistance for most activities. She expressed hope that the exercise would help preserve leg strength and support post-discharge mobility. While she generally found the exercise enjoyable, accessible, and motivating, particularly appreciating the opportunity to train in bed, she also reported fatigue as a barrier to consistent participation.

Key themes and illustrative quotes are presented in [Table 3](#)

**Table 3** Key Themes and Illustrative Quotes

<b>Theme 1: Hospitalisation and Perceived Health Benefits of Robot-Assisted Exercise</b>	<b>Theme 2: Experience With Robot-Assisted Exercise</b>	<b>Theme 3: Motivation and Engagement</b>
<p><b>Interviewer:</b> How do you spend your time while you are in the hospital?</p> <p><b>Patient:</b> I have not been able to do anything during the days I have been here (...) I could barely get up and needed help with everything.</p>	<p><b>Interviewer:</b> How would you describe performing robot-assisted exercise?</p> <p><b>Patient:</b> It has been exciting. And now I am curious to see if it works when I get home. Because the legs are the first thing we notice when we have been unwell. They deteriorate quite quickly.</p>	<p><b>Interviewer:</b> Did you feel motivated to participate in the exercise?</p> <p><b>Patient:</b> Yes, some lovely young people come, and that makes you want to participate. (The patient referred to the trainers as “lovely young people.”)</p>
<p><b>Interviewer:</b> What does this robot-assisted exercise mean for your health?</p> <p><b>Patient:</b> I hope it means that I have not lost too much strength in my legs. That I can get up and move around again fairly quickly. So I do not have to just sit in my room at home.</p>	<p><b>Interviewer:</b> What’s it like to exercise while lying in bed?</p> <p><b>Patient:</b> If I had to go somewhere else, I would not have been able to at all (...) It’s really good for a lot of people.</p>	<p><b>Interviewer:</b> How does robot-assisted exercise affect your mood?</p> <p><b>Patient:</b> It puts you in a good mood. It’s kind of fun. Something is happening. And I am excited to get home and see if it has worked. That’s the purpose of it.</p>

(Continued)

Table 3 (Continued).

Theme 1: Hospitalisation and Perceived Health Benefits of Robot-Assisted Exercise	Theme 2: Experience With Robot-Assisted Exercise	Theme 3: Motivation and Engagement
	<p><b>Interviewer:</b> What's it like to exercise twice a day?</p> <p><b>Patient:</b> It was fine on the first day, but then I took a break, and if visitors come today, then it will only be once. And tomorrow, I am going home.</p> <p><b>Field notes</b> collected by the trainer stated that the patient declined the exercise with the note "patient was very tired".</p>	

## Discussion

This case report contributes to the field of gerontechnology by providing a detailed description of robot-assisted physical exercise offering insights into its use in a geriatric acute hospital setting. The study also presents baseline characteristics and outcomes including qualitative data from patient interview illustrating an individual user experience with active robot-assisted physical exercise.

## Robot-Assisted Physical Exercise in Geriatric Acute Care

The structured exercise protocol enabled the included patient, a frail, hospitalised 98-year-old woman, to engage in active robot-assisted physical exercise without the need for physical relocation. The bedside delivery of exercise was crucial, as the patient stated she would not have been able to participate if it required leaving the bed. While upright mobilisation is always the preferred goal, some hospitalised older adults are too ill or frail to start out with standing or walking exercises. In such cases, bed-based exercise offers a practical starting point, helping prevent further deconditioning and supporting progression toward full mobilisation.<sup>26</sup> This supports earlier findings on the physical and logistical barriers to rehabilitation in acute care settings.<sup>8,27</sup>

Exercise was scheduled in the afternoon and evening, potentially avoiding peak clinical activity, in line with recommendations for flexible exercise timing in frail patients.<sup>27</sup> The intervention also ran on weekends and public holidays, ensuring continuity.

Although exercise was accessible and well-integrated, the patient's fluctuating participation due to fatigue underscores the need for individualised, patient-centred scheduling. The progression model allowed exercise at 65–100% of maximal capacity with real-time monitoring, aligning with best practices in progressive overload.<sup>2</sup>

This case report exemplifies how the field of robot technology in rehabilitation is expanding, with new devices and systems emerging each year.<sup>28</sup> However, the applicability of such technology is influenced by several contextual factors, as access to robot-assisted rehabilitation may vary across healthcare settings due to resource availability and costs. This should be considered when interpreting the wider applicability of this technology.

While the patient in this case report was allocated to active robot-assisted physical exercise and therefore does not provide information about the passive version of the intervention, findings from a previous feasibility and pilot study of the passive ROBERT device demonstrated that also passive robot-assisted mobilisation was feasible and well accepted by patients, relatives, and staff.<sup>12</sup>

## Patient Admission Timeline

The patient was included in the ROBUST RCT on her second day in the Geriatric department and completed her first exercise session the same evening, ensuring a prompt start to the intervention. However, being bedridden for two days prior to exercise may have already led to immobility-related decline, potentially impacting her readiness to engage in

exercise. Research has shown that older adults can lose up to 10% of their muscle strength after just 2–3 days of bed rest, particularly in the lower limbs, with further reductions in functional capacity occurring within the first week of hospitalisation.<sup>29,30</sup> These findings underscore the importance of initiating physical activity as early as possible during hospitalisation to prevent or mitigate functional decline.

Her fluctuating participation further underscores the challenges of maintaining engagement in frail, hospitalised older adults, emphasizing the need for flexible, patient-centered rehabilitation strategies. Therefore, integrating psychosocial approaches to enhance motivation could be a valuable supplement. Techniques such as motivational interviewing, psychoeducation, and realistic goal-setting have been shown to support adherence in older adults by strengthening coping skills, problem-solving abilities, and perceived self-efficacy.<sup>31</sup> Combining physical exercise with tailored psychosocial support may therefore optimise outcomes for this population.

## Patient Perspectives on Robot-Assisted Physical Exercise

The patient expressed both curiosity and optimism about the benefits of robot-assisted physical exercise, stating she hoped it would help maintain leg strength and facilitate a faster return to mobility at home. She described the exercise as enjoyable and mood-boosting, emphasizing that the presence of “lovely young people” (trainers) increased her motivation to participate. These reflections underline the importance of social interaction in rehabilitation and support existing evidence that patient engagement is influenced by perceived enjoyment and supportive staff relationships.<sup>32</sup> Daily encouragement, goal setting, and performance feedback were central strategies used to promote participation, approaches known to enhance physical activity levels in hospitalised patients.<sup>32</sup>

Despite this, fatigue significantly impacted exercise adherence. The patient declined several sessions, and field notes documented pauses due to exhaustion. This highlights a frequent challenge in geriatric rehabilitation, where fluctuating energy levels and medical complexity can limit consistent participation.<sup>8</sup>

The overall findings underline the importance of tailoring in-hospital exercise interventions to individual needs, energy levels, and environmental factors.

The patient described in this case report was broadly representative of the participants in the active intervention group in terms of age, frailty level, and baseline functional status, rather than a positive outlier, providing context for how this individual case fits within the wider study population.

## Limitations

The patient’s cognitive function was mildly impaired (MMSE<sup>®</sup> from 23 to 21),<sup>33</sup> which may have influenced the precision and depth of questionnaire and interview responses. This should be considered when interpreting the patient-reported outcomes. Furthermore, as findings from a single case cannot be generalised, the insights presented here should be interpreted with caution. More robust evidence from the ongoing ROBUST RCT will be required to determine the effectiveness and broader applicability of robot-assisted physical exercise.

## Conclusion

This case report provides a detailed description of robot-assisted physical exercise in a hospitalised geriatric patient, offering insights into an acute care setting, and patient experience. The structured bedside intervention ensured accessibility for a frail patient, allowing participation without requiring leaving the hospital room.

The patient responded positively to the exercise, describing it as engaging, mood-boosting, and beneficial for maintaining leg strength. However, fatigue influenced her adherence, highlighting the challenges of maintaining consistent participation in rehabilitation for older patients. These findings emphasise the importance of flexible, patient-centered strategies that accommodate fluctuations in energy levels, medical conditions, and hospital routines.

By documenting the practical aspects of robot-assisted physical exercise, this case report contributes to the growing field of gerontechnology and underscores the potential of robotic in-hospital rehabilitation to support early mobilisation in hospitalised older patients. This case report illustrates that even when exercise is adapted to bedridden patients and delivered at the bedside, sustaining engagement remains difficult. Still, while full adherence may not be feasible for all hospitalised older adults, initiating even modest amounts of physical activity may yield important benefits compared to

complete inactivity. Future research, including the ROBUST RCT, will provide further evidence on its effectiveness in improving functional outcomes.

## Ai Statement

ChatGPT (GPT-5, OpenAI) was used for English translation and language refinement of the manuscript. All content was reviewed and verified by the authors.

## Ethical Approval And Consent Statement

The ROBUST randomised controlled trial received ethical approval from The Regional Scientific Ethical Committee for Southern Denmark<sup>34</sup> (Project-ID: S-20210029) and approval from The Danish Data Protection Agency (Journal No. 21/3398).

Written informed consent for publication was obtained from the patient. The consent covers participation in the ROBUST RCT, including data collection, interviews, and the use of anonymised information for scientific publication. The patient explicitly expressed motivation to share her experience, with the intention that her case could contribute to improved care for future older patients. In line with principles of privacy, confidentiality, and limited anonymity, all potentially identifying information has been removed. Although complete anonymity can never be guaranteed in case reports, every effort has been made to minimise the possibility of identification. Importantly, the woman depicted in [Figure 1](#) is not the patient described in this case report but an unrelated participant who also provided written consent for publication of the photograph. The patient's face shown in [Figure 1](#) has been fully blurred to ensure anonymity, and signed photo consent for publication from both the patient and the trainer is kept on record.

We strongly believe that this case report fully complies with COPE guidelines and the journal's editorial policies regarding consent, privacy, confidentiality, and anonymity. All ethical requirements have been carefully considered, and the publication is made strictly within the terms of the patient's informed consent and with full adherence to established standards for protecting patient rights.

All sensitive participant data are stored in the REDCap database<sup>35</sup> and on a secure SharePoint platform approved by the Danish Data Protection Agency.

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## Disclosure

The authors declare that they have no competing interests regarding the current study.

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