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RESEARCH PAPERS

Effects of self-monitoring using an accelerometer on physical activity of older people with long-term care insurance in Japan: a randomized controlled trial

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Running head: Effects of self-monitoring on physical activity

Keywords: Accelerometer, long-term care insurance, physical activity, randomized controlled trial,; self-monitoring.

Key Summary points

Aim: We investigated the effectiveness of a self-monitoring intervention to promote step count and reduce sedentary behavior in older people covered by the long-term care insurance system (LTCI) in Japan.

Findings: Results from a randomized controlled trial of a self-monitoring intervention using accelerometers with a 5-week follow-up: improvement in number of steps, light physical activity, and sedentary behavior in the intervention group compared to the control group.

Message: Self-monitoring with an accelerometer may be effective in increasing the number of steps taken and amount of light physical activity per day and in reducing sedentary behavior in older people with LTCI.

ABSTRACT (250/250 words)

Purpose: This study aimed to investigate the effects of a self-monitoring intervention to promote an increase in physical activity, as measured by step count, and reduce sedentary behavior in older people covered by the long-term care insurance system (LTCI) in Japan.

Methods: This was a randomized controlled trial conducted at a daycare center from October 2022 to January 2023. Fifty-two older adults with LTCI who were able to walk with or without aids were assigned to an intervention (n=26) group and control (n=26) group. During the 5-week follow-up period, the intervention group received education on physical activity and self-monitoring such as goal setting, self-management and feedback. The primary outcome was step count, and secondary outcome was sedentary behavior.

Results: Participants who completed the study to the end of the 5-week follow-up and drop-out participants for whom outcome data were available were included in the final analysis of 57 participants, n=24 (79.8±8.8 years, male 25.5%) in the intervention group and n=23 patients (82.5±8.5 years, male 39.1%) in the control group. Comparisons between the two groups at baseline showed no significant differences. In the results of a two-way mixed analysis of variance (ANOVA) including 2 (group: control, intervention) × 2 (period: baseline, 5-week follow-up) factors, an interaction was observed in the number of steps, sedentary behavior, and light physical activity ($p<0.05$).

Conclusion: Self-monitoring of physical activity using an accelerometer may be effective in increasing the number of steps and light physical activity and in reducing sedentary behavior in older people with LTCI.

Clinical trial registration: UMIN000052044, registered on 2023/08/29.

Introduction

The number of older people requiring care is increasing due to age-related health problems [1]. As a countermeasure, Japan launched a public long-term care insurance system (LTCI) in 2000 [2,3]. The number of LTCI users has increased by threefold from 2.18 million in 2000 to 6.9 million in 2021, making national expenditures on long-term care a serious problem [1,3].

In terms of the health of the older people, a reduction in physical activity, such as in walking and increased sedentary behavior, is associated with a higher risk of mortality [4,5]. Promotion of physical activity is recommended to prevent diseases such as heart disease [6], diabetes [7], hypertension [8], orthopedic disease [9], and stroke [10], as well as to improve health-related quality of life (HRQOL) and overall health [11,12]. In particular, the number of steps taken by older people with LTCI is lower than that of healthy older people [13].

Self-monitoring is known to be an effective method for promoting physical activity [14]. Self-monitoring is a behavior change technique using praise and encouragement through goal setting, self-management, and feedback and has been used to promote physical activity and regulate blood glucose levels [15,16]. The effects of accelerometer-based self-monitoring on physical activity in healthy older people [17], hospitalized patients such as those with stroke or heart disease [18-20], and chronically ill patients [21,22] have been reported in randomized controlled trials. In other words, promoting physical activity in older people with LTCI, who are at higher risk of death or hospitalization than healthy older people, may have a positive impact on health care and LTCI costs and improve QOL.

However, daycare services for older people with LTCI primarily aim to promote health based on maintaining and improving physical function, and there has been little verification of programs that incorporate effective content that focuses on their physical activity [13]. Also, very few studies have intervened in improving the physical activity of older people with LTCI, such as by increasing the number of steps taken or reducing sedentary behavior. Furthermore, the impact of a self-monitoring intervention using an accelerometer on physical activity in older people with LTCI is not known. Therefore, the purpose of this study was to investigate the effects on physical activity of a self-monitoring intervention to promote the number of steps taken as measured by step count and to decrease sedentary behavior in older people with LTCI in a randomized controlled trial.

Methods

Study design

The study was designed as a prospective, single-blind, randomized controlled trial. The study protocol was approved by the Reiwa Health Sciences University Research Ethics Committee (approval number: 22-008) and registered with the University Hospital Medical

Information Network Clinical Trials Registry (UMIN000052044). This study was conducted in accordance with “Extending the CONSORT statement to randomized trials of nonpharmacologic treatment: explanation and elaboration” [23]. The study complied with the guidelines of the Declaration of Helsinki, and written informed consent was obtained from all participants.

Participants and investigation

Participants were enrolled if they had undergone rehabilitation at a daycare center between October 2022 and January 2023. Participant inclusion criteria included age ≥65 years, LTCI support levels 1 and 2, and able to walk with or without walking aids. Exclusion criteria were dementia (Mini Mental State Examination score <24) [24], not agreeing to participate in the study, not using the center for more than 1 week, and worsening of symptoms such as pain, shortness of breath, abnormal blood pressure, palpitations, and fatigue. Assignment to the intervention group or control group was conducted by block randomization of two blocks of six samples in a computerized random number table. All interventions and evaluations were performed by two co-investigator physical therapists. Therefore, they were not blinded to the interventions or evaluations. Participants in both groups were informed of the importance of promoting physical activity and asked to wear accelerometers, but the differences between the intervention and control groups were not explained. Although the participants knew the study focused on physical activity, the specific intervention and assigned groups were unknown and the co-researchers were careful not to mention them; thus, blinding was maintained. After allocation, the intervention group was notified that an accelerometer would be used to self-monitoring the number of steps they took and that the goal was to promote physical activity through recording and advice from physical therapists when using daycare. The control group was informed that an accelerometer would be used to collect step count data, that promoting step count was optional, and that advice on how to increase step count using self-monitoring would not be given. Analysis of the results was conducted by the principal investigator. The principal investigator had no contact with the participants, did not administer the intervention or assessments, and was not informed of the group assignments.

Participant characteristics assessed included age, sex, body mass index, LTCI level [1-3], comorbidities, and medicines taken, and physical functions such as handgrip strength [25], normal gait speed [26], one-leg standing time [27], and sit-to-stand-5 (SS5) [28] were measured at baseline.

Handgrip strength was used to assess upper extremity muscle strength. Using a Smedley-type hand dynamometer (TKK5401, Takei Electric Industry Co., Ltd., Niigata, Japan), measurements were taken twice on the left and right sides, and the maximum value obtained was used [25]. Normal gait speed, a measure of walking ability, was measured using a stopwatch and defined as the time required to walk 5 m at normal speed [26]. One-leg standing time, a measure of balance, was measured using a stopwatch and defined as the longest time the eyes were open and the posture could be held. Measurements were taken twice on the left and right sides, and the maximum value was set to 60 seconds [27]. The SS5 was used as an indicator of lower limb muscle strength [28]. The measurer prepared a chair with a seat height of 40 cm and asked the participants to “cross your arms, stand up and sit down on the chair as quickly as possible, five times in a row,” and the time it took to do so was measured. These physical function measurements were performed by two physical therapists according to a physical therapy measurement manual referencing previous studies [25-28].

Long-Term Care Insurance

LTCI in Japan defines “support level” as the level of support (from 1 to 2) required for daily living and “care levels” as the different degrees (from 1 to 5) of care required, with services being available for each level. Support level 1 covers individuals who are independent in activities of daily living (ADL) but require some supervision for instrumental ADL such as shopping. Support level 2 covers individuals whose ability to walk is impaired due to lower extremity muscle weakness. Individuals assigned to Care level 1 require nursing care for some ADL. Those assigned to Care level 2 require more care for some ADL than individuals at Care level 1. Care level 3 covers individuals who use aids for mobility or a wheelchair to walk and need care for most ADL. Individuals at Care level 4 require a wheelchair for mobility and are unable to perform ADL without care, and Care level 5 covers individuals who are mostly bedridden, have difficulty communicating, and are unable to eat on their own [1-3]. These LTCI levels were determined by two physical therapists from the participants’ medical data.

Outcomes

The main outcome was the number of steps taken per day [29]. Secondary outcomes were changes in sedentary behavior [30], light physical activity, moderate physical activity, vigorous physical activity [31], and HRQOL [32]. The number of steps taken per day and each physical activity were measured using a tri-axial accelerometer (Active Style Pro HJA-750C, OMRON, Kyoto, Japan) attached to the waist [29,31]. A macro program (ver. 1.0) developed and distributed by the Japan Physical Activity Research Platform was used for processing of the accelerometer data [33]. For physical activity, metabolic equivalent values (METs) obtained every 10 seconds by the accelerometer were calculated. Cutoff values based on METs were used to determine each intensity: sedentary behavior (≤1.5 METs), light physical activity level (>1.5 to <3.0 METs), moderate physical activity (≥3.0 to <6.0 METs), and vigorous physical activity (≥6.0 METs) [30,31].

Participants wore their accelerometers continuously from baseline to the end of a 5-week follow-up period. Only data from the participants who wore the accelerometer for at least 10 hours per 5 days at baseline over the 5-week follow-up were used, and the mean value was representative.

HRQOL was measured using the EuroQol 5-Dimension 5-Level (EQ5D5L) score. This score is determined from a self-administered questionnaire that evaluates health status in the five categories of "mobility," "self-care," "usual activities," "pain/discomfort," and "anxiety/depression" using a 5-point scale (1: no, 2: slight, 3: moderate, 4: severe, 5: extreme problem/unable to). The collected EQ5D5L results can be converted to a utility score using the Japanese EQ-5D-5L value set. The scores range from -0.025 to 1.000, with higher scores indicating full health [32,34].

Intervention group and control group

The flow of this study is shown in Figure 1. During the 5-week follow-up period, self-monitoring of behavior change techniques such as education, goal setting, self-management, and feedback were used with intervention group [18-20].

In terms of content, the intervention group was (i) given accelerometers, pamphlets, and calendars; (ii) educated on steps and sedentary behaviors using the pamphlets; (iii) asked to set goals for steps and sedentary behavior; (iv) asked to record the number of steps and duration of sedentary behavior on a calendar; and (v) given feedback, praise, and encouragement, and asked to reconsider goals based on records of steps and sedentary behavior. Specific education to promote physical activity was provided for approximately 15 minutes at baseline using pamphlets to convey the relationship between physical activity and prognosis (Supplementary Figures 1-3). As well, instruction on increasing the number of steps by 50–100 steps/day [35,36], decreasing sedentary behavior time by at least 30 min/day from baseline [37], and if sitting time exceeded one hour, that "standing" or "walking" should be performed at least once as goals. Based on the records entered on the calendar, we praised the participants when they achieved their goals and encouraged them and had them reconsider their goals when they did not. That feedback was provided once a week when participants visited the daycare, for about 5 minutes, during a break in each exercise session.

The control group was (i) given accelerometers, pamphlets, and calendars, and (ii) educated on steps and sedentary behaviors using the pamphlets. They were not given advice on how to increase physical activity, such as through feedback or reconsideration of goals based on recordings on their calendar of the number of steps taken and the time spent in sedentary behavior.

Participants used the center primarily to improve their physical functions, such as muscle strength, balance ability, and aerobic capacity, and to improve their health. In common, both the intervention and control groups participated in a 3-hour rehabilitation program consisting of stretching (upper and lower extremity muscles), resistance exercises (repetitive sit-to-stand exercises, and seated exercises with a TheraBand), aerobic exercise (bicycle ergometer or Nu-Step, and walking), balance training (single-leg standing exercises, mat-based exercises), and ADL training (such as step climbing) [38]. The frequency of participation was once a week for level of support 1 and twice per week for level of support 2. Exercise intensity and duration ranged from 11 to 13 on a rating of perceived exertion [39], and each exercise included a break every 20 minutes. The program was managed by two physical therapists, one nurse, and one caregiver.

Safety

Participant safety was assessed during the entire study in terms of the number and severity of adverse events attributable to the intervention. Participants were surveyed by research personnel at the time of center use for any adverse experiences that occurred during the study.

Statistical analysis

G*Power (version 3.1; HHU, Düsseldorf, Germany) was used to calculate the sample size needed to identify differences in primary outcomes between the two groups. The sample size was 36 participants with an alpha error of 0.05 and power of 0.8, referring to an effect size of d = 1.15 from a previous study [18]. We assumed a dropout rate of 30% and a target sample size of 52 participants.

Statistical analyses were performed according to ITT principles and included all data for all randomized participants whenever possible. Data from participants who dropped out were included when outcome indicators at baseline were available. Baseline participant characteristics and physical function, as well as accelerometer wearing time, were compared between the two groups using an unpaired *t*-test or $\chi 2$ test. The effects of the intervention on outcome measures such as number of steps, time of sedentary behavior, low-intensity activity, moderate activity, high-intensity activity, and HRQOL were analyzed using two-way mixed analysis of variance (ANOVA) including 2 (groups: control, intervention) × 2 (term: baseline, 5-week follow-up) factors with repeated measures and repeated measures with 95% confidence intervals for the last factor. Bonferroni adjustment and post-hoc pairwise comparisons were also used. ANOVA effect sizes (η^2) are calculated, showing that effect sizes >0.01 are small, >0.06 are moderate, and >0.15 are large [40]. Per protocol analyses, which included only participants who completed the 5-week follow-up, used a two-group comparison, and after adjusting for items that were significantly different between the two groups, repeated measures two-way ANOVA. A p-value of <0.05 was considered to indicate statistical significance. Statistical analyses were performed with IBM SPSS 25.0 J statistical software (IBM SPSS Japan, Inc., Tokyo, Japan).

Results

Participant flow

The participant flow in this study is shown in Figure 1. Of the 106 rehabilitation participants recruited, 54 were excluded and thus 52 participants meeting the criteria were randomly assigned to the intervention (n=26) group and control (n=26) group. In total, 38 participants, n=19 in the intervention group and n=19 in the control group, completed the study at the end of the 5-week follow-up. Data from participants who dropped out (intervention group: n=5, control group: n=4) were incorporated, and the final analysis included 57 participants, n=24 in the intervention group and n=23 in the control group.

Participant characteristics and accelerometer wearing time

Baseline participant characteristics and accelerometer wearing time are shown in Table 1. There were no significant differences in patient characteristics and accelerometer wearing time between the two groups.

Effects of self-monitoring on physical activity

The results of the repeated measures two-way mixed ANOVA for physical activity and HRQOL at baseline and follow-up for the two groups are shown in Table 2. No main effect was found for Term. There was a significant interaction between group (intervention, control) and time (baseline, 5-week follow-up) in the number of steps taken, time of sedentary behavior, and light activity ($p < 0.05$).

The per protocol analysis showed significant differences in diabetes, dyslipidemia, and cerebrovascular disease in the intervention group compared to the control group ($p < 0.05$), and two-way ANOVA after adjustment for these factors showed an interaction effect between number of steps and sedentary behavior ($p < 0.05$) (Supplementary Tables 1 and 2).

Discussion

To our knowledge, this is the first report of the effects of self-monitoring with an accelerometer on physical activity, as assessed by number of steps taken and duration of sedentary behavior, in older people with LTCI. The results showed that in this study, the self-monitoring intervention group achieved significant improvements in the number of steps taken and light physical activity performed and in reducing sedentary behavior compared to the control group.

In reports on older people with LTCI and an average age of 80 years, the number of steps taken was approximately 2000 steps/day [13,41], and in a group with an average age of 81 years, physical activity ranged from 562.7–673 min/day for sedentary activity, 215–263 min/day for low-intensity, and 3.0–8.7 min/day for moderate-intensity activity [42,43]. The duration of sedentary behavior reported in healthy older people was >480 min/day [44]. The mean age of the older people with LTCI in the present study was 80 years, baseline step count was 1367–1682 steps/day, duration of sedentary behavior was 547–523 min/day, light activity was 276–293 min/day, and moderate activity 9.1–9.3 min/day. Compared to the previous studies, these physical activity results showed a slightly lower number of steps and a slightly higher duration of light activity in a population that was roughly similar to the those of the previous studies [13,41-43].

In other studies not targeting older people with LTCI, self-monitoring interventions for physical activity were reported to promote steps in mild stroke disease [18], heart disease [19,20], and healthy older people [17], and to reduce sedentary behavior in mild stroke disease [45]. The results of the present study support the effectiveness of accelerometer-based self-monitoring interventions similar to these previous studies.

There were differences in the intervention methods and participants between the present study and the previous studies [13,41-43,45]. In the self-monitoring intervention, the previous studies targeted either steps or sedentary behavior, whereas the present study targeted both indicators. First, the present study focused on the importance of both promoting steps and decreasing sedentary behavior via physical activity education. Second, the self-monitoring indicators were the number of steps taken and the duration of sedentary behavior, and both values were recorded on a calendar, and third, a target value was set for each indicator. Clearly communicating the need to increase the number of steps and reduce sedentary behavior through self-monitoring and setting of goals is important for self-motivation [46]. In addition, we found no previous randomized controlled trials of a self-monitoring intervention using an accelerometer to promote physical activity in older people with LTCI. The results of this intervention promoting physical activity in this target population were novel to this study.

Older people with LTCI have reduced mobility and activity compared to healthy older people, so increasing physical activity is not easy [4,13]. However, goals such as increasing the number of steps can be easily understood and practiced, and reducing the time spent in sedentary behavior, such as by standing or taking a short walk, are activities that can be performed indoors and do not require high mobility [47]. Also, the intervention group in the present study performed more light physical activity, took more steps, and had shorter sedentary behavior time than the control group. A previous study in healthy older people reported that moderate to vigorous physical activity increases when sedentary behavior decreases, which is somewhat similar to the findings in the present study [48]. Increasing light physical activity such as by standing, performing standing work, and taking a few steps has been noted to address sedentary behavior [49]. Therefore, it is possible that the intervention group was aware of standing and taking a few steps in daily life as a way to reduce sedentary behavior, which may have promoted more steps and light physical activity. Further, the goals of the self-monitoring intervention, which included education, goal setting, self-monitoring, and feedback on the promotion of walking and reduction of sedentary behavior from the beginning to the end of the 5-week follow-up period, were to promote health and prevent serious illness. As the study participants had already originally received rehabilitation for health promotion and prevention of serious illness at the daycare center, they were likely to understand and be more willing to practice self-monitoring interventions, which have the same objectives [38]. Furthermore, in this study, self-monitoring to promote physical activity was safe, and no adverse events such as falls or increased pain occurred. Thus, a self-monitoring intervention to promote steps and reduce sedentary behavior in older people with LTCI is suggested to be a safe and effective way to effect changes in step counts and light physical activity in daily life and to reduce sedentary behavior.

However, this study found no effect of self-monitoring on HRQOL. Previous studies have shown that increased physical activity through long-term interventions in older people is effective in reducing psychological distress and improving HRQOL [50-52]. However, several reasons were considered for the present results. The duration of the intervention was short in terms of the duration of life with increased physical activity, which may not have resulted in sufficient changes in HRQOL [52]. In addition to walking, physical activity can include housework, group sports, gardening, and sightseeing [53-55], but whether these types of physical activity were performed is unknown in this study, and they could also contribute to bettering HRQOL. Therefore, further research into other activities performed is warranted in older people with LTCI.

This study has limitations. First, it was conducted at a single facility using a small sample size. Second, we were not able to examine the types of physical activity performed. Furthermore, we could not examine the sustained effects of the self-monitoring intervention. Therefore, further research is needed on the effects of self-monitoring on physical activity and HRQOL in older people with LTCI. Specifically, it will be necessary to include a larger number of participants to improve the reliability of the results and to include participants from different multi-center sites so that the generalizability of the results can be expanded. It is important to focus on different types of physical activities besides walking, such as housework, group sports, gardening, and sightseeing, to determine their impact on HRQOL. In addition, tracking participants months and years after the intervention and evaluating changes in physical activity and HRQOL will help to understand the lasting effects of the self-monitoring intervention.

Conclusions

This study suggested the importance that self-monitoring interventions targeting physical activity, such as the number of steps taken and duration of sedentary behavior, have on older people with LTCI. The results indicated that among older people with LTCI, the self-monitoring intervention group showed significant improvements in the number of steps taken, light physical activity performed, and reduction in sedentary behavior time compared to the control group. Furthermore, the self-monitoring intervention did not cause any adverse events such as falls or increased pain. Therefore, self-monitoring with an accelerometer may be effective in increasing the number of steps taken and amount of light physical activity performed per day and in reducing sedentary behavior in older people with LTCI.

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Author Contributions

Conceptualization, M.K., K.P.I., T.N., T.Y., S.O., K.F., W.Y., and H.M.; methodology, M.K. and K.P.I.; protocol development, obtaining ethical approval and formal analysis. M.K.; participant recruitment and investigation, K.F. and W.Y.; writing—original draft preparation, M.K.; writing—review and editing, M.K., K.P.I., T.N., T.Y., S.O., K.F., W.Y., and H.M.; resources and funding acquisition, M.K. and K.P.I.; supervision, K.P.I. All authors have read and agreed to the published version of the manuscript.

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Declarations

Competing Interests

The Authors declare that there is no conflict of interest.

Ethics approval

The study protocol was approved by the Reiwa Health Sciences University Research Ethics Committee (approval number: 22-008). The study complied with the guidelines of the Declaration of Helsinki, and written informed consent was obtained from all participants.

Informed Consent

Written informed consent was obtained from each participant in this study.

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Figure Legends

Figure 1. Flow of this study.

Figure 2. Participant flow. LTCI, long-term care insurance.

Table 1. Participant characteristics and accelerometer wearing time.

	Intervention group (n=24)	Control group (n=23)	*t* or χ^2 value	*p* Value
Age, years	79.8 ± 8.8	82.5 ± 8.5	-1.1	0.277
Sex, male, %	25.0	39.1	1.1[a]	0.299
Body mass index, kg/m^2	24.3 ± 4.1	23.6 ± 2.2	0.4	0.463
LTCI, level of support 1/2, %	58.3/41.7	56.5/43.5	<0.1[a]	0.900
Comorbidity, %				
Hypertension	75.0	56.5	1.8[a]	0.181
Diabetes	29.2	13.0	1.8[a]	0.177
Dyslipidemia	33.3	17.4	1.6[a]	0.210
Orthopedic disease	62.5	73.9	0.7[a]	0.401
Cerebrovascular disease	50.0	26.1	2.8[a]	0.092
Heart disease	29.2	13.0	1.8[a]	0.177
Chronic kidney disease	4.2	4.3	<0.1[a]	0.975
Cancer disease	12.5	30.4	2.3[a]	0.133
Medicine, %				
Ca antagonist	47.6	39.1	0.3[a]	0.570
ARB or ACE	23.8	4.3	3.5[a]	0.060
Statin	19.0	34.8	1.4[a]	0.242
Hypoglycemic drug	19.0	8.7	1.0[a]	0.318
Beta-blocker	0.0	8.7	1.9[a]	0.167
Handgrip strength, kg	20.5 ± 6.0	21.1 ± 8.8	-0.3	0.781
Male, kg	26.6 ± 4.7	29.9 ± 5.9	-1.1	0.284
Female, kg	18.5 ± 4.9	15.4 ± 4.6	1.8	0.090
Normal gait speed, m/sec	0.95 ± 0.23	1.06 ± 0.39	-1.2	0.249
One-leg standing time, sec	14.0 ± 18.2	13.7 ± 19.7	<0.1	0.956
Sit-to-stand-5, sec	11.2 ± 3.1	12.5 ± 4.0	-1.3	0.212
Wearing time, baseline, min/day	831.8 ± 99.2	869.9 ± 109.0	-1.3	0.216
Wearing time, 5-week follow-up, min/day	825.6 ± 94.4	881.2 ± 141.0	-1.4	0.153
Non-wearing time, baseline, min/day	308.2 ± 99.2	270.1 ± 109.0	1.3	0.216
Non-wearing time, 5-week follow-up, min/day	331.3 ± 121.0	258.5 ± 141.0	1.7	0.096

ARB: Angiotensin II receptor blocker; ACE: angiotensin-converting-enzyme inhibitor; LTCI: long-term care insurance.

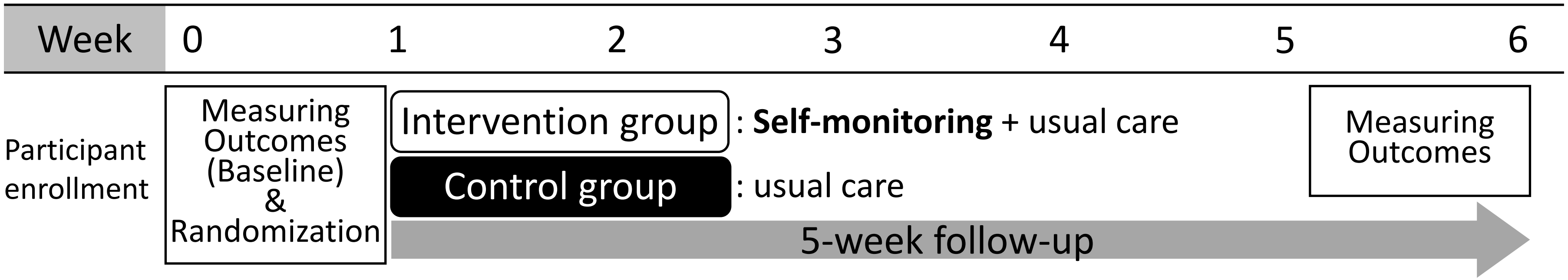
Values are shown as mean ± SD or ordinal variables and counts (%) for categorical variables.

[a] $\chi 2$ value.

Table 2. Physical activity and health-related quality of life in the two groups.

	Intervention group (n=24)			Control group (n=23)			Interactions				
							Term		Group × Term		
							F value	*P* value	*F* value	*P* value	Effect size (η^2)
Number of steps, steps/day							2.2	0.150	20.0	<0.001	0.149
Baseline	1367.8	±	932.5	1797.0	±	1482.9					
5-week follow-up	1682.7	±	1126.5	1352.7	±	954.1					
Sedentary behavior, min/day							0.7	0.684	11.5	<0.002	0.225
Baseline	547.4	±	118.8	555.0	±	131.4					
5-week follow-up	523.3	±	108.8	608.3	±	154.4					
Light physical activity, min/day							0.8	0.373	7.0	<0.012	0.154
Baseline	276.6	±	88.3	304.7	±	105.3					
5-week follow-up	293.0	±	107.4	264.1	±	97.0					
Moderate physical activity, min/day							0.2	0.640	1.4	1.367	0.044
Baseline	9.1	±	8.6	9.5	±	7.8					
5-week follow-up	9.3	±	9.7	9.1	±	7.1					
Vigorous physical activity, min/day							<0.1	0.946	1.8	0.183	0.039
Baseline	0.2	±	2.2	0.1	±	0.7					
5-week follow-up	0.2	±	0.8	0.3	±	0.9					
EuroQol 5-Dimension 5-Level							3.6	0.067	0.2	0.650	0.192
Baseline	0.61	±	0.18	0.67	±	0.19					
5-week follow-up	0.56	±	0.21	0.60	±	0.24					

Values are shown as mean ± SD.



Self-monitoring contents		Intervention group	Control group
(i)	Distribution of accelerometers, pamphlets, and calendars	○	○
(ii)	Education on steps and sedentary behavior using the pamphlets	○	○
(iii)	Set goals for steps and sedentary behavior	○	
(iv)	Record number of steps and duration of sedentary behavior on a calendar	○	
(v)	Receive feedback, praise, and encouragement, and reconsideration of goals based on records of steps and sedentary behavior	○	

Figure 1. Flow of this study

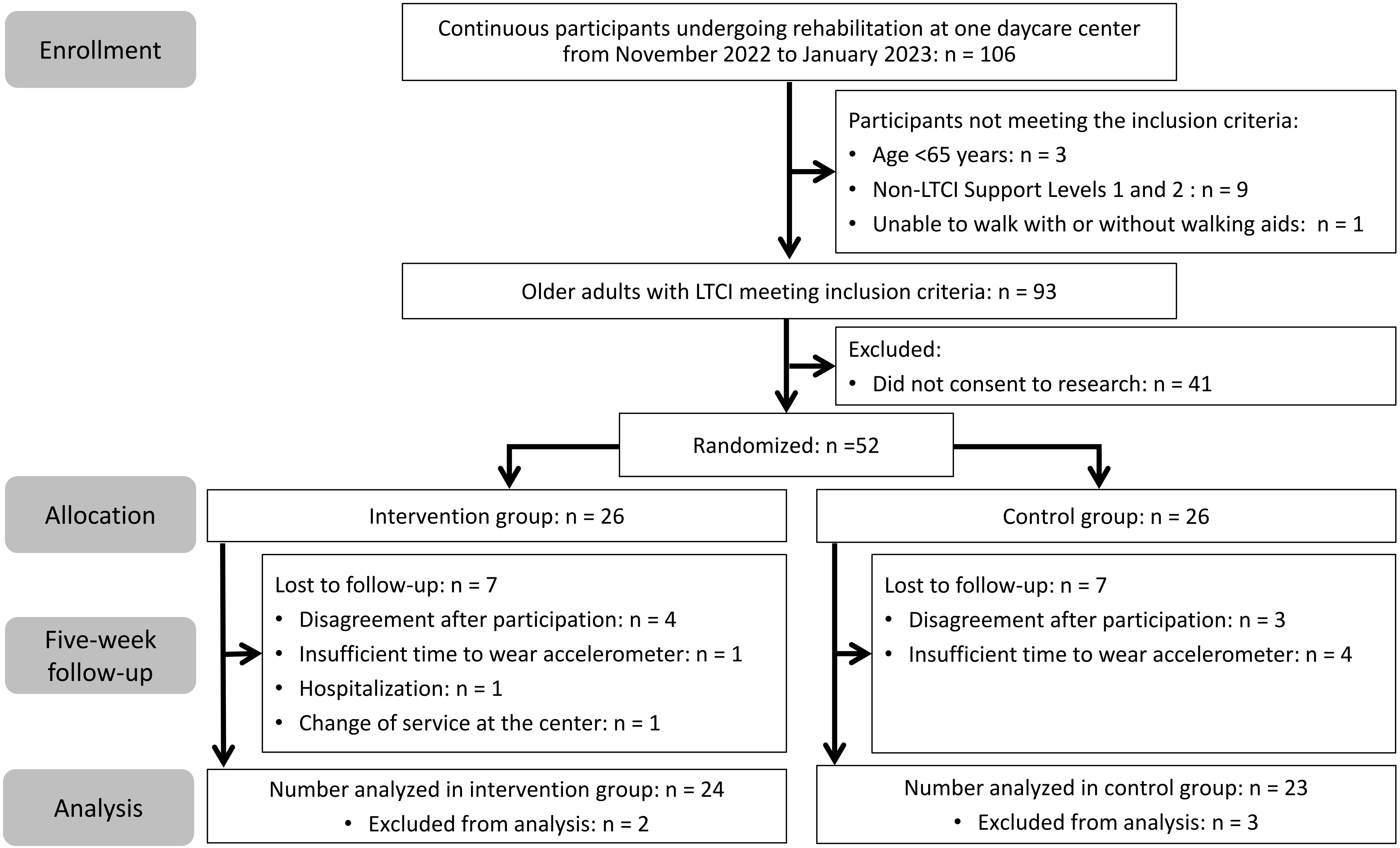


Figure 2. Participant flow