STATISTICAL ANALYSIS PLAN (SAP) FOR THE ROBUST RCT

SECTION 1: ADMINISTRATIVE INFORMATION

TITLE

Statistical analysis plan (SAP): ROBot-assisted physical training of older patient during acUte hospitalisation – a randomised controlled trial (ROBUST)

SAP VERSION

Version 1 Marts 18 2025

PROTOCOL VERSION

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SAP REVISIONS

ROLES AND RESPONSIBILITY

Person writing the SAP:
Ann Sophia Bertelsen, MSPH, PhD-student[1,2,3]

Senior statistician responsible:
Jørgen T. Lauridsen, MSc, Professor, PhD[8]

Chief investigator/clinical lead:
Jesper Ryg, MD, Professor, PhD[1,2]

Co-authors:
Tahir Masud, MA, MSc, FRCP, Professor[1,2,4], Charlotte Suetta, MD, Professor, DmSci, PhD[5,6], Lisbeth Minet, MHS, Professor, PhD[1,2], Stig Andersen, MD, Professor, PhD[7] , Kim Delbaere, FAHMS, BAS, MPT, M.Ed, PhD[9,10]

1: Geriatric Research Unit, Department of Clinical Research, University of Southern Denmark
2: Department of Geriatric Medicine, Odense University Hospital, Denmark
3: OPEN, Open Patient data Explorative Network, Odense University Hospital, Region of Southern Denmark, Odense C, Denmark
4: Department of Geriatric Medicine, Nottingham University Hospital NHS Trust, Nottingham, UK
5: Department of Geriatric and Palliative Medicine, Copenhagen University Hospital, Bispebjerg and Frederiksberg, Copenhagen, Denmark
6: Department of Clinical Medicine, Faculty of Health, University of Copenhagen, Copenhagen, Denmark
7: Department of Geriatric Medicine, Aalborg University Hospital, Denmark
8: Department of Economics, University of Southern Denmark
9: Falls, Balance and Injury Research Centre, Neuroscience, Research Australia, Randwick, NSW, Australia
10: School of Population Health, University of New South Wales, Kensington, NSW, Australia

SIGNATURES

Person writing the SAP: Ann Sophia Bertelsen, MSPH, PhD-student

Senior statistician responsible: Jørgen T. Lauridsen, MSc, Professor, PhD

Chief investigator/clinical lead: Jesper Ryg, MD, Professor, PhD

SECTION 2: INTRODUCTION

BACKGROUND AND RATIONALE

Hospitalisation is associated with a high risk of loss of independence especially in older patients living with frailty (1). Hospital-associated disability leads to inability to ambulate, prolonged hospitalisation, higher health care expenditures, and increased requirement for institutionalisation after discharge (1). Functional decline is the leading complication of hospitalisation in older people where at least 34% experience a loss of independence in at least one basic activity of daily living as an unintended consequence of their hospital stay (1, 2). A major reason is that older people spend most of their time passive in bed while hospitalised (3, 4). Whereas physical inactivity poses a threat to muscle tissue and functional capacity to all people, older adults lose lean tissue most rapidly. Loss of muscle mass in bedridden patients happens fast (5) and more than half of all older people do not recover their pre-admission functional level one year after discharge with high rates of care home admissions and increased mortality (4, 6, 7).

Studies have shown that in-hospital exercise and early physical rehabilitation are beneficial for older people in terms of improved physical functioning, shorter hospital stay, and reduced care home admissions (8, 9). Furthermore, a reduction in length of stay can decrease in-patient hospital costs and increase hospital bed availability, increasing the overall cost-efficiency of hospitals (10). Despite this, early mobilisation and training of the least active older people is often overlooked as an intervention during hospitalisation (1).

The field of robot technology in rehabilitation is expanding with an increase in new devices and technologies emerging each year (10). Robots have the potential to increase the quantity of therapy received by an individual. One such example is the newly developed Danish training robot ROBERT® (11). This robot is capable of helping patients to perform exercises while the patient is lying in bed, which makes it possible to train even bedridden people effectively.

However, a critical gap in the current literature is the lack of randomised controlled trials (RCTs) investigating the feasibility of early in-hospital robot-assisted exercise programs for acute geriatric patients, particularly those incorporating a sham intervention to rigorously assess effectiveness.

OBJECTIVES

OBJECTIVE: The overall objective is to examine the impact of active robot-assisted resistance training (intervention) versus passive robot-assisted training (comparator) on functional status (primary outcome) and patient reported and cognitive, muscle, frailty and sarcopenia, and costs related factors (secondary outcomes) during acute hospitalisation (timepoint) in older geriatric patients (population).

The specific aims and hypothesis of the study are the following:

PRIMARY AIM:

Specific Aim 1: To compare the effects of robot-assisted resistance training versus passive robot-assisted training on functional status from baseline to discharge.

Hypothesis Specific Aim 1: Active robot-assisted resistance training is superior to passive robot-assisted training on functional status from baseline to discharge.

SECONDARY AIMS:

Specific Aim 2: To compare the effects of robot-assisted resistance training versus passive robot-assisted training on functional status at 1 and 3-months follow up.

Hypothesis Specific Aim 2: Active robot assisted resistance training is superior to passive robot assisted training on functional status at 1 and 3-months follow up.

Specific Aim 3: To compare the effects of robot-assisted resistance training versus passive robot-assisted training on patient reported and cognitive factors from baseline to discharge and at 1 and 3-months follow up.

Hypothesis Specific Aim 3: Active robot assisted resistance training is superior to passive robot assisted training on patient reported and cognitive factors from baseline to discharge and at 1 and 3-months follow up.

Specific Aim 4: To compare the effects of robot-assisted resistance training versus passive robot-assisted training on cost related factors from baseline to discharge and at 1 and 3-months follow up.

Hypothesis Specific Aim 4: Active robot assisted resistance training is superior to passive robot assisted training on health cost related factors from baseline to discharge and at 1 and 3-months follow up.

Specific Aim 5: To compare the effects of robot-assisted resistance training versus passive robot-assisted training on muscle, frailty and sarcopenia related factors from baseline to discharge and at 1 and 3-months follow up.

Hypothesis Specific Aim 5: Active robot assisted resistance training is superior to passive robot assisted training on muscle, frailty and sarcopenia related factors from baseline to discharge and at 1 and 3-months follow up.

OUTCOME DEFINITIONS

Primary outcome:

Primary outcome is functional status defined as change in activities of daily living (ADL) measured by Barthel Index 100 (12-14) and sit-to-stand performance measured by 30-second chair stand test (15) from baseline prior to randomisation and to the day of discharge.

Secondary outcomes:

Besides the baseline and primary outcome, several secondary outcomes were assessed at baseline, discharge, and at 1- and 3-months follow-up within four categories:

- Functional related outcomes
- Cognitive and psychological related outcomes
- Cost related outcome
- Muscle related outcome

All specific outcome measurement and units are presented below

Functional outcomes	• Functional status by Barthel Index 100 with a total score ranging from 0 (completely dependent) to 100 (completely independent) (12-14). • Functional status by 30-second chair stand test measuring number of full repetitions (n) completed in 30 seconds (15).
Patient reported and cognitive outcomes	• Concern about falling assessed using the 16-item Short Falls Efficacy Scale International (Short FES-I) questionnaire (16, 17) including information on the actual number of falls (n). Higher scores indicate greater concern of falling. • Quality of life assessed using the questionnaire "Quality of life EuroQol-5 dimension (EQ-5D)". Index score ranging from 0 (equivalent to death) to 1 (perfect health) along with a Visual Analog Scale (VAS) on perceived health status ranging from 0 (the worst possible health status) to 100 (the best possible health status) (18). • Mood status assessed by the 15-item Geriatric Depression Scale (GDS). Scores of 0-4 are considered normal, depending on age, education, and complaints; 5-8 indicate mild depression; 9-11 moderate depression; and 12-15 indicate severe depression (19). • Cognitive function assessed by the Mini-Mental State Examination (MMSE). The maximum score for the MMSE is 30. A score of 25 or higher is classed as normal. If the score is ≤ 24, the result is usually considered to be abnormal, indicating possible cognitive impairment (20, 21).
Cost outcomes	• Discharge destination (own home, temporary rehabilitation unit, care home). • Length of hospital stay (LOS) defined as number of days in the geriatric department (n). • Readmission (n) defined as any unplanned hospital contact with a duration of 12+ hours, occurring between 4 hours and 30 days following discharge from the geriatric department (22). • Mortality within 3 months follow up from hospital discharge. • Individual level data on "need of care at home" from the municipalities will be collected when the RCT ends to assess amount of home care provided by the municipality during the period of 3 months before admission to 3 months after discharge. Need of care will be presented within four categories: personal care, practical help, training/rehabilitation and nursing care.
Muscle and frailty outcomes	• Sarcopenia will be assessed based on the 2019 European guidelines (23). • Muscle quantity (kg) assessed using bioelectrical impedance by InBodyS10® (24). • 3m gait speed test score. Patients who could not complete the task is assigned a score of 0. Those completing the task is assigned scores of 1 to 4, corresponding to the quartiles of time needed to complete the task, with the fastest times scored as 4 (25).

	• 9-point Clinical Frailty Scale (CFS) with pictograms. Higher scores indicate greater frailty (26). Originally, the CFS aims to reflect the baseline health state (2 weeks before), however in this study the CFS is used to reflect the current status at the time of assessment.

Table 1: Specific measurements and units for the primary and secondary outcomes.

SECTION 3: STUDY METHODS

TRIAL DESIGN

The ROBUST study is a double blinded placebo-controlled RCT in older patients acutely admitted to a geriatric department with 3 months follow-up. The study was conducted as a single-centre trial at the Department of Geriatric Medicine, Odense University Hospital, Svendborg, Denmark from January 5 2023 to December 20 2025.

All participants were offered drinkable protein supplements and received standard individual physiotherapy and care during hospitalisation and randomised in parallel groups to either active robot-assisted resistance training (active group) or passive robot-assisted sham training (control group) in a 1:1 allocation ratio.

INTERVENTION DESCRIPTION

The robot-assisted training was performed using an innovative training robot (ROBERT®) (11). The robot is able to hold the patient's leg and perform extension movements of the hip and knee. The movement can be performed either active or passive. In the active training mode, the patient must use their muscular power to stretch the leg while the robot provides low/moderate resistance (active group). In the passive mode, the robot moves the leg independently without the patient using their own muscle power (control group). Exercise was performed on both legs separately.

Successful robot-assisted training was defined as a minimum of three sessions during the hospital stay. Following each training session, all participants were offered nutritional drinkable supplements each containing a minimum of 18 to 26 gram of protein per serving (125-250 ml) (27, 28).

Intervention group

The intervention group received active robot-assisted resistance training twice a day until day of discharge in addition to standard individualised care and physiotherapy. An active robot-assisted resistance training session consisted of three sets of active extensions of hip and knee under verbal motivation in order to perform as many repetitions as possible. Training intensity was 65-100% of maximum capacity with breaks of 60s between each set. To ensure progression, level of resistance was assessed at each session. Borg Scale was used for ratings of patients perceived exertion following every training set (29).

Control group

Participants in the control group received passive robot-assisted sham training by the robot twice a day until day of discharge in addition to standard individualised care and physiotherapy. A sham training session consisted of three sets of eight repetitions performed by the training robot, which passively moved the patient’s leg in extension of hip and knee with breaks of 60s between each set.

RANDOMISATION

Patients were allocated randomly to either the control or intervention group with a 1:1 allocation and block randomisation without stratification using computer-generated randomisation set up by an external statistician from Open Patient data Explorative Network (OPEN), Odense University Hospital, Region of Southern Denmark (30).

SAMPLE SIZE

Minimum clinical important change for the 30-second chair stand test is 2.6 repetitions (31) and mean reference values for people in the relevant age groups is 13 according to a recent Danish study (32). With a significance level of 5%, 80% power, and an expected drop-out rate of 20%, 74 participants in each group (148 in total) are needed to detect a between-group difference of 2.6 repetitions. The magnitude of clinical meaningful change of Barthel Index is 5 points and the mean (SD) Barthel Index score of patients at geriatric department OUH is 59.5 (24.3). A recent study in geriatric patients reported a change of 6.9 point during exercise (6). To achieve 80% power for demonstrating the same mean difference this study would require 244 participants per group (488 in total) with a significance level of 5% and an expected drop-out rate of 20%.
Thus, a total of 488 participants was required for our primary outcome.

FRAMEWORK

The RCT is designed with a superiority framework. Passive robot-assisted training serves as a sham control group to compare the effects of active robot-assisted resistance training in the intervention group. The superiority framework is based on the hypothesis that while both groups are expected to experience a decline in functional status during hospitalisation—a well-documented consequence of acute illness and bedrest—the decline will be significantly mitigated in the group receiving active robot-assisted resistance training.

The active robot-assisted resistance training is anticipated to slow the loss of muscle strength and functional capacity by engaging patients in meaningful physical activity, as opposed to passive training, which primarily simulates movement without the patient's active involvement. This difference is expected to result in greater preservation of functional capacities in the active group, demonstrating a superior effect compared to the sham control.

This framework reflects the expectation that active intervention can provide a more robust defense against the functional decline typically associated with acute hospitalisation, thereby substantiating the superiority of active robot-assisted training.

STATISTICAL INTERIM ANALYSES AND STOPPING GUIDANCE

No interim analyses were pre-planned, as the study was designed to continue until the required sample size for the primary outcomes was achieved.
The study protocol was structured to allow for the continuation of recruitment to ensure an adequate number of patients for the per-protocol analysis, even in the event of dropouts or non-adherence.

TIMING OF FINAL ANALYSIS

All outcomes will be analysed collectively after the last patient completed the study, including follow-up assessments.

TIMING OF OUTCOME ASSESSMENTS

Each day hospitalized patients were listed according to most recently admitted and then screened according to this list. Patients were enrolled within a maximum of 48 hours from time of admission at department of geriatric medicine.

The schedule of enrolment, interventions, and assessments are shown schematic in Table 2.

	Enrolment	Allocation	Close-out		
TIMEPOINT	$-t_1$	**Admission/ Baseline**	***Discharge***	***1 month Follow-up***	***3 month Follow-up***
ENROLMENT:					
Eligibility screening	X				
Informed consent	X				
Demographic data		X			
Age, gender, civil- and living status, body mass index (BMI)		X			
Allocation		X			
INTERVENTIONS:					
Active resistance robot training		Twice daily during hospitalisation			
Passive sham robot training		Twice daily during hospitalisation			
ASSESSMENTS:					
Current Barthel-Index		X	X	X	X
Historical Barthel-Index		X			
30-second chair stand test		X	X	X	X
Quality of life EuroQol-5 dimension (EQ-5D)		X	X	X	X
Mini-Mental State Examination (MMSE)		X	X	X	X
Short Falls Efficacy Scale International (Short FES-I)		X	X	X	X
Number of falls		X	X	X	X
Geriatric Depression Scale (GDS)		X	X	X	X
Muscle quantity (bioimpedance by InBodyS10®)		X	X	X	X
Sarcopenia		X	X	X	X
3m gait speed		X	X	X	X
Need of homecare including historical		X	X	X	X
Clinical Frailty Scale (CFS)		X	X	X	X
Length of hospital stay (LOS)			X		
Discharge destination			X		
Hospital readmission				X	
Mortality			X	X	X
C-reactive protein (CRP) Blood sample		X			
Reason for admission (ICD-10 diagnose)			X		
Admissions within one year prior baseline		X			
Use of medications		X	X		

Table 2: SPIRIT - Timepoints of enrolment, interventions, and assessments.

SECTION 4: STATISTICAL PRINCIPLES

CONFIDENCE INTERVALS AND P VALUES

The level of statistical significance is set at 5% ($p < 0.05$). Confidence intervals (CIs) will be reported at the 95% level.

No adjustments for multiplicity are planned, as the study is primarily focused on a single primary outcome. Secondary outcomes will be interpreted descriptively to support the primary findings, with the understanding that multiple comparisons may increase the risk of type I errors.

ADHERENCE AND PROTOCOL DEVIATIONS

Adherence to the Intervention

Adherence was assessed through detailed records maintained by the trainers, who documented whether training sessions were completed or missed.

Reasons for missed sessions were categorised as follows:

- Patient-related: The patient declined to participate or was unable to train due to illness or fatigue.
- Logistic-related: Sessions were missed due to time constraints, scheduling conflicts, or the patient being transferred to another hospital.
- Robot-related: Technical robot malfunctions, which prevented the session from taking place.

A pre-planned subgroup analysis will evaluate participants who completed less than 75% of the planned training sessions to those with higher adherence (≥75%). This analysis will explore the relationship between adherence levels and the effectiveness of the intervention.

Protocol Deviations

Protocol deviations will be summarised to identify patterns and assess their impact on the study outcomes. Examples of deviations:

- Timing of final outcome testing: In some cases, patients were tested on a Friday instead of their actual discharge day on Saturday, due to the staff shortages over the weekend.
- Follow-up visits: Follow-up assessments were occasionally performed outside the protocol-specified time windows of 30 days ± 2 days for 1-month follow-up and 90 days ± 2 days for 3-month follow-up.

In cases of major protocol deviations, these will be reviewed and addressed to evaluate their potential effect on the validity of the results.

ANALYSIS POPULATIONS

The randomised groups will be compared with respect to the primary and secondary endpoints using an intention-to-treat (ITT) analysis, which includes all participants as randomised.

A predefined per-protocol (PP) analysis will also be performed. The per-protocol population is defined as those patients who completed at least three robot-assisted training sessions during hospitalization, as this represents the predefined minimum intervention exposure needed to assess its intended effect.

A complete case analysis will include only those participants with no missing data for the variables required to evaluate the primary and secondary outcomes. Participants with incomplete data due to withdrawal, missed follow-ups, or protocol deviations will be excluded from this analysis.

SECTION 5: TRIAL POPULATION

SCREENING DATA

Screening data were not collected for this study.

ELIGIBILITY

Older people admitted to the Department of Geriatric Medicine at Odense University Hospital, Svendborg, Denmark was eligible for study participation.

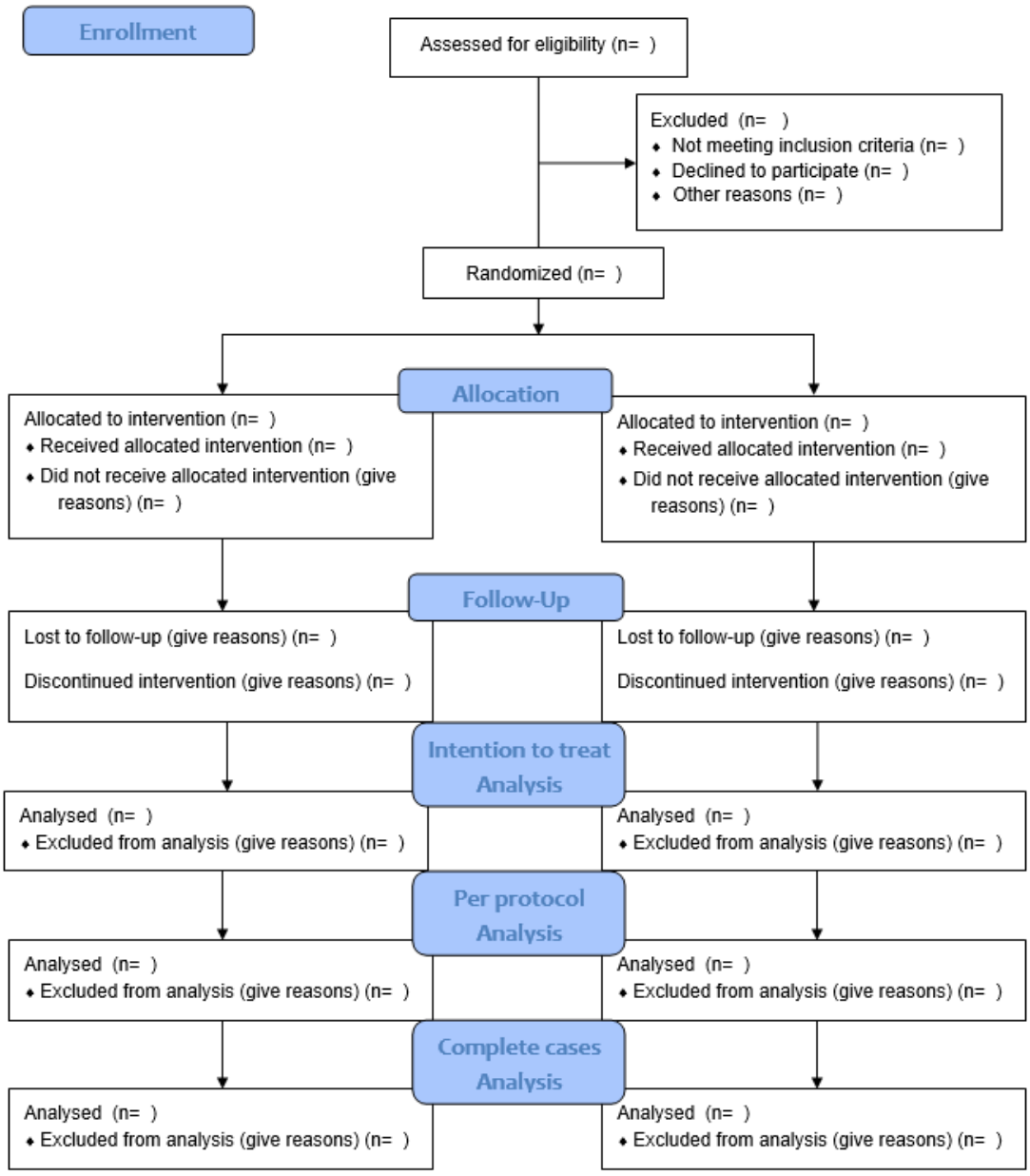
Inclusion criteria:

- ≥65 years of age
- Able to ambulate before hospitalisation (with/without assistance)
- Able to communicate with the research team
- Expected length of stay ≥2 days
- Residing on the island of Funen

Exclusion criteria:

- Able to ambulate without assistance at time of inclusion
- Known severe dementia
- Delirium defined as positive Confusion and Assessment Method score (32)
- Terminal illness
- Recent major surgery or lower extremity bone fracture in the past 3 months
- Conditions contradicting use of ROBERT® (unstable vertebral-, pelvic, or lower extremity fractures; high intracranial pressure; pressure ulcers or risk of developing pressure ulcers due to fragile skin; patients with medical instability)
- Metastases at femur or hip
- Deemed not suitable for mobilisation sessions with the robot by the healthcare professional
- Weight >165 kg
- Have been admitted to the department for more than 48 hours before screening

RECRUITMENT



WITHDRAWAL/FOLLOW-UP

Definitions

- Withdrawal: Defined as a patient actively deciding to discontinue participation in the study, either during hospitalisation or at any time during follow-up.
- Lost to Follow-Up: Defined as the inability to contact or collect data from a patient despite reasonable efforts at any specified follow-up time point.

Categorisation and Timing

Withdrawal and lost to follow-up will be reported descriptively and categorised based on the timing of occurrence:

- During hospitalisation: Withdrawal or lost to follow-up while the patient is still admitted.
- At discharge: Withdrawal or lost to follow-up on or immediately before the planned discharge.
- 1-month follow-up: Withdrawal or lost to follow-up at 30 days (±2 days) post-discharge.
- 3-months follow-up: Withdrawal or lost to follow-up at 90 days (±2 days) post-discharge.

Reasons and data presentation

The reasons for withdrawal or lost to follow-up will be detailed where available and presented in a tabulated format, providing insight into patient retention and study feasibility.

Examples include:

- Withdrawal due to patient choice (e.g., no longer willing to participate).
- Lost to follow-up due to inability to contact the patient (e.g., incorrect contact information or non-response).
- Other reasons, such as health deterioration, death, or transfer to a different care facility.
- Lack of research personnel**:** Training sessions or follow-up assessments missed due to staff shortages.

BASELINE PATIENT CHARACTERISTICS

Variables will be presented as means (± standard deviations, SD) when normally distributed or medians with interquartile ranges (IQR) when non-normally distributed.

	Intervention group	**Control group**
Baseline variables		
Gender, n (%) - Female - Male		
Living arrangement, n (%) - Married or living together - Living alone		
Residence type, n (%) - Independent - Nursing home - Temporary rehabilitation stay		
Age (years) (median (IQR)/mean (SD))		
BMI (kg/m2) (median (IQR)/mean (SD))		
Number of daily medications (median (IQR)/mean (SD))		
C-reactive protein (CRP) blood sample, mg/L (median (IQR/mean (SD))		
Reason for hospital admission (ICD-10 diagnose, n (%))		
Admission within one year prior baseline, n (%)		
Functional variables		
Historic Barthel Index 100 (14 days before hospital admission) (median (IQR)/mean (SD))		
Baseline Barthel Index 100 (median (IQR)/mean (SD))		
30-second chair stand test (n) (median (IQR)/mean (SD))		
Muscle and frailty variables		
Sarcopenia, n %		
Muscle mass (BIA), (kg) (median (IQR)/mean (SD))		
3m gait speed test score (median (IQR)/mean (SD))		
Clinical Frailty Scale (CFS) (median (IQR)/mean (SD))		
Patients reported and cognitive variables		
Quality of life EuroQol-5 dimension (EQ-5D) (median (IQR)/mean (SD))		
Short Falls Efficacy Scale International (Short FES-I) (median (IQR)/mean (SD))		
Falls in the last 12 months, n (%) - 0 - 1 - ≥2		

Geriatric Depression Scale (GDS) (median (IQR)/mean (SD))		
Mini-Mental State Examination (MMSE) (median (IQR)/mean (SD))		
Cost variables		
Length of stay (days) (median (IQR)/ mean (SD))		
Discharge destination, n (%) - own home - temporary rehabilitation unit - care home		
Readmission within 30 days, n %		
Need of care at home prior admission, mean hours (h) per week - Total care - Personal care - Practical help - Training/rehabilitation - Nursing care		

Table 1: Baseline Characteristics of Acute Hospitalised Older Adults at Admission

SECTION 6: ANALYSIS

ANALYSIS METHODS

The characteristics of the two groups will be compared using descriptive statistics. Variables will be presented as means (± standard deviations, SD) when normally distributed or medians with interquartile ranges (IQR) when not. Serially measured variables during follow-up will be analysed using Chi-square or Fisher's exact test for categorical variables and appropriate statistical tests for continuous data.

For the primary and secondary outcomes, linear mixed-effects regression models will be used to assess changes from baseline to follow-up, accounting for repeated measures and variability across individuals. The linear mixed-effects regression models will include fixed effects (time (measurement point), treatment group (active vs. passive training), and the interaction between time and treatment to assess differential effects over time), and random effects (patient-specific random intercepts to account for individual variability in baseline functional levels). Kaplan-Meier analysis will be used for survival outcomes, and regression models for hospital readmissions.

Regression Model Specification

The choice of regression model will depend on the data type and distribution:

- Continuous outcomes (e.g., functional scores) will be analyzed using linear mixed-effects regression models with fixed effects for time, treatment group, and their interaction, and random intercepts to account for individual variability.
- Binary outcomes (e.g., readmission yes/no) will be analysed using logistic regression models.
- Time-to-event outcomes (e.g., time to readmission or survival) will be analyzed using Cox proportional hazards regression, provided the proportional hazards assumption is met.

Model Control

Residuals will be assessed for normality and homoscedasticity in linear models. If model assumptions are violated, alternative methods such as non-parametric tests (e.g., Wilcoxon signed-rank test) or generalised linear models will be considered.

Sensitivity Analyses

Sensitivity analyses will be performed for each primary and secondary outcome to test the robustness of the results:

- Missing data: Complete-case analysis will be compared with multiple imputation (see below in the Missing Data section) to assess the potential impact of missing data. If assumptions are violated, alternative methods such as non-parametric tests (e.g., Wilcoxon signed-rank test) or generalized linear models will be used.

Additional Analysis

Per-protocol analysis: A comparison of ITT and PP results will help identify potential differences due to adherence levels.

Planned Subgroup Analyses

The following subgroup analyses are pre-planned to explore whether the intervention effect varies across patient subgroups, by using the methods described above in the Analysis Methods section:

- Amount of completed training sessions: Comparison of outcomes between participants who completed >75% of planned training sessions versus those with lower adherence.
- Time to rehabilitation in the municipality after discharge: Analysis of outcomes based on differences in the time required for initiation of rehabilitation services post-discharge.

- Baseline functional level: Subgroup comparisons based on initial Barthel Index, Clinical Frailty Scale (CFS) scores, and the level of home care required prior to admission.
- Performance in the 30-second chair stand test: Comparison of outcomes stratified by baseline performance in the 30-second chair stand test.

MISSING DATA

No imputation will be performed for missing data. Instead, a complete-case analysis will be conducted, including only participants with no missing data to assess primary and secondary outcomes.

To evaluate the robustness of the findings, multiple imputation will be used as a sensitivity analysis to handle missing data. The imputation process will assume that data are missing at random and will include baseline characteristics, treatment groups, and other relevant variables to predict missing values. We assume data are at least Missing at Random (MAR) and will use multiple imputation as the primary approach to minimize potential bias. Additionally, if concern arises that missing data could be Missing Not at Random (MNAR), a pattern-mixture model or delta-adjustment approach will be explored to assess the potential impact on the study's conclusions.

By comparing results from the complete-case analysis with those obtained from the multiple imputation approach, we will assess the potential impact of missing data on the study's conclusions.

ADDITIONAL ANALYSES

Beyond the analyses described in the protocol, several additional statistical and exploratory analyses could be valuable for providing deeper insights into the intervention's effects and applicability. Below are suggestions for potential additional analyses:

- Cost-effectiveness analysis: We will evaluate the cost-effectiveness of the intervention by recalculating and summarizing cost outcomes in economic terms. The specific cost outcomes are detailed in the Outcomes Definitions section.

HARMS

Definition of Adverse Events

An adverse event (AE) is defined as any unintended or unfavourable event occurring in a trial participant during or after the use of a medical device, regardless of whether a direct causal relationship to the device is established. Examples include skin redness, discomfort, or temporary numbness in the patient's toes due to prolonged use of the robot accessory.

Definition of Serious Adverse Events

A serious adverse event (SAE) is defined as an event that results in one or more of the following:

- Death
- A life-threatening condition
- Permanent damage to the body or bodily functions
- Hospitalization or an extension of an existing hospital stay
- The need for medical or surgical intervention to prevent the above outcomes

Reporting and Management of Adverse Events

All AEs were recorded in detail during the trial. If an adverse reaction occurred during robot training, the

training would be immediately stopped to prevent further harm. In the case of an SAE, it would be promptly reported to the Patient Complaints Centre (Danish Patient Safety Database), the study principal investigator, and the device manufacturer.

Categorization and Analysis of Adverse Events
All AEs recorded during the study will be categorised in detail based on:

Severity: Mild, moderate, or severe.

Expectedness: Expected (previously documented) or unexpected.

Causality: Related to the intervention (e.g., robot-assisted training) or unrelated.

The data will be analysed descriptively and presented in tabular format, summarising the type, frequency, and severity of AEs. Additionally, incidence rates will be calculated to provide insights into the safety profile of the intervention.

STATISTICAL SOFTWARE

All analyses will be carried out using the statistical software RStudio, which is a widely used, open-source platform for statistical computing and graphics. The most recent version of the software when initiating analyses will be applied, and specific packages be selected during the analyses.

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