Walking for better outcomes and recovery: The effect of WALK-FOR in preventing hospital-associated functional decline among older adults

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Abstract

Background: In-hospital immobility of older adults is associated with hospital-associated functional decline (HAFD). This study examined the WALK-FOR program's effects on HAFD prevention.

Methods: A quasi-experimental pre-post two-group (intervention group [IG] *n* = 188, control group [CG] *n* = 189) design was applied in two hospital internal-medical units. On admission, patients reported pre-hospitalization functional status, which was assessed again at discharge and 1-month follow-up. Primary outcome was decline in basic activities of daily living (BADL), using the Modified Barthel Index (MBI). Secondary outcomes were decline in instrumental ADL (Lawton's IADL scale) and community mobility (Yale Physical Activity Survey). All participants (75.1 ± 7 years old) were cognitively intact and ambulatory at admission. The WALK-FOR included a unit-tailored mobility program utilizing patient-and-staff education with a specific mobility goal (900 steps/days), measured by accelerometer.

Results: Decline in BADL occurred among 33% of the CG versus 23% of the IG ($p = 0.02$) at discharge, and among 43% of the CG versus 30% in the IG ($p = 0.01$) at 1-month follow-up. Similarly, 26% of the CG versus 15% of the IG declined in community mobility at 1-month follow-up ($p = 0.01$). Adjusted for major covariates, the intervention reduced the odds of decline in BADL by 41% ($p = 0.05$) at discharge and by 49% at 1-month follow-up ($p = 0.01$), and in community mobility by 63% ($p = 0.02$). There was no significant effect of the intervention on IADL decline ($p = 0.19$).

Conclusions: The WALK-FOR intervention is effective in reducing HAFD.

Key words: in-hospital mobility, hospitalization, intervention, functional decline, activities of daily living.

Introduction

Hospitalization of older adults for non-disabling conditions, such as pneumonia or chronic illness exacerbations, results in 30–50% functional decline (1-4) and long-term community-mobility limitations (5). About one-third of older adults fail to recover their pre-hospitalization functional status and continue to decline by 1-year follow-up and have a higher subsequent mortality risk (4,6). Limited in-hospital mobility is strongly linked to hospital-associated functional decline (HAFD) among older adults, even after controlling for important confounders such as prior functioning, comorbidity, illness acuity, depression, and malnutrition (2,3). Nevertheless, regardless of their walking abilities, older adults spend more than two-thirds of their hospital stay lying in bed, as measured by accelerometer (7-9).

Various interventional studies have found a positive effect of increased in-hospital mobility on basic activities of daily living (BADL) (10-13), length of stay (LOS) (10,14), in-hospital mobility (10,14), community mobility (15), and instrumental activities of daily living (IADL) (16). Although preventing functional decline is the ultimate goal of every geriatric treatment (3,17-19), and the potential to improve mobility in hospital settings has been widely demonstrated (10,11,13-15), previous studies revealed two gaps to address when developing new mobility interventions: (1) considering characteristics of the local context that may improve implementation and sustainability, and (2) setting a measurable mobility goal.

The WALK-FOR (walking for better outcomes and recovery) intervention is a theory-driven intervention aimed to address these gaps. First, it adopts a well-grounded and flexible model, the SEIPS 2.0 (System Engineering Initiative for Patients Safety) (20), which guided the adaptation to the local context (21). The strength of the model is its ability to identify and manipulate local factors limiting in-

hospital mobility while adapting elements from existing interventions (20). Second, it addresses 900 steps per day as a measurable goal. Walking fewer than 900 steps per day was linked to a 4.7-fold risk of developing HAFD (22) and therefore can serve as a walking-dose benchmark. Thus, the aim of the current study is to examine the effect of WALK-FOR on the prevention of HAFD at discharge and at 1-month follow-up from acute hospitalization in internal medical units.

Methods

Research Design and Participants

We used a quasi-experimental pre-post two-group comparative design to assess the impact of the WALK-FOR intervention program on functional decline at discharge and at 1-month follow-up. The control group (CG) for usual-care practice was collected first and lasted from October 2015 through February 2016. Following this phase was a 3-month development phase that included field mapping, after which the WALK-FOR protocol was fully implemented and an intervention group (IG) was collected, which lasted from June 2016 through September 2016.

Hebrew-, Russian-, or Arabic-speaking older adults (≥65 years), admitted for non-disabling diagnosis to one of two internal-medicine units in a medical center in northern Israel, and who were able to walk at time of admission, were screened for participation in the study. The study setting included 46 beds in each unit, with a 75-meter corridor, five nurses, and two nurses' aides during the daytime, a 20% position of physical therapists, and no assistive mobility devices at baseline. Exclusion criteria were immobility due to medical restrictions, end-of-life care, or impaired cognition (a score of ≤5 points on the Short Portable Mental Status Questionnaire) (23). Participants were recruited within the first 24 hours of admission and were followed

for 3 hospitalization days, at discharge, and at 1-month follow-up. The study was approved by the University of Haifa's ethics board (Approval no. 139/16) and by HaEmek Medical Center's Helsinki committee (Approval no. 0100-15-EMC). All participants signed informed consent forms. The study was registered in the Australian New Zealand Clinical Trials Registry (registration record ACTRN12616001274460).

Intervention

Development phase. The first stage of the intervention development was field mapping by addressing the main obstacles to patient mobility while illuminating local strengths, relying on the SIEPS 2.0 theoretical model (20). The principal investigators (AZ, MA) conducted a series of meetings with the hospital leadership (including YH) and the interdisciplinary team to identify local constraints and resources and to design the intervention. During this process, in-depth interviews were conducted with all disciplines, including nurses' aides, who were designated to assist mobility. After articulating the project road map, we borrowed a materials kit from Liu and colleagues (14), adjusted for local settings and needs. During the first 2 months, hospital management dedicated half an hour per day to supervising the intervention.

Intervention description. The intervention included a unit-tailored mobility program structured for unit staff, patients, and their caregivers and distributed through video clips, in-personal communication, brochures, and posters. More specifically, a dose of at least 900 steps per day (22) was defined as a behavioral goal. Staff underwent theoretical and practical training to assess mobility and to safely mobilize patients. Several changes were added to the processes at the hospital setting: (1) nurses assessed mobility and provided mobility recommendations at admission, (2) electronic medical records were modified to include patients' mobility ability as well

as reports on daily walking distance, and (3) environmental modification included removing physical obstacles from corridors, marking walking trails, and purchasing extra walkers. No additional staff members were recruited. The intervention stages and the effort involved in its development are described in detail elsewhere (21).

Intervention fidelity. To assess the effect of the intervention on actual mobility, daily step count was collected for up to 3 days by an ankle-worn accelerometer (Actical), and total daily mean steps was calculated for both groups. To evaluate the behavioral change of staff toward mobility and to address the effect of the intervention on patients' beliefs regarding in-hospital mobility, patients were asked two yes/no questions: 'Were you encouraged by staff members to walk more?' and 'Do you believe in-hospital mobility will improve your recovery?' Additionally, falls were documented as a balancing measure by a cross-reference from patient reports and medical records every 24 hours.

Functional Assessments

Primary outcome. HAFD was operationalized by three domains: BADL, IADL, and community mobility. The primary outcome, BADL, was measured using the 10-item Modified Barthel Index (MBI, score 0–100). The MBI consists of individuals' subjective assessment of their independence level in performing BADL (24). BADL was assessed on admission retrospectively for pre-morbid status (2 weeks pre-admission), at discharge, and by telephone 1 month post-discharge. A functional decline in BADL was defined as a decrease of 5 points or more on the MBI from pre-morbid stage to discharge or to 1-month follow-up, which expresses a loss of independence in one of the BADL criteria, such as walking (25).

Secondary outcomes. IADL was assessed using Lawton's IADL eight-item scale for pre-morbid status (2 weeks pre-admission) and by telephone 1 month post-discharge (26). A decline in IADL was defined as a decrease of 1 point or more, representing a loss of independence in one IADL function (27).

Community mobility was assessed using an activity summary index, a subscale of the Yale Physical Activity Survey (YPAS) (28), at admission for pre-morbid status (during the previous month) and at 1-month follow-up. The summary index was correlated with daily steps measured by accelerometer ($r = 0.45$, $p < 0.001$) (28). The YPAS activity subscale score ranges from 0–142, with higher scores representing greater mobility. Scores are calculated based on frequency and duration of various activities performed by the patient throughout a typical week in the previous month, including vigorous activities, leisurely walking, walking up and down stairs, mobility, standing, and sitting (29). A typically clinically significant cut-off of 10% decline (30) in community mobility was defined as a 14-point or more reduction in YPAS score, representing a decrease from walking 3 to 4 times a week for 10 to 30 minutes to not walking outdoors.

Covariates

The following potential confounders (2,3,31) were assessed at admission: comorbidity using the Charlson Comorbidity Index (CCI) (32), severity of illness using the National Early Warning Score (NEWS) (33), severity of symptoms using 11 self-rated common symptoms during hospitalization (34), LOS, age, and sex. In addition, depressive symptoms were assessed using the HADS, coded as normal, borderline, and positive symptoms of depression groups (35); and low and high malnutrition risk was estimated using the Malnutrition Universal Screening Tool (MUST) (36).

Statistical Analysis

We used *t* tests and chi-squared tests to test for significant differences between the CG and IG for continuous and categorical variables, respectively. Multivariate logistic regressions were modeled separately for BADL, IADL, and community-mobility decline to examine the effect of participation in IG compared with CG on preventing HAFD. All models were adjusted for well-known confounders affecting functional abilities during and post hospitalization: pre-morbid BADL, IADL, and community mobility; age, gender, LOS, comorbidity, severity of symptoms, severity of illness, depressive symptoms, and malnutrition risk (2,3,31). All analyses were performed using IBM SPSS 23.0 package (SPSS INC, Chicago, IL).

INSERT FIGURE 1 ABOUT HERE

Results

Of the 890 patients approached, 401 were recruited, and 377 completed participation in the study (189 recruited to CG and 188 to IG). The refusal and dropout rates were 15.2% and 12.7%, respectively, and similar to those in other studies in the field (15) (see Figure 1). Study group characteristics are presented in Table 1. Overall, the participants had a mean age of 75.4 (±7.0) years, and 226 (60%) were male. The mean LOS was 6.1 days (±3.7, range: 2–34 days, median: 5 days). No significant differences were found between IG and CG for most baseline characteristics, as described in Table 1. Small but significant differences were found between the two groups in BADL and IADL functions 2 weeks pre-admission and in comorbidity at admission, implying that the CG patients were less independent 2 weeks before admission and had slightly worse comorbidity scores (see Table 1). However, no significant differences between the CG and IG ($p = 0.41$) were reported for

community mobility during the month before hospitalization. These variables were controlled for in the multivariate analysis.

INSERT TABLE 1 HERE

Of the 377 participants, 368 (97%) had valid accelerometer data for a continuous 24 hours up to 72 hours. Accelerometer data were lost because of eight technical problems; additionally, one participant removed the device before completing 24 hours of assessment. During hospitalization, IG patients walked significantly more than CG patients: the mean number of steps per day for IG patients was 1.8 times that for CG patients (3,205 vs. 1,791 steps, $t = -4.9$ $p < 0.001$), and the number of IG patients who walked above 900 steps per day was 1.4 times that of CG patients (87% vs. 61%, respectively, $\chi^2 = 34.1$, $p < 0.001$). This difference was significant after adjusting for baseline characteristics in the logistic regression analysis (see supplementary table). Furthermore, 32 CG patients (17%) and 157 IG patients (84%) reported receiving instructions from staff to walk more ($\chi^2 = 121.0$, $p < 0.001$), and 135 CG patients (71%) versus 158 IG patients (84%) believed that increasing in-hospital mobility would improve their recovery ($\chi^2 = 7.2$, $p = 0.007$). Three falls with no serious trauma (~1.6%) occurred in each group, as reported by patient's daily self-report and medical records.

INSERT TABLE 2 HERE

As presented in Table 2, participation in the WALK-FOR program led to a significant reduction in the number of patients with HAFD: 63 CG patients out of 189 (33%) declined in BADL at discharge versus 43 IG patients out of 188 (23%), and 74 CG patients out of 173 (43%) versus 53 IG patients out of 177 (30%) declined at 1-month follow-up. Multivariate analysis adjusted for confounding variables showed that participation in the IG significantly reduced the odds of BADL decline at

discharge by 41% (OR 0.59, 95% CI 0.34–1.0, $p = 0.05$) and by 49% at 1-month follow-up (OR 0.51, 95% CI 0.30–0.85, $p = 0.01$). Similar trends were observed for community mobility 1 month post-discharge with a decline in 45 CG patients out of 173 (26%) and 27 IG patients out of 177 (15%); and 63% lower odds of decline among IG patients compared with CG patients (OR 0.37, 95% CI 0.16–0.85, $p = 0.02$). There was no significant effect of the intervention on prevention of decline in IADL ($p = 0.19$) 1 month after discharge.

Discussion

The current study examined the effect of the WALK-FOR program on preventing HAFD. The findings confirm that through its combination of attaining a goal of 900 steps, education, and consistent consideration of the local context and its resources, the WALK-FOR is an effective way to reduce BADL functional decline at discharge by 41% and at 1-month follow-up by about half. Additionally, the WALK-FOR reduced decline in community mobility at 1-month follow-up by 63%. These findings were significant even after adjusting for major covariates such as pre-hospitalization functional status, age, sex, LOS, comorbidities, depressive symptoms, and severity of illness. Overall, the number of patients experiencing a decline in BADL or community mobility during hospitalization and at 1-month follow-up was reduced by one-third in the IG compared with the CG. Moreover, the WALK-FOR did not increase the number of falls, as only three patients (1%) fell in each group, consistent with similar studies (15). However, no significant difference between groups in IADL decline was found.

The WALK-FOR intervention reduced the decline in the primary outcome: BADL at discharge and at 1 month post discharge. Findings regarding BADL of other

interventions are mixed (10-12,15,16,37). On one hand, nurse-driven mobility protocols (10) and multidisciplinary interventions targeting physical and cognitive functions (11,12) demonstrated a clinically significant improvement in BADL functioning at time of discharge. On the other hand, three interventional studies which included both exercise and walking as tolerated, using an allied health-assistant, did not demonstrate an effect on ADL decline at discharge (15,16,37) or at 1-month post-hospitalization (15). The differences in the findings across interventions may be explained by (1) the potentially high standard of care that may include physical therapy and as such reduce the added value of the intervention in some settings (37); (2) the use of different instruments (the Barthel Index and the Functional Independence Measure), scoring systems, and baseline time points (e.g., admission or 2 weeks before hospitalization) to capture ADL decline; and (3) different definitions of mobility goals across studies.

Our encouraging findings for the secondary outcome—community mobility (measured by YPAS)—are in line with the results of Brown and colleagues, which demonstrated prevention of community-mobility loss 1 month post hospitalization, measured by Life Space Assessment (LSA) (15). The findings from both studies have similar clinical implications, which reflects a person's ability to participate socially. This finding may stem from improved awareness of the importance of one's mobility, which in turn influenced the levels of mobility even 1 month post hospitalization. In contrast to these findings, Siebens and colleagues (16) did not demonstrate prevention of community-mobility decline. However, comparison between studies is difficult because of the significant differences in measurement tools. Siebens and colleagues (16) used only one question (frequency of leaving the neighborhood), which only

partially captured community mobility compared with the LSA and YPAS measures (15,28,29).

The WALK-FOR did not significantly prevent decline in IADL 1 month post discharge. This finding is in line with the study of Landefeld and colleagues (12) but in contrast to the findings of Siebens and colleagues (16). The differences can be explained by the intervention focus: the WALK-FOR and Landefeld and colleagues' (12) interventions concentrated on altering mobility behavior during hospitalization, whereas Siebens and colleagues (16) also added instructions for mobility behavior during 1 month post hospitalization. Siebens and colleagues explicitly instructed participants to conduct home exercises that should be documented and followed weekly. Adding mobility instructions for the post-discharge period may reduce the decline in IADL (16).

Interventions aimed at increasing in-hospital mobility among older adults hospitalized for non-disabling conditions have the potential to reduce HAFD (10,11,13-16). However, consensus regarding mobility definitions and interventions' functional measures remains to be achieved, limiting the ability to compare studies and generalize their findings. Different interventional studies used different functional instruments, time points of measure (which, in addition, lacked post-hospitalization follow-up), and statistical approaches. The definition of in-hospital mobility is also inconsistent in terms of its operationalization and the required dose. Existing interventions operationally defined in-hospital mobility as anything from merely getting out of bed (14) to walking two or three times a day (10,14,15). Moreover, within these definitions, the recommended dose for mobility to prevent HAFD ranges from 15 to 20 min (15) to walking as much as tolerated (10,14). To our knowledge,

this is the first study to demonstrate the effect of adapting an objectively measurable daily walking goal (>900 steps) on the reduction of HAFD.

Arriving at a measurable goal is a crucial step in the development of effective interventions (20,21). However, achieving the desired goal requires in-depth exploration of the local context that includes understanding an organization's needs, culture, and resources (20). Unlike most interventions, in which efforts invested in the implementation phase use external assistants (11-13,15,16), the current study invested most efforts during the context-evaluation and adjustment phases (21). Similar efforts were invested in the study by Liu and colleagues (14). Reliance on existing resources may increase the likelihood of implementation sustainability.

The current study had several limitations that future research should address. The sample is fairly homogenous and composed of relatively high-functioning older adults, although the mean age (15), sex, comorbidity (11), and pre-morbid functional status (10) are similar to those in other studies. Moreover, the intervention group demonstrated higher functional abilities and lower burden of chronic illnesses, 2 weeks prior to the intervention. To reduce this potential bias, these variables (ADL, IADL, and comorbidity) were controlled for in the analysis. Additionally, this study was conducted in one hospital setting to explore the effect of local sustainable practice alterations. To prevent treatment contamination (38), it was designed as a quasi-experimental study that controlled for a large set of confounders. Future studies should incorporate a more heterogenic sample that would enable subgroup analysis and implementation of a stronger design, such as a multi-center randomized clinical trial, to strengthen the results.

To conclude, the current investigation joins the growing body of studies demonstrating the positive effect of increased in-hospital mobility to prevent HAFD.

A combination of three elements contributes to the success of the WALK-FOR intervention: (1) definition of a measurable walking goal, (2) in-depth understanding of the context, and (3) ongoing education of patients and staff about the importance of mobility. The program was found to be safe and applicable for its reliance on local resources. Findings from this study should be replicated in broader populations within different settings while considering a measurable mobility dose as a behavioral goal and function as an ultimate outcome.

Funding

This study received no funding.

Conflicts of Interest

The authors have no potential conflicts of interest to disclose.

Acknowledgements

We thank the WALK-FOR team: Azaiza Esam, RN, Shulyaev Ksenya, PhD, Falah Wedad, RN, Liberty Anat, RN, Zaguri-Greener Dalit, RN, Krivonos Yulia, RN, and the internal medical units' staff at the HaEmek Medical Center as well as the HaEmek Medical Center nursing leadership. Kristen Ebert-Wagner provided language editing and copyediting of the manuscript.

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Table 1. Baseline Characteristics of Study Population, by Study Group

Characteristic Variables	Control Group (*n* = 189)	Intervention Group (*n* = 188)	*P*-value[b]
Age, y, mean (SD), [64–98]	75.3 (6.8)	75.4 (7.3)	.83
Ethnicity, Jewish, *n* (%)	121 (64)	128 (68)	.49
Gender, Male, *n* (%)	118 (62)	108 (57)	.32
Education, years, mean (SD), [0–21]	8.4 (5.3)	9.4 (7.3)	.06
Economic status: below the average, *n* (%)	155 (89)	163 (86)	.38
Living status, Community living, n (%)	185 (98)	184 (98)	.48
Pre-morbid BADL status (Modified Barthel Index >80), *n* (%)[a]	139 (73)	157 (83)	.02*
Pre-morbid BADL status (Modified Barthel Index), mean (SD) [21–100]	87.7 (17.1)	92.2 (13.1)	.004*
Pre-morbid IADL status (Lawton's IADL scale), mean (SD), [0–16]	10.5 (5.2)	12.1 (4.3)	.001*
Community mobility (Yale Physical Activity Scale), mean (SD) , [0–137]	28.3 (23.0)	26.4 (21.0)	.40
Comorbidity (Charlson Comorbidity Index), mean (SD), [0–9]	2.4 (1.9)	1.8 (1.6)	.001*

Characteristic Variables	Control Group (n = 189)	Intervention Group (n = 188)	P-value[b]
Length of stay, days, mean (SD), {median}, [2–34]	6.5 (4.3) {5.0}	5.8 (3.0) {5.0}	.11
Severity of illness (National Early Warning Score) mean (SD), [0–7.6]	1.6 (1.45)	1.5 (1.3)	.56
Severity of symptoms, mean (SD), [0–3.73]	0.9 (.7)	0.8 (.7)	.054
Risk of malnutrition (Malnutrition Universal Screening Tool), *n* (%)			.44
Low risk	154 (82)	162 (86)	
High risk	35 (18)	26 (14)	
Depressive symptoms (Hospital Anxiety and Depression Scale), *n* (%)			.21
Borderline (score 8–10)	60 (31)	57 (30)	
Symptoms of depression (score 11+)	58 (31)	71 (38)	

Note: BADL = Basic Activities of daily living. IADL = Instrumental activities of daily living.

[a] Independence in BADL (MBI > 80) was defined in accordance with the accepted Modified Barthel Index cutoff point (39).

[b] *P*-values from chi-square tests for categorical and *t* tests for continuous variables.

(*$P < 0.05$)

Table 2. Decline in Functional Status, by Study Group

Outcome Variables[£]	Control Group Frequency (%)	Intervention Group Frequency (%)	OR	*P*-value	95% CI
Decline in BADL: pre-morbid to discharge[a]	63/189 (33)	43/188 (23)	.59	.05	.34–1.0
Decline in BADL: pre-morbid to 1-month follow-up[a]	74/173 (43)	53/177 (30)	.51	.01	.30–.85
Decline in community mobility: pre-morbid to 1-month follow-up[b]	45/173 (26)	27/177 (15)	.37	.02	.16-.85
Decline in IADL: pre-morbid to 1-month follow-up[a]	91/173 (52)	87/177 (49)	.72	.19	.45–1.1

Note: Abbreviations: OR = odds ratio; 95% CI = 95% confidence interval.

[£] All models were adjusted for pre-morbid status of basic activities of daily living (BADL), instrumental ADL, and community mobility; age, gender, length of stay, comorbidity, severity of symptoms, severity of illness, depressive symptoms, and malnutrition risk.

[a] ADL and IADL pre-morbid status refer to the period 2 weeks before admission.

[b] Community mobility pre-morbid status refers to the previous month.

Figure 1

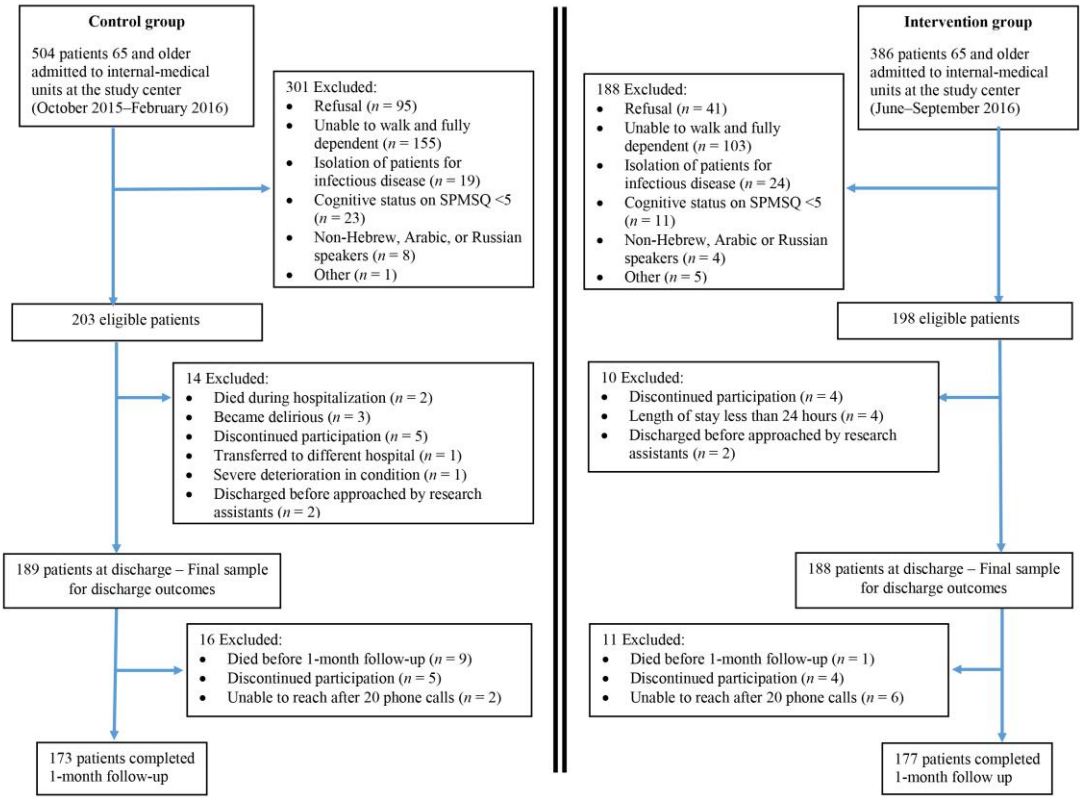

Figure 1. Flow diagram: Process of patient recruitment and dropouts through the phases of the current trial, by study group.