Comparison of Tele-rehabilitation and In-person Rehabilitation in Elderly Patients with Sarcopenia: A Randomized Controlled Trial

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Abstract

Background: Sarcopenia is closely associated with poor quality of life and mortality and the prevention and treatment of sarcopenia represent a critical area of research, with significant implications for the health of the elderly population. Resistance training is an effective treatment for elderly patients with sarcopenia. However, due to reasons such as inadequate rehabilitation facilities, transportation barriers, financial constraints, and diminished physical ability, elderly patients with sarcopenia often face challenges when receiving traditional rehabilitation treatments at hospitals.

Objective: This study aims to compare the effects of a digital rehabilitation program with traditional therapist-supervised rehabilitation training in elderly patients with sarcopenia.

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Conclusions: A 4-week remote resistance training program is effective in improving strength, balance, and IADL in elderly patients with sarcopenia, with effects comparable to rehabilitation supervised by a physical therapist. Tele-rehabilitation may be a convenient and effective alternative for elderly sarcopenia patients who have limited access to rehabilitation resources. Clinical Trial: http://www.chictr.org.cn/, ChiCTR 2300071648, May 22, 2023.

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Trial Registration: http://www.chictr.org.cn/, ChiCTR 2300071648, May 22, 2023.

KEYWORDS: tele-rehabilitation, elderly, sarcopenia, resistance exercise

Introduction

Muscle reduction typically progresses gradually between the ages of 40 and 50, but accelerates rapidly after age 60, with approximately 30% of skeletal muscle mass lost between the ages of 50 and 80. [1, 2] Sarcopenia is characterized by a significant loss of skeletal muscle mass and function, which increases the risk of falls, fractures, and physical disability, and is closely associated with poor quality of life and mortality. [3, 4] In Asian countries, the prevalence of sarcopenia ranges from 5.5% to 25.7%. Globally, the prevalence is estimated to be 8% to 36% in individuals under the age of 60, and 10% to 27% in those over 60.[5, 6] Thus, the prevention and treatment of sarcopenia represent a critical area of research, with significant implications for the health of the elderly population.

Resistance training has been shown to enhance muscle strength, aerobic endurance, and muscle mass.[7] This includes various exercises using free weights, machines, resistance bands, or body weight. Resistance training has demonstrated notable efficacy in improving strength in patients with sarcopenia.[8-11] Guidelines from the World Health Organization, as well as those from the United Kingdom and Australia, recommend 2 to 3 sessions of resistance training per week to prevent and manage sarcopenia.[12, 13] Furthermore, consistent adherence to exercise is crucial, as irregular or intermittent training may impair treatment outcomes.[14]

However, elderly patients with sarcopenia often face challenges when engaging in resistance training. In developing countries, in particular, access to professional rehabilitation services is limited due to inadequate rehabilitation facilities, transportation barriers, financial constraints, and diminished physical ability, all of which reduce patient participation. [13, 15] Additionally, elderly patients tend to have low adherence to self-guided home training programs, largely due to the lack of professional supervision, fear of injury, and low motivation.[16]

Given these challenges, digital programs delivered through mobile applications offer a potential solution, allowing patients to receive professional guidance and monitoring from the comfort of their homes. This approach could alleviate the burden on hospital resources and improve patient adherence to training programs.[17] Recent studies have shown that home-based programs can have a positive impact on improving the function and quality of life of elderly patients.[18, 19] Therefore, this study aims to compare the effects of a digital rehabilitation program with traditional therapist-supervised rehabilitation training in elderly patients with sarcopenia, addressing the challenges mentioned above.

Materials and Methods

Study Design

This single-center, randomized, prospective controlled trial was conducted at Peking Union Medical College Hospital, affiliated with the Chinese Academy of Medical Sciences. Ethical approval for the study was granted by the Ethics Committee of Peking Union Medical College Hospital (Ethics approval number: JS-2648). The study is registered with the Chinese Clinical Trial Registry (Registration number: ChiCTR 2300071648).

Participants

All participants in this study were recruited from Peking Union Medical College Hospital. Two geriatricians and a rehabilitation physician selected patients diagnosed with sarcopenia who met the inclusion and exclusion criteria. Each patient was thoroughly informed about the purpose, procedures, and potential risks of the trial, and all provided written informed consent. The inclusion and exclusion criteria are outlined in Textbox 1.

Textbox 1. Inclusion and Exclusion Criteria for the Study.

Inclusion Criteria

- Diagnosed with sarcopenia based on the 2019 Asian Working Group for Sarcopenia (AWGS) criteria
- Age between 60 and 80 years
- Able to use a smartphone and follow the exercise regimen
- No participation in any rehabilitation programs in the past month

Exclusion Criteria

- Severe cognitive impairment (MMSE score < 24), hearing impairment, or vision impairment
- Severe neurological, musculoskeletal, or organ (cardiovascular, pulmonary, hepatic, renal) diseases, or malignant tumors
- Uncontrolled hypertension, unstable metabolic diseases, or any other condition deemed inappropriate for participation by the researchers
- Unsuitable for bioelectrical impedance analysis (e.g., presence of metallic implants or pacemakers)
- Inability to stand or walk without assistance
- Poor adherence

Sample Size Calculation

The sample size was calculated using PASS 15. Based on the principle of noninferiority RCTs and previous clinical studies□[20] the mean difference in the grip strength between the home-based exercise group and the therapist supervision-based exercise group was 3, the SD was estimated to be 4 for both groups, and the noninferiority margin for the grip was 1. A sample size of 46 was required based on a bilateral α=.05 and β=.1, and a sample size of 58 was required to account for a 20% dropout rate.

Randomization

A total of 58 participants were randomly assigned to either the TRG (tele-rehabilitation group) or the IRG (in-person rehabilitation group) using a randomization platform. Based on the platform's results (e.g., C, T, C, T, T, C), slips of paper labeled “T” and “C” were placed into sealed, opaque, and uniformly sized envelopes. After completing the baseline measurements, the envelopes were opened in sequence to reveal the group assignments. The allocation sequence was generated by two researchers, who were not involved in the study, using a blocked randomization model.

Intervention

The training program for sarcopenia patients in both the TRG and IRG was identical. The program consisted of six resistance exercises targeting specific muscle groups, including the back extensors, biceps brachii, gluteus maximus, gluteus medius, deltoid, and quadriceps. The specific exercises included glute bridges, resisted elbow flexion, hip extension, hip abduction, shoulder abduction, and knee extension (Figure 1). Participants performed resistance training three times a week, with each exercise performed in three sets of 10 repetitions per set, over a four-week period. Effective training intensity was ensured through the use of the "Rate of Perceived Exertion" (RPE) scale, with a target RPE of 12-14 at the end of each exercise session. Each session included approximately 10 minutes of warm-up, 40 minutes of resistance training, and 10 minutes of stretching, totaling around 1 hour.

TRG (Tele-rehabilitation Group)

Prior to the commencement of the experiment, professional medical personnel created specific videos for each training exercise in the rehabilitation program and uploaded them to the tele-rehabilitation system along with detailed instructions. Participants received an initial face-to-face session with a physical therapist to ensure they understood the key points of each exercise and could perform them correctly at home using instructional videos. During this in-person session, the therapist helped participants download and register the app, sent digital exercise training protocols to the patients’ personal accounts and provided tension-appropriate resistance bands based on the participant's functional capacity. Subsequently, the patients were to follow the instructions provided in the video to complete each action in the regimen at home. Participants were required to report any adverse events during the exercise sessions to the research team immediately and to submit their RPE values through the application after each training session. The tele-rehabilitation system transmission portal automatically recorded their exercise performance, including the duration of each session and the frequency of weekly exercises. Figure 2 illustrates the 3 distinct components of tele-rehabilitation system: the physician portal, the user portal, and the transmission portal.

IRG (In-person Rehabilitation Group)

Participants in the IRG received in-person rehabilitation sessions under the supervision of a physical therapist.

Measures

All the following tests were conducted by the same physical therapist within three days before and after the exercise intervention.

Body Composition

Body composition was measured using bioelectrical impedance analysis (BIA-101 Anniversary Sport Edition, Akern-RJL Systems, Florence, Ital), with specific metrics including total skeletal muscle mass (TSM), body fat percentage (BFP), and skeletal muscle mass index (SMI).

Strength

Strength was assessed using grip strength, the 30-Second Arm Curl Test (30SACT), the 30-Second Sitting-to-Rising Test (30SSRT), peak quadriceps extension torque (EPT), and total power (ETP).

For the grip strength test, participants used their dominant hand to apply maximum pressure to the dynamometer handle (Jamar Hydraulic T, Patterson Medical, American). In the 30SACT, participants sat with their upper arms pressed against their torso while holding 8-pound dumbbells for men and 5-pound dumbbells for women. They were instructed to perform elbow curls as quickly as possible for 30 seconds. In the 30SSRT, participants sat on a 43 cm high chair and alternated between sitting and standing as many times as possible within 30 seconds. Each of these tests was performed three times, with a one-minute rest between trials, and the maximum value was recorded as the final result.

Quadriceps extension strength indices were measured using an isokinetic dynamometer (ISOMOVE, Tecnobody, Italy). The seat of the dynamometer was reclined at approximately 85°, with the participant's thigh, pelvis, and torso secured by straps. The rotation axis of the device was aligned with the lateral epicondyle of the femur, and the lever pad was positioned 3 cm above the lateral malleolus. The test consisted of 5 maximal repetitions at a speed of 20°/s, during which participants extended their knees as fast as possible against the resistance shown on the screen, reaching the target end point indicated by the graphical display.

Balance, Cardiopulmonary Endurance, and Self-Care Ability

Balance was assessed using the Berg Balance Scale (BBS) and the Timed Up and Go Test (TUGT). The BBS evaluated 14 tasks, with each task scored from 0 (unable to complete) to 4 (completed independently), and the total score represented the sum of all individual task scores. The TUGT assessed functional mobility and fall risk by timing how long it took a participant to rise from a chair, walk a short distance (3 meters), turn, walk back, and sit down again.

Cardiopulmonary endurance was measured using the 6-Minute Walk Test (6MWT), which quantified the distance a participant could walk on a flat, hard surface in 6 minutes. The primary outcome was the total distance walked, with longer distances indicating better cardiopulmonary function.

The Instrumental Activities of Daily Living (IADL) scale was used to assess participants' self-care abilities.

Statistical Analysis

The data analysis was performed using SPSS version 26.0. Categorical variables were expressed as numbers, while continuous variables were presented as mean ± standard deviation. Differences in continuous variables between groups were analyzed using independent samples t-tests or Mann-Whitney U tests, as appropriate. Categorical variables were compared using the Chi-square test. Paired t-tests were used for within-group comparisons before and after the intervention, while independent samples t-tests were applied for comparisons between groups. A P-value of less than 0.05 was considered statistically significant.

Results

Study Flow and General Participant Characteristics

Between May 30, 2023 and July 1, 2024, 106 patients were assessed for eligibility. Of these, 43 subjects were excluded based on the criteria, and 5 subjects declined participation after the initial screening. As a result, 58 patients were included in the final study. As shown in Figure 3, participants were randomly assigned to one of two groups: the TRG (n=29) or the IRG (n=29).

During the study, 4 participants in the TRG group and 1 participant in the IRG group did not complete the 4-week follow-up. Additionally, one participant from each group discontinued the training due to worsening pre-existing conditions: hip pain in the TRG group and elbow pain in the IRG group. After discontinuing the exercise, the hip pain subsided, and the elbow pain returned to baseline levels. Ultimately, 24 patients in the TRG group and 27 patients in the IRG group completed both the training program and the 4-week follow-up. Adherence to the exercise intervention was defined as the proportion of completed sessions relative to the total prescribed sessions, with adherence rates of 97% in the TRG group and 92% in the IRG group. The most commonly reported adverse effect was muscle soreness, and no exercise-related injuries or major adverse events were reported.

The baseline characteristics of the patients in the TRG and IRG groups were comparable. There were no significant differences between the two groups in terms of age, gender, height, weight, TSM, BFP, SMI, grip strength, quadriceps femoris EPT, BBS, 6MWT, or IADL (Table 1).

Body Composition

After 4 weeks, both groups showed a reduction in BFP and increases in TSM and SMI, but these changes were not statistically significant (Table 2).

Strength

Table 3 presents the changes in strength before and after the intervention. Both groups demonstrated significant improvements in strength (grip strength, 30SACT, 30SSRT, quadriceps femoris EPT and ETP) ($P<0.05$) (Table 3). However, there were no statistically significant differences between the groups in terms of the changes in any of the strength indicators (Figure 4).

Balance, Cardiopulmonary Endurance, and IADL

Post-intervention, both groups exhibited significant improvements in BBS and IADL ($P<0.05$), while the improvements in TUGT and 6MWT were not statistically significant (Table 4). There were no significant differences between the groups in the changes observed in balance, cardiopulmonary endurance, or IADL (Figure 4).

Discussion

With the global increase in life expectancy and the decline in birth rates, the proportion of elderly individuals in China has risen sharply over the past few decades. As the aging population grows, national healthcare expenditures have also surged, prompting the Chinese government to prioritize addressing the health challenges associated with population aging. Sarcopenia, characterized by a significant decline in muscle mass due to factors such as nutritional status, physical activity, genetics, or hormonal changes, along with the deterioration of tendon performance and neural patterns,[21] leads to the loss of muscle strength and mobility. Sarcopenia is one of the most critical factors contributing to functional decline and loss of independence in older adults. It not only reduces their quality of life but is also associated with increased morbidity and mortality, as well as elevated public health costs.[21] Supervised exercise is considered an effective strategy for managing sarcopenia and frailty, yet many patients lack access to such resources. This study found that a one-month remote resistance training program significantly improved the strength and balance of sarcopenia patients, with outcomes comparable to face-to-face rehabilitation supervised by therapists. These findings highlight the potential of tele-rehabilitation as a feasible solution for populations with limited access to healthcare resources and demonstrate how digital health solutions can enhance elderly care and address the unique needs of an aging society.

Previous studies have reported mixed findings on the effects of resistance training on body composition. Some scholars have observed that 12 weeks of resistance training can increase muscle mass in sarcopenic patients.[22, 23] In another study, women with obesity-related sarcopenia underwent 12 weeks of resistance training, three times per week. While the training group experienced an increase in lean mass of the lower limbs, the increase in total body lean mass did not reach statistical significance compared to the control group.[24] Another study found that after 3 months of resistance training in elderly patients with obesity-related sarcopenia, reductions were observed in fat mass, total fat mass, and body fat percentage in the upper limbs, but there was no significant increase in lean mass.[25] Two systematic reviews and meta-analyses also yielded conflicting conclusions.[26, 27] Mechanistically, the increase in muscle mass in elderly individuals following resistance training may be attributed to enhanced muscle protein synthesis,[28] increased satellite cell activity and quantity,[29] elevated secretion of anabolic hormones,[30] improved mitochondrial quality and function,[31] and decreased activity of catabolic cytokines.[32] In our study, we found both groups demonstrated increases in lean mass and decreases in body fat percentage, though these changes did not reach statistical significance. This may be due to the relatively short duration of the 4-week resistance training intervention, which may not have been sufficient to induce significant alterations in body composition. It is also possible that extending the training period could result in more pronounced changes in body composition.

In this study, both the TRG and IRG groups showed significant improvements in strength-related indicators, including grip strength, 30SSRT, 30SACT, and knee extension torque indices. These findings are consistent with previous systematic reviews and meta-analyses.[26, 27] Studies have shown that resistance training can increase muscle fiber volume, particularly Type II fast-twitch fibers.[33] Similarly, the studies by Gadelha and Liao[34, 35] confirmed that resistance training enhances muscle function by improving muscle fiber adaptability and optimizing strength output mechanisms. At the molecular level, research by P. Sousa-Victor et al.[36] demonstrated that resistance training increases satellite cell activity and muscle protein synthesis, reduces muscle degradation, and improves muscle mass. Studies by Philp et al.[36, 37] have shown that this type of exercise activates the mTOR signaling pathway, influencing protein synthesis, autophagy, and the expression of PGC-1α, thereby promoting sustained muscle growth and enhancing muscle performance. In this study, these effects were observed after just one month of resistance training, further demonstrating the significant therapeutic role of resistance training in the treatment of sarcopenia. The lack of significant differences in training outcomes between the two groups supports the application of tele-rehabilitation therapies in elderly patients with sarcopenia.

Lower limb muscle endurance is critical for dynamic balance. The reduction in muscle cross-sectional area and neural fibers, particularly fast-twitch fibers, leads to a decline in muscle strength, especially in the lower limbs. This decrease in lower limb strength causes patients to spend extended periods sitting or lying down. Prolonged inactivity and sedentary behavior further exacerbate muscle loss and strength decline.[38, 39] Reduced lower limb function impairs the ability to perform daily tasks, such as standing up from a chair, picking up items from the floor, walking, and climbing stairs.[40] In situations of instability, the central nervous system compensates by increasing muscle recruitment. One study[41] found that with aging, there is a loss of up to 75% of Type II fibers, which diminishes functional mobility and muscle strength output. Concurrently, the synaptic input to α-motor neurons and the number of cortical neurons forming the corticospinal tract also decrease.[42] Resistance training can activate more motor units and muscle fibers, enhance synaptic input to α-motor neurons, and recruit more cortical neurons within the corticospinal tract, thereby improving coordination, reaction time, and strength to support dynamic balance.[43, 44] One study[45] demonstrated that three months of resistance training (three sessions per week) improved muscle mass, physical fitness, and functional outcomes (upper and lower limb muscle mass, gait speed, timed up-and-go, chair stand test, functional reach, single-leg stance, and overall fitness score). Another study[46] showed that participants' functional fitness, such as walking time, chair stand test, and 8-foot up-and-go, improved compared to the control group. In this study, after 4 weeks of training, both groups showed improvements in their BBS scores, which is consistent with previous findings. However, there was no significant improvement in TUGT, likely due to the relatively short duration of the training. The effective stimulation of key muscle groups, such as the gluteus maximus, quadriceps, and tibialis anterior, by resistance training may improve lower limb strength and neuromuscular coordination, enhancing stability and balance.

In terms of cardiorespiratory endurance, although resistance training primarily focuses on muscle strengthening rather than endurance, research suggests that resistance training may also improve endurance. For patients with sarcopenia, increased lower limb strength can translate into faster walking speeds,[24] and training peripheral muscles may improve indices related to respiratory function, thereby providing more substantial support for endurance.[47] One study indicated that resistance training could enhance the six-minute walking distance in frail elderly individuals,[48] while another systematic review found that resistance training improved cardiorespiratory function in healthy older adults, including peak oxygen uptake, anaerobic threshold, and six-minute walking distance.[49] In this study, both groups demonstrated improvements in six-minute walking distance, though neither reached statistical significance, possibly due to the short duration of the training program. Regarding IADL, previous systematic reviews have shown that patients with reduced muscle mass are more likely to experience impairments in ADL and IADL, with reduced grip strength also being associated with impairments in ADL and IADL.[50] In this study, both groups showed significant improvements in IADL after training, with no significant differences observed between the groups.

One of the limitations of this study is that it was a single-center randomized controlled trial with a relatively small sample size. To address this limitation, the research team plans to conduct follow-up multicenter studies in regions with limited healthcare resources, where sarcopenic patients often have difficulty accessing professional exercise guidance. Additionally, the follow-up period in this study was relatively short. Future studies will involve a larger cohort to investigate the effects of tele-rehabilitation exercise interventions on sarcopenia over 8 weeks, 12 weeks, or even longer. Lastly, although participants were instructed to maintain consistent dietary habits throughout the study, detailed nutritional data were not adequately recorded.

Conclusion

This study demonstrates that tele-rehabilitation is as effective as traditional face-to-face rehabilitation in improving strength, balance, and IADL in sarcopenic patients. Moreover, tele-rehabilitation can reduce the time, cost, and use of medical resources. For sarcopenic patients who lack access to high-quality rehabilitation services, tele-rehabilitation therapy presents significant potential.

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Conflicts of Interest

The authors state that they have no interests which might be perceived as posing a conflict or bias.

Data Availability

All data generated and analyzed during this study are fully presented in this article and its supplementary materials.

Author Contributions

Study conception and design: Ying Liu and Lu Zhang; Patient recruitment: Lin Kang、Qiumei Wang; Rehab video production :Xuan Shu; Intervention management and data collection: Ying Ge and Wowa Zhao; Data analysis and draft: Lu Zhang; Editing: Ying Liu. All authors have approved the final version of the paper.

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Table 1 Participants' physical characteristics.

	TRG（n=24）	**IRG（n=27）**	**p-value**
Age (years)	70.47±6.05	69.81±5.76	0.744
Gender (Male/Female)	6/18	7/20	0.929
Height (cm)	160.73±6.63	161.88±5.97	0.610
Weight (kg)	53.49±7.55	53.95±8.14	0.865
TSM (kg/m^2)	26.82±10.04	25.71±8.04	0.716
BFP（%）	31.31±8.34	28.28±6.17	0.234
SMI (kg/m^2)	5.60±0.51	5.64±0.77	0.876
Grip strength (kg)	18.59±5.95	18.96±6.57	0.866
Quadriceps femoris EPT(N·m)	26.19±10.26	26.95±11.81	0.842
BBS	49.00±4.18	49.11±4.89	0.946
6MWT（m）	354.19±97.56	349.84±97.43	0.896
IADL	21.31±1.96	21.42±1.98	0.872

TRG: tele- rehabilitation group, IRG: in-person rehabilitation group, TSM: total skeletal muscle mass, BFP: body fat percentage, SMI: skeletal muscle mass index, EPT: extension peak torque, BBS: Berg Balance Scale, 6MWT: 6-Minute Walk Test, IADL: Instrumental Activities of Daily Living

Table 2 Changes in body composition.

	TRG（n=24）				IRG（n=27）				Between Group Δ
	Baseline	week 4	Δ	P	Baseline	week 4	Δ	P	p-value
TSM（kg/m²）	25.71±8.04	27.84±8.38	3.04±9.00	0.273	26.82±10.04	29.86±9.83	2.14±8.24	0.197	0.759
BFP (%)	28.28±6.17	27.96±5.78	-1.98±6.96	0.522	31.31±8.34	29.33±6.59	-0.32±2.09	0.274	0.343
SMI（kg/m²）	5.64±0.77	5.85±0.66	0.30±0.89	0.280	5.60±0.51	5.90±0.99	0.21±0.80	0.249	0.774

TRG: tele- rehabilitation group, IRG: in-person rehabilitation group, TSM: total skeletal muscle mass, BFP: body fat percentage, SMI: skeletal muscle mass index

Table 3 Changes in strength.

	TRG （n=24）				IRG（n=27）				Between Group Δ
	Baseline	4-week	Δ	P	Baseline	4-week	Δ	P	p-value
Grip strength (Kg)	18.10±5.56	19.92±5.9	1.33±1.89	0.015	18.59±5.95	19.59±6.11	0.64±2.24	0.013	0.338
30SACT (number of times)	12.48±2.68	14.94±3.68	2.13±2.92	0.011	12.25±4.19	14.68±4.36	1.58±1.98	0.003	0.531
30SSRT (number of times)	15.16±7.23	16.58±8.42	1.94±2.64	0.045	14.31±4.04	16.25±4.91	1.42±3.02	0.011	0.422
Quadriceps femoris EPT（N·m）	26.19±10.26	35.00±13.74	8.81±10.36	0.004	26.95±11.81	32.74±12.33	5.79±7.22	0.003	0.318
Quadriceps femoris ETP（J）	85.96±26.98	117.27±52.48	18.93±40.03	0.018	97.27±38.86	111.89±50.31	19.47±25.87	0.007	0.597

TRG: tele- rehabilitation group, IRG: in-person rehabilitation group, 30SACT: 30-Second Arm Curl Test, 30SSRT: 30-Second Sitting-Rising Test, EPT: extension peak torque, ETP: extension total power

Table 4 Changes in balance, cardiopulmonary endurance and IADL

	TRG （n=24）				IRG（n=27）				Between Group Δ
	Baseline	4-week	Δ	P	Baseline	4-week	Δ	P	p-value
BBS	49.00±4.18	52.19±3.10	3.19±2.86	0.000	49.11±4.89	52.15±3.79	3.06±2.44	0.000	0.881
TUGT（s）	9.23±2.19	8.57±1.71	-0.66±1.44	0.086	9.68±2.76	8.94±2.14	-0.73±1.79	0.101	0.901
6MWT（m）	354.19±97.56	363.19±82.29	8.28±41.92	0.372	349.84±97.43	364.63±112.27	13.58±40.72	0.112	0.72

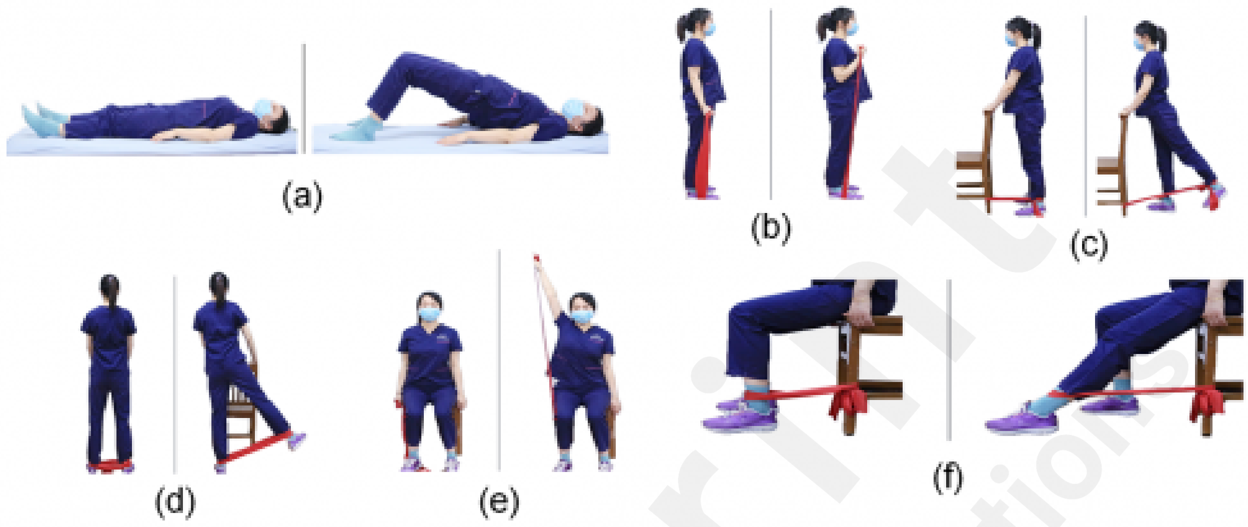
									4
IADL	21.31±1.96	21.81±1.76	0.50±0.89	0.041	21.42±1.98	22.05±1.58	0.63±1.06	0.019	0.698

TRG: tele- rehabilitation group, IRG: in-person rehabilitation group, BBS: Berg Balance Scale, TUGT: Timed Up and Go Test , 6MWT: 6-Minute Walk Test , IADL: Instrumental Activities of Daily Living

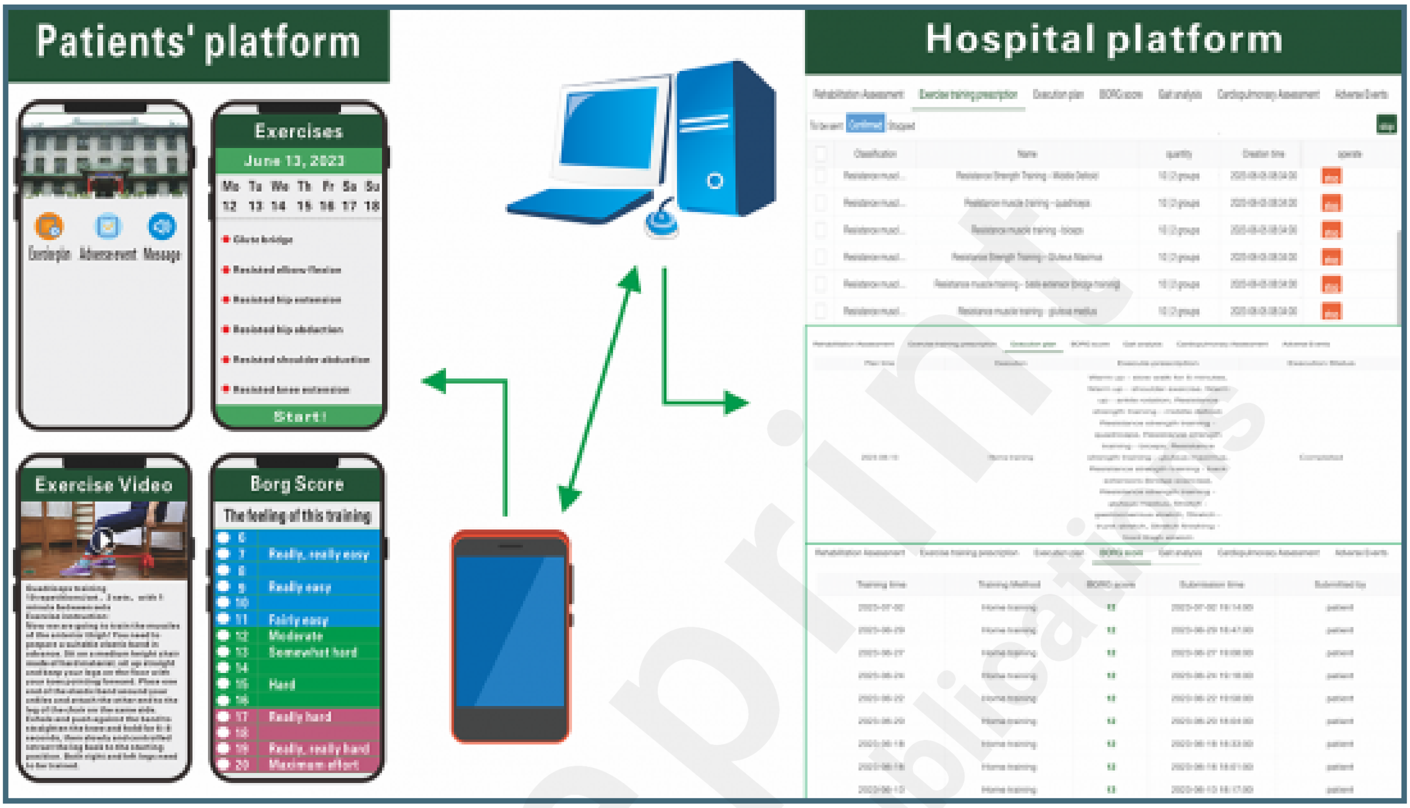
Supplementary Files

Figures

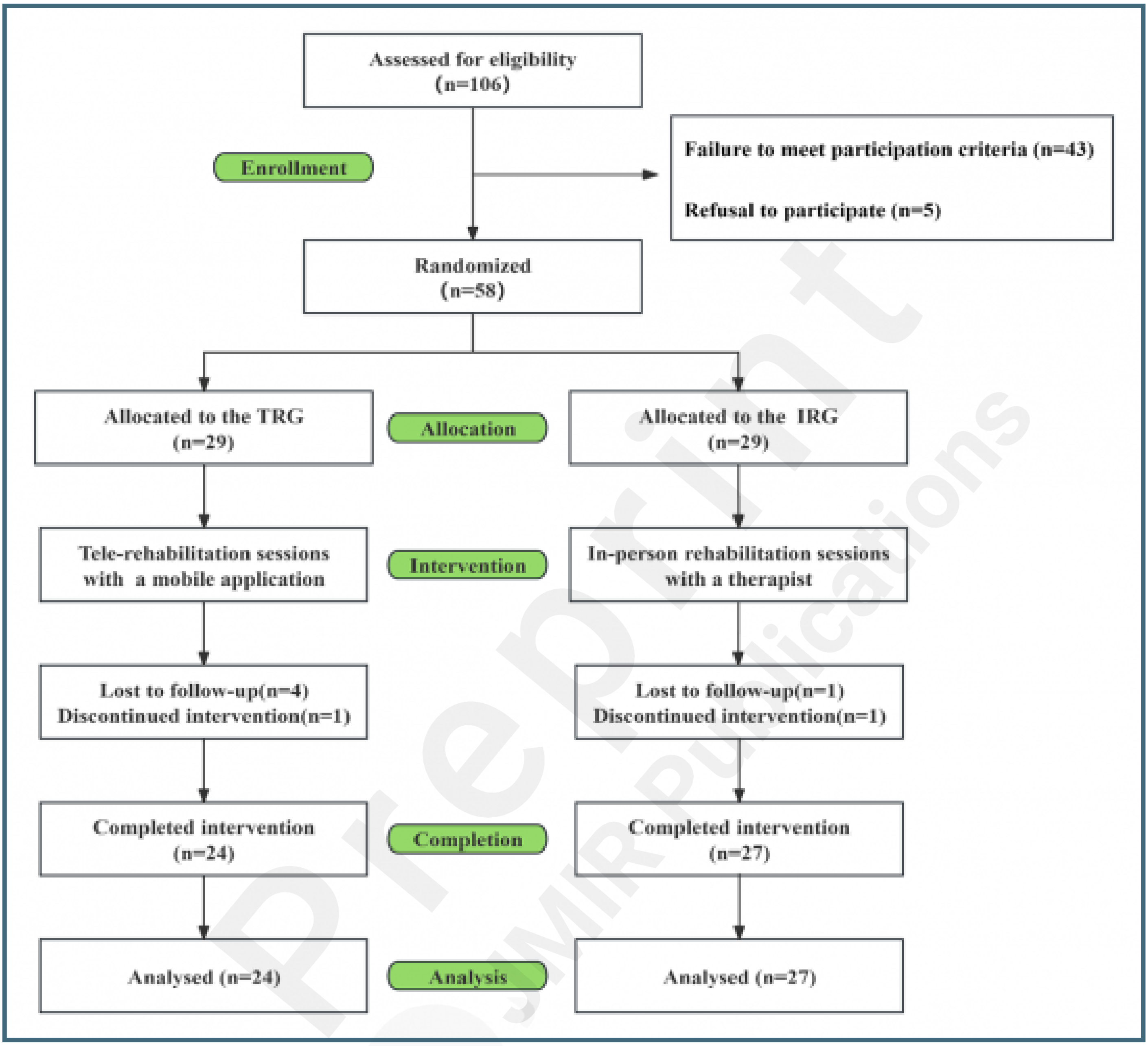
The exercises include (a) Glute bridge, (b) Resisted elbow flexion, (c) Resisted hip extension, (d) Resisted hip abduction, (e) Resisted shoulder abduction, (f) Resisted knee extension.



The 3 different parts of the tele-rehabilitation system. The doctor's portal could be used to create and modify exercises, monitor training progress, and view patient data. The patients could use the user's portal to complete the prescribed exercises and provide feedback to the physical therapists. Finally, the transmitter portal encrypts and transmits the data collected, ensuring the overall system's integrity.



Study ?ow.


Assessed for eligibility
(n=106)
Enrollment
Failure to meet participation criteria (n=43)
Refusal to participate (n=5)
Randomized
(n=58)
Allocated to the TRG
(n=29)
Allocation
Allocated to the IRG
(n=29)
Tele-rehabilitation sessions with a mobile application
Intervention
In-person rehabilitation sessions with a therapist
Lost to follow-up(n=4)
Discontinued intervention(n=1)
Lost to follow-up(n=1)
Discontinued intervention(n=1)
Completed intervention
(n=24)
Completion
Completed intervention
(n=27)
Analysed (n=24)
Analysis
Analysed (n=27)

The grip strength, quadriceps femoris EPT, BBS, and IADL data at baseline and 4 weeks; error bars represent 95% CIs.