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Original Study

# Patterns of Objectively Measured Sedentary Behavior and Physical Activity and Their Association with Changes in Physical and Functional Performance in Geriatric Rehabilitation Inpatients

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A B S T R A C T

*Objectives:* To examine whether The Ending PyJama (PJ) Paralysis campaign, focused on increasing in-hospital physical activity, affects objectively measured sedentary behavior and physical activity patterns and if these are associated with changes in physical and functional performance in geriatric rehabilitation inpatients.
*Design:* Quasi-experimental study.
*Setting and Participants:* Within the REStORing health of acutely unwell adulTs (RESORT) observational, longitudinal cohort of geriatric rehabilitation inpatients, the Ending PJ Paralysis campaign was implemented on 2 out of 4 wards.
*Methods:* Objectively measured sedentary behavior and physical activity were measured by an inertial sensor (ActivPAL4) for 1 week, comparing control (non-PJ) and intervention (PJ) groups using linear mixed models. Mean sedentary behavior and physical activity measures and their association with physical and functional performance changes were investigated by linear regression analyses, stratified by low vs high performance at admission using the median as a cut-off.
*Results:* A total of 145 (n = 68 non-PJ and n = 77 PJ) inpatients with a mean age of 83.0 (7.7) years (55.9% female inpatients) were included. The median nonupright time was 23.1 [22.1-23.6] and 23.0 [21.8-23.6] hours/day for non-PJ and PJ groups, respectively. Objectively measured sedentary behavior and physical

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This study was approved by the Melbourne Health Human Research Ethics Committee (HREC/17/MH/103) with all ethical guidelines followed in full accordance with the Declaration of Helsinki.[1] Written informed consent was obtained from all patients or nominated proxies.

Data are available on reasonable request.

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activity measures did not significantly change over measurement days and were independent of the Ending PJ Paralysis campaign. For inpatients with low performance at admission, lower sedentary behavior [B(SE) −0.013 (0.005) to −0.157 (0.045), $P < .01$] and higher physical activity [B(SE) 0.033 (0.007) to 0.814 (0.200), $P < .01$] measures were associated with improved physical performance. In addition, lower sedentary behaviour [B(SE) = -0.058 (0.024), $P < .05$ and higher physical activity [B (SE) 0.060 (0.024) to 0.683 (0.182), $P < .05$] were associated with improved instrumental functional performance.

*Conclusions and Implications:* In geriatric rehabilitation inpatients, the Ending PJ Paralysis campaign did not affect objectively measured sedentary behavior and physical activity patterns. Lower mean sedentary behaviour and higher physical activity measures were associated with improved physical and functional performance in inpatients with low performance.



Hospitalized older adults have low levels of in-hospital physical activity[2,3] and high levels of sedentary behavior, spending up to 86.5% of their time in sedentary behavior.[4] This contributes to undesired consequences of hospitalization, such as functional loss[5–7] and a higher risk of death after discharge.[8] Physical interventions for older inpatients are often aimed at improving physical and functional performance rather than increasing physical activity,[9] and are effective in acutely hospitalized older adults.[10] It is hypothesized that these associations also hold for geriatric rehabilitation inpatients. In contrast, a systematic review in this population showed that interventions explicitly aiming to increase daily objectively measured physical activity behavior were ineffective, although only three studies were included.[11]

To encourage physical activity in older inpatients, the Ending PyJama (PJ) Paralysis campaign was initiated in 2017 as a Twitter campaign.[12–14] In this campaign, nursing staff encourage inpatients to be more physically active by getting dressed in day-clothes, having meals out of bed, and partaking in additional walks during the day. The Ending PJ Paralysis campaign was implemented in several countries.[15,16] The first studies showed conflicting results: positive effects with a 37% reduction in falls, 86% reduction in pressure injuries, 80% reduction in inpatient complaints, and a reduction of 1.5 days in length of stay,[17] whereas effects on physical and functional performance were lacking.[18] Whether or not the Ending PJ paralysis campaign affects objectively measured sedentary behavior and physical activity patterns in geriatric rehabilitation inpatients and whether these are associated with changes in physical and functional performance is unknown. Patterns of sedentary behavior and physical activity are best studied using inertial sensors because self-reported measures under- and overestimate actual physical activity.[19,20]

The primary aim of this study in geriatric rehabilitation inpatients was to describe whether objectively measured sedentary behavior and physical activity patterns over 1 week were affected by the Ending PJ Paralysis campaign, taking the nursing staff availability at the bed-side and the time of day into account. Secondarily, associations between objectively measured sedentary behavior and physical activity measures and changes in physical and functional performance were investigated.

## Methods

### *Study Design and Setting*

The REStORing health of acutely unwell adulTs (RESORT) is an observational, longitudinal cohort of geriatric rehabilitation inpatients admitted at the Royal Park Campus of the Royal Melbourne Hospital (Melbourne, Victoria, Australia), which provides inpatient hospital-based care in 4 different wards. Geriatric rehabilitation inpatients were transferred from acute care wards toward these post-acute rehabilitation wards. Those unable to provide informed consent, without a legal proxy to consent or undergoing palliative care were excluded. Inpatients were assessed by a Comprehensive Geriatric Assessment within 48 hours of admission, which involves a multidisciplinary diagnostic process that assesses health domains, including medical, cognitive, physical, functional, and social parameters.[21] Inpatients within the RESORT cohort were considered for inclusion in the Ending PJ Paralysis campaign, using a quasi-experimental design comparing the control (non-PJ) group receiving usual care and intervention (PJ) group. The Ending PJ Paralysis campaign was adopted on one-half of the geriatric rehabilitation wards from June 3, 2019 to March 29, 2020. The campaign aimed to have at least (1) 80% of inpatients dressed in day-clothes by 11 o'clock, (2) 80% of inpatients wear appropriate footwear when out of bed, (3) 80% of inpatients eat lunch and dinner sitting out of bed, and (4) a 50% increase in participation of daily physical activity.[18] The intervention group was exposed to a multidisciplinary intervention, including extensive staff and inpatient education, a promotional campaign, and the introduction of communal dining and walking trails. Further details on the Ending PJ Paralysis study are mentioned elsewhere.[18] Hypothesized was that the intervention was dependent on (1) the availability of nursing staff, as nurses encourage physical activity in inpatients throughout the day; and (2) the time of day. Nursing shifts were divided into groups representing low, intermediate, and high nursing staff availability, based on a combination of hand-over times, patient care load and breaks (Supplementary Table 1). To explore further distributions over the day, the morning (6 AM–12 PM), afternoon (12 PM–6 PM), and evening (6 PM–12 AM) were separated. Waking time was set from 7 PM to 9 PM . As part of the Ending PJ Paralysis campaign, objectively measured sedentary behavior and physical activity were assessed from October 22, 2019 to March 29, 2020. All inpatients without a bilateral lower extremity paralysis were considered eligible and no baseline level of ambulation status was required.

### *Inpatient Characteristics at Admission*

Inpatient medical records were used to extract age, sex, number of medications, and the length of stay (in days) in geriatric rehabilitation. Use of a walking aid and a history of at least 1 fall in the past year were self-reported or extracted from medical records. Standing height was assessed to the nearest 0.1 cm using a stadiometer if the inpatient could stand. Otherwise, knee height was assessed using a measuring rod and height was calculated using the Chumlea equation for Caucasians.[22] Weight was assessed to the nearest 0.1 kg either by using a standing scale, seated scale, or a weighted hoist, depending on the inpatient's ambulation status. Body mass index was calculated by body mass (kg) divided by height squared (m) and expressed in kg/m$^2$. The primary reason for hospital admission was categorized into musculoskeletal, cardiovascular or respiratory, neurologic, infectious, and other reasons. Comorbidity was assessed by the Charlson Comorbidity Index (range 0–37)[23] and the Cumulative Illness Rating

**Table 1**
Inpatient Characteristics of the Total Population and Stratified by the Ending PyJama Paralysis Campaign

| | n | Total (N = 145) | Non-PJ Group (Control) (n = 68) | PJ Group (Intervention) (n = 77) | *P* |
|---|---|---|---|---|---|
| Age, y, median [IQR] | 145 | 83.0 (7.7) | 82.9 (7.7) | 83.0 (7.8) | .966 |
| Female, n (%) | 145 | 81 (55.9%) | 37 (54.4%) | 44 (57.1%) | .741 |
| Highest level of education: primary school, n (%) | 122 | 35 (28.7%) | 16 (28.1%) | 19 (29.2%) | .888 |
| Comorbidity: | | | | | |
| CCI score [0–36], median [IQR] | 145 | 2 [1-3] | 2 [1-4] | 2 [1-3] | .140 |
| CIRS score [0-56], median [IQR] | 145 | 12 [8-16] | 11 [8-14] | 13 [8-16] | .065 |
| CIRS severity index, median [IQR] | 145 | 2.0 (0.5) | 1.9 (0.5) | 2.2 (0.6) | **.008** |
| Number of medications | 145 | 9.2 (4.7) | 9.0 (4.9) | 9.5 (4.6) | .566 |
| CFS score [0-9] | 130 | 6 [5-7] | 6 [5-6] | 6 [5-7] | .358 |
| FAC score [0-5] | 140 | 3 [1-3] | 2 [1-3] | 3 [1-4] | .123 |
| Walking aid, n (%) | 141 | 96 (68.1%) | 43 (65.2%) | 53 (70.7%) | .483 |
| Fall in the past y, n (%) | 143 | 108 (75.5%) | 52 (76.5%) | 56 (74.7%) | .802 |
| Cognitively impaired, n (%) | 145 | 89 (61.4) | 43 (63.2%) | 46 (59.7%) | .666 |
| Delirium risk (short CAM), n (%) | 145 | 27 (18.6%) | 15 (22.1%) | 12 (15.6%) | .318 |
| HADS, n (%) | | | | | |
| Anxiety, abnormal score, n (%) | 110 | 22 (20.0%) | 10 (20.4%) | 12 (19.7%) | .924 |
| Depression, abnormal score, n (%) | 107 | 31 (29.0%) | 15 (31.9%) | 16 (26.7%) | .553 |
| Risk of malnutrition (MST) | 141 | 50 (35.5%) | 28 (43.8%) | 22 (28.6%) | .061 |
| Length of stay (d) | 145 | 17 [12-30] | 18 [12-32] | 16 [11-28] | .276 |
| Primary reason for admission, n (%) | 145 | | | | |
| Musculoskeletal | | 71 (49.0%) | 33 (48.5%) | 38 (49.4%) | .921 |
| Cardiovascular and respiratory | | 21 (14.5%) | 12 (17.6%) | 9 (11.7%) | .309 |
| Neurologic | | 20 (13.8%) | 8 (11.8%) | 12 (15.6%) | .506 |
| Infectious | | 4 (2.8%) | 2 (2.9%) | 2 (2.6%) | 1.000 |
| Other | | 29 (20.0%) | 13 (19.1%) | 16 (20.8%) | .803 |
| Anthropometry | | | | | |
| Height (cm) | 141 | 163.2 (10.2) | 163.1 (10.0) | 163.4 (10.4) | .861 |
| Weight (kg) | 145 | 70.9 [59.4-84.6] | 69.1 [58.9-83.2] | 71.5 [61.2-85.2] | .455 |
| BMI (kg/m$^2$) | 141 | 27.2 [23.1-31.5] | 26.9 [22.9-31.5] | 27.3 [23.3-32.1] | .499 |
| Objectively measured physical activity | | | | | |
| Wearing time (d) | 145 | 6 [5-6] | 6 [6-6] | 6 [5-6] | .830 |
| Nonupright time (h/d)* | 145 | 23.0 [22.0-23.6] | 23.1 [22.1-23.6] | 23.0 [21.8-23.6] | .568 |
| Sitting time (h/d)* | 145 | 9.2 [2.5-11.6] | 8.5 [2.5-11.5] | 9.7 [2.5-11.7] | .772 |
| Lying time (h/d)* | 145 | 12.9 [10.0-20.5] | 14.2 [10.2-20.5] | 12.7 [9.9-20.5] | .518 |
| Upright time (min/d)* | 145 | 58.42 [25.6-120.5] | 56.8 [24.0-108.7] | 58.4 [26.4-133.2] | .507 |
| Standing time (min/d)* | 145 | 46.8 [22.9-102.0] | 48.3 [21.2-91.8] | 46.5 [22.9-113.9] | .656 |
| Stepping time (min/d)* | 145 | 7.4 [1.5-14.5] | 5.1 [0.9-14.4] | 8.1 [2.0-14.6] | .433 |
| Steps (number/d)* | 145 | 402 [65-899] | 291 [42-871] | 471 [79-951] | .417 |
| Sit-to-Stand transitions (number/d)* | 145 | 20 [10-30] | 18 [9-30] | 21 [10-30] | .345 |
| Physical and functional performance at admission | | | | | |
| Hand grip strength (kg) | 131 | | | | |
| Female | 72 | 13.1 (6.9) | 10.0 (6.2) | 15.7 (6.4) | **.001** |
| Male | 59 | 20.5 (8.9) | 21.5 (6.4) | 19.6 (10.9) | .366 |
| SPPB score [0-12] | 136 | 1 [0-4] | 1 [0-4] | 1 [0-5] | .924 |
| Gait speed (m/s) | 140 | 0.18 [0.00-0.49] | 0.00 [0.00-0.47] | 0.27 [0.00-0.52] | .247 |
| ADL score [0-6] | 145 | 2 [1-3] | 2 [1-2] | 2 [1-3] | .474 |
| IADL score [0-8] | 145 | 1 [0-2] | 1 [0-1] | 1 [1-2] | **.003** |
| Change in physical and functional performance during geriatric rehabilitation | | | | | |
| Hand grip strength (kg) | 113 | 0.00 [-1.90-3.00] | 0.75 [-1.73-3.00] | 0.00 [-2.00-4.00] | .878 |
| SPPB score [0-12] | 116 | 1 [0-3] | 1 [0-3] | 1 [0-3] | .937 |
| Gait speed (m/s) | 120 | 0.14 [0.00-0.38] | 0.15 [0.00-0.38] | 0.14 [0.00-0.38] | .966 |
| ADL score [0-6] | 137 | 1 [0-3] | 2 [0-3] | 1 [0-3] | .610 |
| IADL score [0-8] | 136 | 1 [0-3] | 1 [0-3] | 1 [0-3] | .694 |

BMI, Body Mass Index; CAM, Confusion Assessment Method; CCI, Charlson Comorbidity Index; CFS, Clinical Frailty Scale; CIRS, Cumulative Illness Rating Scale; FAC, Functional Ambulation Classification; HADS, Hospital Anxiety and Depression Scale; MST, Malnutrition Screening Tool.

*The mean of the objectively measured sedentary behavior and physical activity measure over measurement days. Independent samples *t*-test for normally distributed variables, Mann-Whitney U-test for non-normally distributed variables, $\chi^2$ or Fisher exact tests for categorical variables were used to compare non-PJ to PJ-group. $P < .05$ presented in bold.

Scale (range 0–56).[24] Frailty was assessed by the Clinical Frailty Scale (range 0–9).[25] Ambulation status was assessed by the Functional Ambulation Classification (range 0–5).[26] Cognitive status was assessed by the Mini-Mental State Examination[27] in all inpatients and by the Montreal Cognitive Assessment[28] and/or the Rowland Universal Dementia Assessment Scale if further cognitive testing was indicated. Cognitive impairment was defined as either a dementia diagnosis reported in medical records, a MMSE score <24/30, a MoCA score <26/30 or a Rowland Universal Dementia Assessment Scale score <23/30. The risk of delirium was assessed by the Short Confusion Assessment Method.[29] The Hospital Anxiety and Depression Scale (range 0–21) was used to assess significant anxiety and depression symptoms with a cut-off score of ≥8.[30] Malnutrition risk was assessed by the Malnutrition Screening Tool, classifying patients at risk with a score ≥2.[31]

### *Objectively Measured Sedentary Behavior and Physical Activity*

The ActivPAL4 (PAL Technologies Ltd) was used as an inertial sensor to assess objectively measured daily sedentary beahavior and physical activity patterns. The ActivPAL consists of a tri-axial capacitive accelerometer with a range of ±4 g, which collected data at a

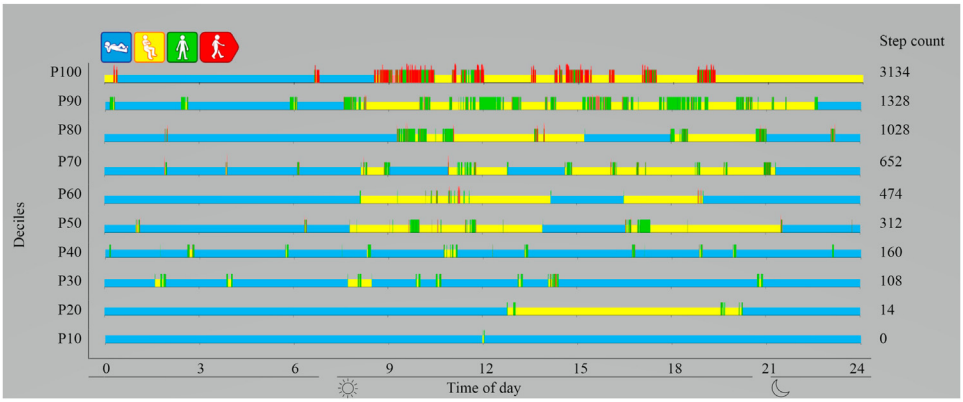


**Fig. 1.** Sedentary behavior and physical activity patterns of one representative day for 10 inpatients representing the deciles made based on the number of steps.

sample frequency of 20 Hz. On day 5 of admission (range: 3–7), the ActivPAL sensor was attached to the right thigh for 1 week, or until hospital discharge. A valid day of measurements was defined as 20/24 hours of wear. Inpatients were included if they reported at least 1 valid day. The ActivPAL software (Generation 8, PAL Technologies Ltd) was used and a custom code obtained objectively measured sedentary behavior and physical activity measures for every 30 minutes. Daily objectively measured sedentary behavior patterns were described by time spent nonupright (sum of sitting and lying), sitting and lying in hours/day, and physical activity patterns by time spent upright (sum of standing and stepping), standing and stepping time in minutes/day, and the number of steps and sit-to-stand transitions per day.

### *Physical and Functional Performance*

Physical performance was assessed by the Short Physical Performance Battery (SPPB, score range 0–12) combining balance, a timed 4-meter walk [gait speed (m/s)] and the timed chair stand test.[32] Handgrip strength was measured 3 times on both hands alternating using a handheld dynamometer (JAMAR hand dynamometer; Sammons Preston, Inc).[33] The maximum value in kilograms was used for analyses. Inpatients who were unable were allocated 0.00 m/s or 0.0 kg. Functional performance was measured using the Katz index of activities of daily living (ADL, range 0–6)[34] and the Lawton and Brody scale of instrumental ADL (IADL, range 0–8).[35] Change (Δ) in physical and functional performance during geriatric rehabilitation was defined as the discharge performance score minus the admission performance score.

### *Statistical Analyses*

Descriptive statistics for continuous variables with a Gaussian (normal) distribution were presented as means with standard deviations (SDs) and a non-Gaussian (skewed) distribution as medians with interquartile ranges (IQR). Categorical variables were presented as numbers with percentages, n (%). Baseline characteristics between the non-PJ and PJ groups were compared using independent-samples *t*-tests (normal distribution), Mann-Whitney U tests (skewed distribution), $\chi^2$- tests, or Fisher exact tests (categorical variables). Deciles based on the mean number of steps per day were made to visualize patterns.

The change of objectively measured sedentary behavior and physical activity measures over days was analyzed using generalized negative binomial mixed models for count variables, ie, number of steps and sit-to-stand transitions. Linear mixed models were conducted to assess the change in noncount, ie, sedentary behavior and physical activity measures. Independent variables included measurement days, the Ending PJ Paralysis campaign and the interaction between measurement days and the Ending PJ Paralysis campaign. A random intercept on patient level was included. The following variables were added to the model to adjust for possible confounding: age, sex, comorbidity (Cumulative Illness Rating Scale score), ambulation status (Functional Ambulation Classification score), and weekend day (binary).

For all valid days, the duration per hour in objectively measured sedentary behavior and physical activity measures were calculated and compared between low, intermediate, and high availability of nursing staff during waking hours and the time of day (morning, afternoon, evening) using Friedman tests, including pairwise comparisons with a Bonferroni correction to adjust for multiple testing. Differences in objectively measured sedentary behavior and

**Table 2**
Results of the Fully Adjusted Models for Patterns of Objectively Measured Sedentary Behavior and Physical Activity Measures Over Measurement Days (n = 140)

| | Nonupright Time (min/d) | Sitting Time (min/d) | Lying Time (min/d) | Upright Time (min/d) | Standing Time (min/d) | Stepping Time (min/d) | Steps (Number/d) | STS (Number/d) |
|---|---|---|---|---|---|---|---|---|
| | *P* | *P* | *P* | *P* | *P* | *P* | *P* | *P* |
| Day | .193 | .344 | .346 | .073 | .150 | **<.001** | .630 | .973 |
| Age | .313 | .639 | .515 | .330 | .335 | .594 | .838 | .579 |
| Sex | .349 | .244 | .202 | .359 | .321 | .991 | .575 | .089 |
| Comorbidity | .029 | .271 | .603 | .027 | .066 | **.001** | **.002** | .100 |
| Ambulation status | **<.001** | **.012** | **<.001** | **<.001** | **<.001** | **<.001** | **<.001** | **<.001** |
| Weekend day | .003 | .505 | .306 | **.006** | **.013** | **.017** | **.002** | **<.001** |

CIRS, Cumulative Illness Rating Scale; FAC, Functional Ambulation Classification; STS, sit-to-stand transitions.
$P < .05$ presented in bold.

**Table 3**
Results of the Fully Adjusted Models for Patterns of Objectively Measured Sedentary Behavior and Physical Activity Measures Over Measurement Days, Including the Ending PJ Paralysis Campaign (n = 140)

| | Nonupright Time (min/d) | Sitting Time (min/d) | Lying Time (min/d) | Upright Time (min/d) | Standing Time (min/d) | Stepping Time (min/d) | Steps (number/d) | STS (number/d) |
|---|---|---|---|---|---|---|---|---|
| | *P* | *P* | *P* | *P* | *P* | *P* | *P* | *P* |
| Day | .191 | .334 | .334 | .075 | .152 | **<.001** | .634 | .972 |
| Ending PJ Paralysis | .265 | .707 | .919 | .283 | .296 | .499 | .909 | .902 |
| Day * Ending PJ Paralysis | .667 | .612 | .593 | .848 | .756 | .780 | .921 | .977 |
| Age | .303 | .633 | .508 | .323 | .328 | .590 | .859 | .577 |
| Sex | .371 | .242 | .204 | .382 | .342 | .981 | .574 | .088 |
| Comorbidity | **.020** | .243 | .584 | **.018** | **.047** | **.001** | **.002** | .117 |
| Ambulation status | **<.001** | **.011** | **<.001** | **<.001** | **<.001** | **<.001** | **<.001** | **<.001** |
| Weekend day | **.003** | .477 | .285 | **.006** | **.013** | **.015** | **.002** | **<.001** |

CIRS, Cumulative Illness Rating Scale; FAC, Functional Ambulation Classification; STS, sit-to-stand transitions.
$P < .05$ presented in bold.

physical activity measures between non-PJ and PJ groups per level of nursing staff availability and the time of day were tested by Mann-Whitney U tests.

To investigate the association between mean objectively measured sedentary behavior and physical activity measures over days and changes in physical and functional performance during geriatric inpatient rehabilitation, multivariable linear regression analyses were performed. Moderator analyses were conducted to investigate the effect of low vs high physical and functional performance at admission. The median of the specific performance measure was used as a cut-off, to conduct approximately equal groups of low and high performers. All sedentary behavior and physical activity measures were divided by 10, except for step count which was divided by 100, for interpretation purposes. All analyses were performed using an age and sex-adjusted model (model 1) and additionally adjusted for comorbidity (CIRS-score) (model 2). If the moderator analysis did not show a significant effect, analyses were not stratified and additionally adjusted for physical or functional performance at admission (model 3). Sensitivity analyses investigating differences in patterns of objectively measured sedentary behavior and physical activity measures between inpatients with low vs high physical performance were conducted.

The statistical significance level was set at $\alpha = 0.05$. Analyses were performed using the IBM SPSS Statistics for Windows, v 27.0 (IBM Corp.).

## Results

Table 1 summarizes the characteristics of the 145 included inpatients (55.9% female) with a mean age 83.0 (SD 7.7) years. The median SPPB score was 1 [0–4] and 1 [0–5] for non-PJ (n = 68) and PJ (n = 77) groups and did not differ. Median length of stay was 17 days [IQR 12-30]. Primary reason for admission varied from musculoskeletal (49%) to cardiovascular and respiratory (14.5%) and neurologic (13.8%) diseases.

### *Objectively Measured Sedentary Behavior and Physical Activity Measures*

The median wearing duration of the ActivPAL4 was 6 [5-6] days. Median nonupright time was 23.1 [22.1-23.6] and 23.0 [21.8-23.6] hours/day and the median number of steps was 291 [42-871] and 471 [79-951] per day, for the non-PJ and PJ groups, respectively. Figure 1 shows objectively measured sedentary behavior and physical activity patterns of one day for 10 representative inpatients. Long periods of nonupright time were found, even in inpatients representing higher deciles, representing more physically active inpatients.

### *Ending PJ Paralysis Campaign Effect*

The changes in objectively measured sedentary behavior and physical activity measures over days in the fully adjusted models are presented in Tables 2 and 3, and showed no significant effect of measurement days on these measures, except for stepping time. Table 2 shows the changes of objectively measured sedentary behavior and physical activity measures over days comparing the respective day with day 1. Table 3 shows comparisons between the non-PJ and PJ groups. In the total population, inpatients spent 2.9–6.7 minutes more in stepping time on day 6-8 ($P \leq .048$) when compared with day 1 (Table 4). Neither changes over days for sedentary behavior or physical activity measures (Table 4) nor differences between non-PJ and PJ groups were found (Supplementary Table 2).

Supplementary Tables 3 and 4 shows an overview of objectively measured sedentary behavior and physical activity measures in minutes per hour of ActivPAL wear during waking hours, stratified by nursing staff availability at the bed-side and the time of day. There was no dose-response relationship between nursing staff's availability at the bed-side and sedentary behavior and physical activity measures. Over the day, all physical activity measures were highest in the morning and nonupright time was highest in the evening. No differences were found between non-PJ and PJ groups (Supplementary Tables 5 and 6). Figure 2 shows the mean number of steps per 30-minute period over the day, showing a higher number of steps in the morning and before lunch for both groups.

### *Objectively Measured Sedentary Behavior and physical Activity Measures and Changes in Physical and Functional Performance*

The associations between objectively measured sedentary behavior and physical activity measures and changes in physical and functional performance were dependent on performance levels at admission (Supplementary Table 7). A higher mean nonupright time of 10 min/d was associated with declined SPPB scores of −0.157 [standard error (SE) 0.045) points, $P = .001$], gait speed −0.013 (0.005) m/s, $P = .008$ and IADL scores (−0.058 (0.024) points, $P = .015$). Higher mean objectively measured physical activity measures were associated with improved SPPB scores, gait speed and IADL scores. Higher mean number of sit-to-stand transitions were associated with improved ADL scores.

### *Sensitivity Analyses*

Inpatients with low physical performance were more sedentary and less active than patients with high physical performance and showed a greater increase in physical and functional performance (Supplementary Table 8). Patterns of objectively measured sedentary behavior and physical activity measures over days did not differ,

**Table 4**
Patterns of Objectively Measured Sedentary Behavior and Physical Activity Measures Over Measurement Days

| Day | Nonupright Time (min/d), Unadjusted N = 145 | | | Nonupright Time (min/d), Adjusted N = 140 | | |
|---|---|---|---|---|---|---|
| | Coefficient | 95% CI | *P* | Coefficient | 95% CI | *P* |
| 2 vs 1 | −1.422 | −9.590 to 6.746 | .733 | −4.258 | −11.683 to 3.167 | .261 |
| 3 vs 1 | 1.623 | −6.643 to 9.889 | .700 | 0.946 | −6.618 to 8.511 | .806 |
| 4 vs 1 | 0.076 | −8.432 to 8.583 | .986 | 1.375 | −6.359 to 9.110 | .727 |
| 5 vs 1 | 6.356 | −2.389 to 15.101 | .154 | 3.390 | −4.592 to 11.372 | .405 |
| 6 vs 1 | −8.049 | −17.030 to 0.933 | .079 | −8.640 | −16.802 to −0.478 | **.038** |
| 7 vs 1 | −7.054 | −35.480 to 21.371 | .626 | −5.482 | −30.890 to 19.925 | .972 |
| 8 vs 1 | −1.739 | −44.553 to 41.076 | .936 | −4.703 | −42.903 to 33.497 | .809 |
| 9 vs 1 | −2.068 | −53.979 to 49.842 | .938 | −7.547 | −53.927 to 38.833 | .749 |
| | Sitting time (min/d), unadjusted N = 145 | | | Sitting time (min/d), adjusted N = 140 | | |
| 2 vs 1 | 0.360 | −56.100 to 56.820 | .990 | 1.597 | −55.447 to 58.641 | .576 |
| 3 vs 1 | 6.554 | −50.535 to 63.643 | .822 | 14.832 | −43.244 to 72.907 | .866 |
| 4 vs 1 | −32.887 | −91.602 to 25.828 | .272 | −20.254 | −79.595 to 39.088 | .027 |
| 5 vs 1 | −40.638 | −100.970 to 19.694 | .186 | −29.818 | −91.040 to 31.404 | .279 |
| 6 vs 1 | −42.984 | −104.941 to 18.972 | .174 | −34.545 | −97.139 to 28.049 | .339 |
| 7 vs 1 | −220.724 | −416.570 to −24.877 | **.027** | −219.378 | −414.027 to −24.729 | .503 |
| 8 vs 1 | −35.335 | −330.433 to 259.763 | .814 | −25.119 | −317.885 to 267.648 | .616 |
| 9 vs 1 | 86.686 | −271.414 to 444.785 | .635 | 101.389 | −254.321 to 457.099 | .956 |
| | Lying time (min/d), unadjusted N = 145 | | | Lying time (min/d), adjusted N = 140 | | |
| 2 vs 1 | −1.832 | −58.439 to 54.775 | .949 | −5.696 | −62.790 to 51.398 | .845 |
| 3 vs 1 | −4.214 | −61.462 to 53.033 | .885 | −13.275 | −71.409 to 44.860 | .654 |
| 4 vs 1 | 33.734 | −25.154 to 92.622 | .261 | 22.419 | −36.991 to 81.829 | .459 |
| 5 vs 1 | 47.653 | −12.860 to 108.167 | .123 | 34.010 | −27.287 to 95.306 | .276 |
| 6 vs 1 | 35.640 | −26.506 to 97.786 | .261 | 26.659 | −36.012 to 89.331 | .404 |
| 7 vs 1 | 220.373 | 23.857 to 416.889 | **.028** | 218.653 | 23.711 to 413.595 | **.028** |
| 8 vs 1 | 36.737 | −259.347 to 332.820 | .808 | 23.534 | −269.654 to 316.722 | .875 |
| 9 vs 1 | −86.066 | −445.292 to 273.160 | .638 | −106.292 | −462.464 to 249.880 | .558 |
| | Upright time (min/d), unadjusted N = 145 | | | Upright time (min/d), adjusted N = 140 | | |
| 2 vs 1 | 1.437 | −6.651 to 9.525 | .727 | 4.229 | −3.107 to 11.565 | .258 |
| 3 vs 1 | −2.855 | −11.040 to 5.330 | .494 | −2.122 | −9.596 to 5.352 | .577 |
| 4 vs 1 | −1.895 | −10.320 to 6.530 | .659 | −3.260 | −10.903 to 4.382 | .403 |
| 5 vs 1 | −8.235 | −16.895 to 0.424 | .062 | −5.440 | −13.327 to 2.447 | .176 |
| 6 vs 1 | 7.164 | −1.730 to 16.059 | .114 | 7.748 | −0.316 to 15.813 | .060 |
| 7 vs 1 | 6.090 | −22.058 to 34.239 | .671 | 4.665 | −20.438 to 29.769 | .715 |
| 8 vs 1 | 0.741 | −41.656 to 43.139 | .973 | 3.466 | −34.278 to 41.210 | .857 |
| 9 vs 1 | 1.123 | −50.281 to 52.528 | .966 | 6.190 | −39.635 to 52.016 | .791 |
| Day | Standing Time (min/d), Unadjusted N = 145 | | | Standing Time (min/d), Adjusted N = 140 | | |
| 2 vs 1 | 0.709 | −7.021 to 8.438 | .857 | 3.440 | −3.452 to 10.332 | .328 |
| 3 vs 1 | −4.471 | −12.293 to 3.350 | .262 | −3.171 | −10.193 to 3.850 | .375 |
| 4 vs 1 | −2.788 | −10.839 to 5.262 | .497 | −4.119 | −11.299 to 3.060 | .260 |
| 5 vs 1 | −8.182 | −16.457 to 0.093 | .053 | −5.486 | −12.895 to 1.924 | .147 |
| 6 vs 1 | 4.227 | −4.272 to 12.726 | .329 | 4.808 | −2.768 to 12.383 | .213 |
| 7 vs 1 | −1.520 | −28.418 to 25.378 | .912 | −2.529 | −26.112 to 21.053 | .833 |
| 8 vs 1 | −5.672 | −46.186 to 34.842 | .784 | −3.214 | −38.671 to 32.244 | .859 |
| 9 vs 1 | −1.979 | −51.100 to 47.143 | .937 | 2.573 | −40.477 to 45.623 | .907 |
| | Stepping time (min/day), unadjusted N = 145 | | | Stepping time (min/d), adjusted N = 140 | | |
| 2 vs 1 | 0.736 | −0.552 to 2.025 | .262 | 0.785 | −0.507 to 2.077 | .233 |
| 3 vs 1 | 1.598 | 0.294 to 2.9011 | **.016** | 1.031 | −0.285 to −2.346 | .125 |
| 4 vs 1 | 0.867 | −0.475 to 2.209 | .205 | 0.834 | −0.511 to 2.179 | .224 |
| 5 vs 1 | −0.083 | −1.463 to 1.296 | .906 | 0.188 | −1.370 to 1.407 | .979 |
| 6 vs 1 | 2.912 | 1.495 to 4.328 | **<.001** | 2.920 | 1.500 to 4.339 | **<.001** |
| 7 vs 1 | 7.542 | 3.059 to 12.024 | **.001** | 7.184 | 2.765 to 11.603 | **.001** |
| 8 vs 1 | 6.418 | −0.334 to 13.170 | .062 | 6.711 | 0.067 to 13.355 | **.048** |
| 9 vs 1 | 2.977 | −5.210 to 11.164 | .476 | 3.524 | −4.543 to 11.591 | .391 |
| Day | Steps (number/d), unadjusted N = 145 | | | Steps (number/d), adjusted N = 140 | | |
| | Rate Ratio | 95% CI | *P* | Rate Ratio | 95% CI | *P* |
| 2 vs 1 | 1.069 | 0.765 to 1.492 | .696 | 1.085 | 0.772 to 1.524 | .638 |
| 3 vs 1 | 1.105 | 0.788 to 1.549 | .562 | 1.012 | 0.716 to 1.431 | .946 |
| 4 vs 1 | 1.032 | 0.729 to 1.461 | .859 | 1.013 | 0.711 to 1.443 | .943 |
| 5 vs 1 | 0.939 | 0.656 to 1.342 | .728 | 0.955 | 0.663 to 1.376 | .805 |
| 6 vs 1 | 1.453 | 1.007 to 2.097 | **.046** | 1.453 | 1.001 to 2.110 | .050 |
| 7 vs 1 | 1.155 | 0.366 to 3.643 | .805 | 1.066 | 0.338 to 3.364 | .913 |

(*continued on next page*)

**Table 4** (*continued*)

| Day | Steps (number/d), unadjusted N = 145 | | | Steps (number/d), adjusted N = 140 | | |
|---|---|---|---|---|---|---|
| | Rate Ratio | 95% CI | *P* | Rate Ratio | 95% CI | *P* |
| 8 vs 1 | 0.851 | 0.153 to 4.732 | .853 | 0.840 | 0.152 to 4.652 | .841 |
| 9 vs 1 | 1.354 | 0.169 to 10.848 | .775 | 1.577 | 0.197 to 12.616 | .667 |
| | STS (number/d), unadjusted N = 145 | | | STS (number/d), adjusted N = 140 | | |
| 2 vs 1 | 1.025 | 0.823 to 1.277 | .823 | 1.041 | 0.856 to 1.267 | .686 |
| 3 vs 1 | 1.090 | 0.873 to 1.361 | .445 | 1.050 | 0.860 to 1.282 | .631 |
| 4 vs 1 | 0.995 | 0.792 to 1.251 | .967 | 0.999 | 0.814 to 1.226 | .990 |
| 5 vs 1 | 0.914 | 0.722 to 1.157 | .455 | 0.949 | 0.768 to 1.73 | .628 |
| 6 vs 1 | 1.074 | 0.844 to 1.368 | .560 | 1.088 | 0.877 to 1.350 | .442 |
| 7 vs 1 | 0.918 | 0.427 to 1.972 | .826 | 0.860 | 0.439 to 1.683 | .659 |
| 8 vs 1 | 1.101 | 0.358 to 3.383 | .867 | 1.149 | 0.432 to 3.053 | .781 |
| 9 vs 1 | 0.750 | 0.186 to 3.021 | .685 | 0.865 | 0.255 to 2.936 | .816 |

STS, sit-to-stand transitions
Adjusted for age, sex, comorbidity, ambulation status, and weekend day.

except for stepping time showing a higher stepping time on day 5 and 6 with respect to day 1 in inpatients with high physical performance (Supplementary Tables 9 and 10).

The effect of the Ending PJ Paralysis campaign did not differ between inpatients with low vs high physical performance at admission (Supplementary Tables 11 and 12).

## Discussion

In geriatric rehabilitation inpatients, patterns of objectively measured sedentary behavior and physical activity measures were not affected by the Ending PJ Paralysis campaign and did not change over measurement days. Geriatric rehabilitation inpatients were very physically inactive. Lower objectively measured sedentary behavior and higher physical activity measures were present in the morning when compared with the afternoon and evening. For inpatients with low physical or functional performance at admission, both lower sedentary behavior and higher physical activity measures were associated with improved physical and functional performance during geriatric rehabilitation.

### *Ending PJ Paralysis Campaign Effect*

Although the Ending PJ paralysis campaign embraced recent recommendations to increase in-hospital physical activity,[36] the intervention could not influence objectively measured sedentary behavior and physical activity patterns. Between different levels of nursing staff availability at the bed-side, objectively measured sedentary behavior and physical activity measures significantly differ. However, differences were minimal and no dose-response relationship across levels of nursing staff availability was found. Therefore, these differences were considered not clinically relevant. Allied health professionals' availability may have influenced objectively measured sedentary behavior and physical activity patterns, but was not considered in this study. Another explanation could be that the Ending PJ Paralysis campaign was not intensive enough to change sedentary behavior and physical activity. In a recent systematic review, interventions aimed at increasing nontherapy physical activity in geriatric rehabilitation were found to be ineffective.[11] However, only 3 studies were included, of which one study showed an increase in physical activity.[37] This study included an inertial sensor as a feedback tool to increase physical activity,[37] which has proven effective in ambulatory older adults.[38] In acutely hospitalized older adults, intensive exercise interventions, characterized by supervised sessions that lasted between 15 and 30 minutes and were performed 5 to 7 days a week, have shown to be effective as physical and functional performance improved.[10] However, the effects on objectively measured sedentary behavior and physical activity were not assessed. Innovative health care models such as rehabilitation in the home[39] might also positively influence physical activity, while reducing sedentary behavior.[40] Future studies should assess the impact on objectively measured sedentary behavior and physical activity and may address the possible added beneficial effect of using these measures as a feedback tool.

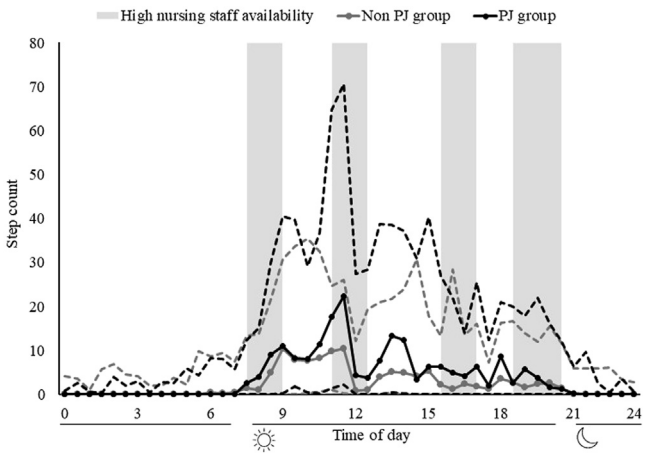


**Fig. 2.** Visualization of the mean number of steps per 30-minute period over the day for the non-PJ and PJ groups, including visualization of the periods of high nursing staff availability at the bed-side. For each 30-minute period, group medians (50th percentiles) are presented by points connected by solid lines and upper (75th percentile) and lower (25th percentile) limits of interquartile ranges are represented by dotted lines.

### *Objectively Measured Sedentary Behavior and Physical Activity Measures and Changes in Physical and Functional Performance*

Even in these frail and highly inactive geriatric rehabilitation inpatients, shown by moderately to severe frailty scores and a median of 402 steps per day, both lower objectively measured sedentary behavior and higher physical activity were associated with improved physical and functional performance for those with low performance at admission only. Improvements in physical performance are important, as these are associated with lower institutionalization and mortality rates 3 months after discharge from geriatric rehabilitation.[41] The disparity in the association between physical activity and outcome for older adults with low vs high physical performance at admission was also found in sedentary older community-dwelling participants of the Lifestyle Interventions and Independence for Elders study.[42] Lower odds of mobility disability were only identified for participants with relatively low physical performance.[42] These results may indicate that

older adults with low physical and/or functional performance have a greater benefit from physical activity.

### *Strength and Limitations*

This is the first study evaluating the effect of the Ending PJ Paralysis campaign on objectively measured sedentary behavior and physical activity measures. A strength of this study is the use of the ActivPAL4, as accelerometers are able to assess sedentary behavior and physical activity reliably in hospitalized older adults[43] in contrast to self-reported measures of sedentary behavior and physical activity.[19] Furthermore, the ActivPAL accurately assesses posture and transitions in older adults with impaired mobility.[44] The number of steps is underestimated in older adults with a slow walking speed (<0.47 m/s),[44] although the ActivPAL performs better than other hip- and wrist-worn devices.[45] A limitation is the current measurement period which might have been too short to capture any changes in objectively measured sedentary behavior and physical activity patterns. This study's quasi-experimental design could also be a limitation, introducing possible bias as inpatients were not randomized over intervention groups. Another limitation is that we were not able to consider allied health care use in our analyses. Finally, inpatients were included regardless of their admission diagnosis, highlighting the generalizability of our results.

## Conclusions and Implications

In geriatric rehabilitation inpatients, the Ending PJ Paralysis campaign did not affect patterns of objectively measured sedentary behavior and physical activity. Inpatients were very physically inactive and showed less sedentary behavior and more physical activity in the morning when compared with the afternoon and evening. Even in this highly inactive population, lower mean objectively measured sedentary behavior and higher mean physical activity measures were associated with improved physical and functional performance for inpatients with low performance at hospital admission.

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**Supplementary Table 1**
Overview of Expected Availability of Nursing Staff at the Bed-Side During Waking Hours

| Time | Shift 1 | Shift 2 | Shift 3 | Desired Activity Level | Availability of Nursing Staff at the Bed-Side |
|---|---|---|---|---|---|
| 7 AM–7:30 AM | Hand-over | | Hand-over | Intermediate | Low |
| 7:30 AM–9:30 AM | | | | High | High |
| 9:30 AM–11 AM | Break | | | High | Intermediate |
| 11 AM–1 PM | | | | High | High |
| 1 PM–2:30 PM | Hand-over<br>Break | Hand-over | | Intermediate | Low |
| 2:30 PM–3:30 PM | | Break | | High | Intermediate |
| 3:30 PM–5:30 PM | | | | High | High |
| 5:30 PM–6:30 PM | | Break | | Intermediate | Low |
| 6:30 PM–9 PM | High | Hand-over | Hand-over | Low | High |

**Supplementary Table 2**
Comparison of Patterns of Objectively Measured Sedentary Behavior and Physical Activity Measures Over Measurement Days Between Non-PJ and PJ Groups

| Day | Nonupright Time (min/d), Unadjusted N = 145 | | | Nonupright Time (min/d), Adjusted N = 140 | | |
|---|---|---|---|---|---|---|
| | PJ Group vs Non-PJ Group Intervention vs control | | | PJ Group vs Non-PJ Group Intervention vs control | | |
| | Coefficient | 95% CI | *P* | Coefficient | 95% CI | *P* |
| 2 vs 1 | 12.324 | −4.077 to 28.726 | .141 | 6.813 | −8.080 to 21.706 | .369 |
| 3 vs 1 | 13.845 | −2.741 to 0.432 | .102 | 8.650 | −6.417 to 23.717 | .260 |
| 4 vs 1 | 9.385 | −7.666 to 26.437 | .280 | 10.634 | −4.874 to 26.141 | .179 |
| 5 vs 1 | 4.931 | −12.596 to 22.458 | .581 | 0.162 | −15.755 to 16.078 | .984 |
| 6 vs 1 | 3.913 | −14.082 to 21.907 | .670 | 2.453 | −13.906 to 18.812 | .769 |
| 7 vs 1 | n/a | | | n/a | | |
| 8 vs 1 | n/a | | | n/a | | |
| 9 vs 1 | n/a | | | n/a | | |
| | Sitting time (min/d), unadjusted N = 145 | | | Sitting time (min/d), adjusted N = 140 | | |
| 2 vs 1 | −42.596 | −156.029 to 70.836 | .461 | −53.561 | −167.945 to 60.822 | .358 |
| 3 vs 1 | −44.783 | −159.406 to 69.841 | .443 | −71.072 | −186.711 to 44.567 | .228 |
| 4 vs 1 | 40.082 | −77.673 to 157.836 | .504 | 29.471 | −89.470 to 148.412 | .627 |
| 5 vs 1 | 5.250 | −115.750 to 126.249 | .932 | −20.292 | −142.343 to 101.760 | .744 |
| 6 vs 1 | −3.627 | −127.836 to 120.581 | .954 | −29.639 | −155.062 to 95.784 | .643 |
| 7 vs 1 | n/a | | | n/a | | |
| 8 vs 1 | n/a | | | n/a | | |
| 9 vs 1 | n/a | | | n/a | | |
| | Lying time (min/d), unadjusted N = 145 | | | Lying time (min/d), adjusted N = 140 | | |
| 2 vs 1 | 54.951 | −58.722 to 168.624 | .343 | 59.937 | −54.533 to 174.407 | .304 |
| 3 vs 1 | 59.590 | −55.295 to 174.475 | .309 | 80.256 | −35.485 to 195.998 | .174 |
| 4 vs 1 | −30.107 | −148.149 to 87.935 | .617 | −18.346 | −137.408 to 100.715 | .762 |
| 5 vs 1 | 0.654 | −120.651 to 121.958 | .992 | 21.340 | −100.842 to 143.522 | .732 |
| 6 vs 1 | 8.217 | −116.309 to 132.743 | .897 | 32.912 | −92.649 to 158.474 | .607 |
| 7 vs 1 | n/a | | | n/a | | |
| 8 vs 1 | n/a | | | n/a | | |
| 9 vs 1 | n/a | | | n/a | | |
| | Upright time (min/d), unadjusted N = 145 | | | Upright time (min/d), adjusted N = 140 | | |
| 2 vs 1 | −12.315 | −28.571 to 3.941 | .137 | −6.772 | −21.504 to 7.960 | .563 |
| 3 vs 1 | −11.196 | −27.636 to 5.244 | .182 | −5.893 | −20.797 to 9.011 | .587 |
| 4 vs 1 | −9.346 | −26.247 to 7.554 | .278 | −10.643 | −25.983 to 4.696 | .174 |
| 5 vs 1 | −8.862 | −26.234 to 8.510 | .317 | −4.355 | −20.099 to 11.389 | .438 |
| 6 vs 1 | −6.081 | −23.916 to 11.755 | .504 | −4.775 | −20.957 to 11.407 | .367 |
| 7 vs 1 | n/a | | | n/a | | |
| 8 vs 1 | n/a | | | n/a | | |
| 9 vs 1 | n/a | | | n/a | | |
| Day | Standing Time (min/d), Unadjusted N = 145 | | | Standing Time (min/d), Adjusted N = 140 | | |
| | PJ Group vs Non-PJ Group Intervention vs Control | | | PJ Group vs Non-PJ Group Intervention vs Control | | |
| | Coefficient | 95% CI | *P* | Coefficient | 95% CI | *P* |
| 2 vs 1 | −13.572 | −29.097 to 1.952 | .087 | −8.202 | −22.035 to 5.631 | .245 |
| 3 vs 1 | −11.985 | −27.684 to 3.715 | .134 | −6.306 | −20.300 to 7.689 | .377 |
| 4 vs 1 | −9.590 | −25.729 to 6.549 | .244 | −11.344 | −25.747 to 3.059 | .122 |
| 5 vs 1 | −10.565 | −27.154 to 6.025 | .212 | −6.197 | −20.980 to 8.586 | .411 |
| 6 vs 1 | −7.436 | −24.468 to 9.596 | .392 | −6.187 | −21.380 to 9.007 | .424 |
| 7 vs 1 | n/a | | | n/a | | |
| 8 vs 1 | n/a | | | n/a | | |
| 9 vs 1 | n/a | | | n/a | | |
| | Stepping time (min/d), unadjusted N = 145 | | | Stepping time (min/d), adjusted N = 140 | | |
| 2 vs 1 | 1.223 | −1.367 to 3.813 | .354 | 1.426 | −1.166 to 4.017 | .281 |
| 3 vs 1 | 0.707 | −1.912 to 3.326 | .596 | 0.376 | −2.246 to 2.997 | .779 |
| 4 vs 1 | 0.150 | −2.542 to 2.843 | .913 | 0.649 | −2.049 to 3.348 | .637 |
| 5 vs 1 | 1.603 | −1.164 to 4.371 | .256 | 1.783 | −0.986 to 4.553 | .207 |
| 6 vs 1 | 1.251 | −1.590 to 4.092 | .388 | 1.350 | −1.497 to 4.196 | .352 |
| 7 vs 1 | n/a | | | n/a | | |
| 8 vs 1 | n/a | | | n/a | | |
| 9 vs 1 | n/a | | | n/a | | |
| Day | Steps(number/d), unadjusted N = 145 | | | Steps (number/d), adjusted N = 140 | | |
| | Rate Ratio | 95% CI | *P* | Rate Ratio | 95% CI | *P* |
| 2 vs 1 | 1.062 | 0.544 to 2.075 | .860 | 1.051 | 0.532 to 2.075 | .886 |
| 3 vs 1 | 1.009 | 0.513 to 1.986 | .979 | 1.019 | 0.512 to 2.027 | .958 |
| 4 vs 1 | 1.045 | 0.521 to 2.098 | .901 | 1.134 | 0.558 to 2.303 | .728 |
| 5 vs 1 | 0.845 | 0.413 to 1.729 | .643 | 0.875 | 0.423 to 1.811 | .718 |

(*continued on next page*)

**Supplementary Table 2** (*continued*)

| Day | Steps(number/d), unadjusted N = 145 | | | Steps (number/d), adjusted N = 140 | | |
|---|---|---|---|---|---|---|
| | Rate Ratio | 95% CI | *P* | Rate Ratio | 95% CI | *P* |
| 6 vs 1 | 0.747 | 0.358 to 1.558 | .437 | 0.750 | 0.355 to 1.582 | .449 |
| 7 vs 1 | n/a | | | n/a | | |
| 8 vs 1 | n/a | | | n/a | | |
| 9 vs 1 | n/a | | | n/a | | |
| | STS (number/d), unadjusted N = 145 | | | STS (number/d), adjusted N = 140 | | |
| 2 vs 1 | 0.875 | 0.563 to 1.359 | .551 | 0.889 | 0.600 to 1.318 | .558 |
| 3 vs 1 | 0.924 | 0.593 to 1.442 | .728 | 0.923 | 0.621 to 1.373 | .962 |
| 4 vs 1 | 1.014 | 0.642 to 1.604 | .951 | 1.044 | 0.693 to 1.572 | .838 |
| 5 vs 1 | 0.926 | 0.578 to 1.484 | .750 | 0.957 | 0.628 to 1.459 | .838 |
| 6 vs 1 | 0.892 | 0.550 to 1.445 | .641 | 0.918 | 0.597 to 1.414 | .698 |
| 7 vs 1 | n/a | | | n/a | | |
| 8 vs 1 | n/a | | | n/a | | |
| 9 vs 1 | n/a | | | n/a | | |

STS, sit-to-stand transitions.
Adjusted for age, sex, comorbidity, and ambulation status and weekend day. Physical performance assessed by Short Physical Performance Battery. n/a: Comparison between non-PJ and PJ group is not applicable as all patients wearing the ActivPAL for 7 days or more were part of the PJ group.

**Supplementary Table 3**
Overview of Objectively Measured Sedentary Behavior and Physical Activity Measures in Minutes per Hour of ActivPAL Wear Between 7 AM and 9 PM, Stratified By Nursing Staff Availability At the Bed-Side

| | Nursing Staff Availability | | | Across Groups | Low vs Intermediate | Low vs High | Intermediate vs High |
|---|---|---|---|---|---|---|---|
| | Low | Intermediate | High | *P* | *P* | *P* | *P* |
| Nonupright time (min/h) | 57.2 [53.0-58.9] | 56.4 [51.4-58.4] | 56.4 [52.7-58.5] | **<.001** | **<.001** | .052 | **.019** |
| Sitting time (min/h) | 34.6 [9.43-45.3] | 34.4 [9.38-47.1] | 33.5 [9.83-42.9] | **<.001** | **.011** | .283 | **.001** |
| Lying time (min/h) | 18.8 [9.17-48.9] | 13.8 [1.39-48.2] | 19.1 [9.73-47.1] | **<.001** | **<.001** | 1.000 | **.001** |
| Upright time (min/h) | 2.78 [1.11-7.03] | 3.58 [1.61-8.62] | 3.56 [1.48-7.31] | **<.001** | **<.001** | .052 | **.019** |
| Standing time (min/h) | 2.37 [0.91-5.84] | 2.93 [1.24-7.31] | 2.95 [1.39-6.01] | **<.001** | **<.001** | **.038** | .096 |
| Stepping time (min/h) | 0.33 [0.06-0.82] | 0.49 [0.07-1.31] | 0.35 [0.07-0.86] | **<.001** | **<.001** | .998 | **.001** |
| Steps (number/h) | 15.6 [2.67-51.8] | 28.4 [2.80-76.0] | 20.5 [3.37-49.8] | **<.001** | **<.001** | 1.000 | **.001** |
| Sit-to-Stand transitions (number/h) | 1.06 [0.50-1.67] | 1.33 [0.60-2.23] | 1.20 [0.62-1.78] | **<.001** | **<.001** | .077 | .120 |

Differences in objectively measured sedentary behavior and physical activity measures between low, intermediate and high nursing staff availability at the bed-side were tested by a Friedman test. Pairwise comparisons have been adjusted by the Bonferroni correction.

**Supplementary Table 4**
Overview of Objectively Measured Sedentary Behavior And Physical Activity Measures In Minutes Per Hour Of ActivPAL Wear Between 6 AM and 12 PM, Stratified by the Time of Day

| | Morning | Afternoon | Evening | Across Groups | Morning vs Afternoon | Morning vs Evening | Afternoon vs Evening |
|---|---|---|---|---|---|---|---|
| | | | | *P* | *P* | *P* | *P* |
| Nonupright time (min/h) | 56.0 [52.7-58.4] | 57.0 [53.1-58.9] | 58.4 [55.9-59.4] | **<.001** | **.016** | **<.001** | **<.001** |
| Sitting time (min/h) | 25.6 [8.83-37.1] | 34.2 [9.70-49.5] | 17.4 [3.61-27.1] | **<.001** | **<.001** | **<.001** | **<.001** |
| Lying time (min/h) | 24.1 [14.2-49.4] | 18.9 [1.83-47.8] | 40.0 [28.9-54.8] | **<.001** | **<.001** | **<.001** | **<.001** |
| Upright time (min/h) | 4.00 [1.59-7.30] | 2.96 [1.15-6.92] | 1.63 [0.64-4.08] | **<.001** | **.016** | **<.001** | **<.001** |
| Standing time (min/h) | 3.24 [1.42-6.33] | 2.33 [0.99-5.64] | 1.43 [0.60-3.40] | **<.001** | **.005** | **<.001** | **<.001** |
| Stepping time (min/h) | 0.43 [0.08-0.90] | 0.35 [0.08-0.83] | 0.17 [0.03-0.49] | **<.001** | **.066** | **<.001** | **<.001** |
| Steps (number/h) | 23.7 [3.50-55.5] | 18.7 [3.08-53.9] | 9.00 [1.08-27.8] | **<.001** | **.193** | **<.001** | **<.001** |
| Sit-to-Stand transitions (number/h) | 1.33 [0.63-1.96] | 1.03 [0.49-1.67] | 0.56 [0.29-1.04] | **<.001** | **.014** | **<.001** | **<.001** |

Morning: 6 AM–12 PM; Afternoon: 12 PM–6 PM; Evening: 6 PM–12 AM. Differences in objectively measured sedentary behavior and physical activity measures between the morning, afternoon and evening were tested by a Friedman test. Pairwise comparisons have been adjusted by the Bonferroni correction.

**Supplementary Table 5**
Differences in Objectively Measured Sedentary Behavior and Physical Activity Measures Between Non-PJ and PJ Groups Per Level Of Nursing Staff Availability (Low, Intermediate, or High) At The Bed-Side

| | Non-PJ Groups (Control) n = 68 | PJ Groups (Intervention) n = 77 | *P* |
|---|---|---|---|
| Nonupright time (min/h) | | | |
| Low | 57.4 [54.3–58.9] | 56.8 [52.5–58.9] | .550 |
| Intermediate | 55.8 [52.0–58.5] | 56.6 [50.6–58.3] | .566 |
| High | 56.8 [53.8–58.7] | 56.1 [51.4–58.3] | .322 |
| Sitting time (min/h) | | | |
| Low | 31.5 [9.60–45.1] | 36.5 [8.64–45.6] | .419 |
| Intermediate | 35.3 [11.7–46.3] | 33.9 [5.84–49.0] | .529 |
| High | 30.5 [10.2–43.2] | 34.3 [6.71–42.4] | .926 |
| Lying time (min/h) | | | |
| Low | 24.8 [9.54–49.8] | 15.5 [8.33–47.6] | .279 |
| Intermediate | 23.0 [5.02–47.3] | 11.9 [0.00–49.8] | .282 |
| High | 25.7 [10.7–47.1] | 16.7 [9.08–47.5] | .421 |
| Upright time (min/h) | | | |
| Low | 2.65 [1.09–5.72] | 3.18 [1.12–7.50] | .550 |
| Intermediate | 4.16 [1.51–8.04] | 3.43 [1.66–9.43] | .566 |
| High | 3.21 [1.32–6.19] | 3.87 [1.70–8.59] | .322 |
| Standing time (min/h) | | | |
| Low | 2.33 [0.90–4.74] | 2.45 [0.91–6.58] | .721 |
| Intermediate | 3.46 [1.10–6.65] | 2.80 [1.32–7.92] | .698 |
| High | 2.90 [1.26–5.32] | 2.95 [1.54–7.60] | .381 |
| Stepping time (min/h) | | | |
| Low | 0.24 [0.07–0.66] | 0.47 [0.05–0.94] | .233 |
| Intermediate | 0.40 [0.05–1.37] | 0.55 [0.11–1.31] | .461 |
| High | 0.29 [0.06–0.75] | 0.37 [0.12–0.97] | .183 |
| Steps (number/h) | | | |
| Low | 13.2 [2.69–39.8] | 24.4 [2.10–56.6] | .239 |
| Intermediate | 28.3 [2.30–72.5] | 28.4 [4.96–78.5] | .426 |
| High | 18.9 [2.01–41.7] | 21.5 [4.44–61.7] | .188 |
| Sit–to–stand transitions (number/h) | | | |
| Low | 0.89 [0.50–1.54] | 1.13 [0.50–1.76] | .416 |
| Intermediate | 1.20 [0.42–2.32] | 1.53 [0.70–2.17] | .502 |
| High | 1.15 [0.54–1.69] | 1.21 [0.70–1.85] | .255 |

Values are presented as median [IQR]. Differences between non-PJ and PJ groups were tested by a Mann-Whitney U test.

**Supplementary Table 6**
Differences in Objectively Measured Sedentary Behavior and Physical Activity Measures Between Non-PJ and PJ Groups for the Morning, Afternoon, and Evening

| | Non-PJ Groups (Control) n = 68 | PJ Groups (Intervention) n = 77 | *P* |
|---|---|---|---|
| Non-upright time (min/h) | | | |
| Morning | 55.4 [52.8–58.6] | 56.2 [52.6–58.3] | .521 |
| Afternoon | 57.0 [54.5–59.0] | 57.3 [52.0–58.6] | .358 |
| Evening | 58.3 [56.6–59.4] | 58.6 [55.2–59.3] | .513 |
| Sitting time (min/h) | | | |
| Morning | 27.9 [9.28–37.7] | 24.8 [7.68–36.3] | .814 |
| Afternoon | 32.6 [9.82–49.2] | 37.7 [8.50–49.6] | .426 |
| Evening | 16.6 [3.79–27.2] | 17.4 [2.95–27.6] | .981 |
| Lying time (min/h) | | | |
| Morning | 25.1 [14.4–49.8] | 23.3 [13.7–47.8] | .714 |
| Afternoon | 22.1 [4.35–47.9] | 12.5 [0.00–48.4] | .194 |
| Evening | 41.3 [29.6–55.1] | 39.7 [27.5–53.0] | .705 |
| Upright time (min/h) | | | |
| Morning | 4.63 [1.40–7.25] | 3.81 [1.66–7.44] | .521 |
| Afternoon | 3.02 [0.97–5.47] | 2.70 [1.42–8.01] | .358 |
| Evening | 1.67 [0.63–3.38] | 1.44 [0.74–4.84] | .513 |
| Standing time (min/h) | | | |
| Morning | 4.08 [1.30–6.35] | 3.04 [1.49–6.36] | .620 |
| Afternoon | 2.52 [0.89–4.24] | 2.22 [1.09–6.64] | .503 |
| Evening | 1.52 [0.61–2.96] | 1.37 [0.51–3.95] | .571 |
| Stepping time (min/h) | | | |
| Morning | 0.33 [0.06–0.90] | 0.48 [0.11–0.91] | .243 |
| Afternoon | 0.29 [0.05–0.70] | 0.43 [0.09–1.12] | .180 |
| Evening | 0.14 [0.02–0.44] | 0.18 [0.03–0.51] | .590 |
| Steps (number/h) | | | |
| Morning | 21.2 [3.06–49.6] | 25.9 [4.37–58.7] | .276 |
| Afternoon | 15.9 [2.51–40.0] | 24.2 [3.31–66.7] | .184 |
| Evening | 9.22 [0.82–23.2] | 8.89 [1.58–32.0] | .704 |
| Sit-to-stand transitions (number/h) | | | |
| Morning | 1.28 [0.53–2.04] | 1.33 [0.79–1.96] | .426 |
| Afternoon | 0.89 [0.37–1.47] | 1.08 [0.53–1.67] | .314 |
| Evening | 0.50 [0.23–0.83] | 0.67 [0.32–1.11] | .250 |

Values are presented as median [IQR]. Differences between non-PJ and PJ groups were tested by a Mann-Whitney U test. Morning: 6 AM–12 PM; Afternoon: 12 PM–6 PM; Evening: 6 PM–12 AM

**Supplementary Table 7**
The Association Between Mean Objectively Measured Sedentary Behavior and Physical Activity Measures and the Change in Physical or Functional Performance Measures During Geriatric Rehabilitation, in the Whole Population or Stratified by Baseline Performance

| | Δ Handgrip Strength (N = 113) | | Δ SPPB Score (N = 116) | | Δ Gait Speed (N = 120) | | Δ ADL Score (N = 137) | | Δ IADL Score (N = 136) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | B (SE) | *P* | B (SE) | *P* | B (SE) | *P* | B (SE) | *P* | B (SE) | *P* |
| Non-upright time (10 min/d) | | | | | | | | | | |
| Low baseline performance | | | n = 72 | | n = 70 | | | | n = 97 | |
| Model 1: age + sex | −0.032 (0.050) | .525 | −0.178 (0.049) | **<.001** | −0.014 (0.005) | **.004** | 0.003 (0.015) | .834 | −0.057 (0.023) | **.013** |
| Model 2: Model 1 + comorbidity | −0.037 (0.051) | .463 | −0.157 (0.045) | **.001** | −0.013 (0.005) | **.008** | 0.005 (0.016) | .738 | −0.058 (0.024) | **.015** |
| High baseline performance | −0.043 (0.049)* | .387 | n = 64 | | n = 70 | | −0.005 (0.016)* | .774 | n = 48 | |
| Model 1: age + sex | | | 0.015 (0.022) | .475 | −0.002 (0.002) | .391 | | | 0.020 (0.027) | .459 |
| Model 2: Model 1 + comorbidity | | | 0.005 (0.022) | .834 | −0.002 (0.002) | .522 | | | 0.020 (0.027) | .465 |
| Upright time (10 min/d) | | | | | | | | | | |
| Low baseline performance | | | n = 72 | | n = 70 | | | | n = 97 | |
| Model 1: age + sex | 0.035 (0.050) | .485 | 0.184 (0.046) | **<.001** | 0.015 (0.005) | **.002** | −0.002 (0.016) | .896 | 0.059 (0.023) | **.011** |
| Model 2: Model 1 + comorbidity | 0.041 (0.051) | .425 | 0.163 (0.045) | **<.001** | 0.014 (0.005) | **.005** | −0.004 (0.016) | .799 | 0.060 (0.024) | **.013** |
| High baseline performance | 0.047 (0.049)* | .343 | n = 64 | | n = 70 | | 0.006 (0.016)* | .708 | n = 48 | |
| Model 1: age + sex | | | −0.015 (0.022) | .478 | 0.002 (0.002) | .386 | | | −0.020 (0.027) | .458 |
| Model 2: Model 1 + comorbidity | | | −0.005 (0.022) | .832 | 0.002 (0.002) | .513 | | | −0.020 (0.027) | .465 |
| Steps (100 steps/d) | | | | | | | | | | |
| Low baseline performance | | | n = 72 | | n = 70 | | n = 67 | | | |
| Model 1: age + sex | 0.025 (0.049) | .612 | 0.453 (0.080) | **<.001** | 0.035 (0.007) | **<.001** | 0.045 (0.024) | .068 | 0.024 (0.017) | .161 |
| Model 2: Model 1 + comorbidity | 0.033 (0.051) | .519 | 0.419 (0.078) | **<.001** | 0.033 (0.007) | **<.001** | 0.042 (0.025) | .094 | 0.024 (0.018) | .185 |
| High baseline performance | 0.044 (0.049)* | .377 | n = 64 | | n = 70 | | n = 78 | | 0.024 (0.018)* | .172 |
| Model 1: age + sex | | | 0.017 (0.020) | .379 | 0.001 (0.002) | .611 | −0.029 (0.019) | .127 | | |
| Model 2: Model 1 + comorbidity | | | 0.004 (0.020) | .861 | 0.0004 (0.002) | .855 | −0.033 (0.020) | .101 | | |
| Sit-to-stand transitions (10 transitions/d) | | | | | | | | | | |
| Low baseline performance | | | n = 72 | | n = 70 | | n = 67 | | | |
| Model 1: age + sex | 0.018 (0.342) | .959 | 0.891 (0.207) | **<.001** | 0.070 (0.021) | **.001** | 0.683 (0.179) | **<.001** | 0.370 (0.110) | **.001** |
| Model 2: Model 1 + comorbidity | 0.046 (0.349) | .896 | 0.814 (0.200) | **<.001** | 0.065 (0.021) | **.002** | 0.683 (0.182) | **<.001** | 0.378 (0.114) | **.001** |
| High baseline performance | 0.210 (0.342)* | .541 | n = 64 | | n = 70 | | n = 78 | | 0.381 (0.114)* | **.001** |
| Model 1: age + sex | | | −0.122 (0.179) | .497 | 0.005 (0.019) | .775 | −0.065 (0.124) | .600 | | |
| Model 2: Model 1 + comorbidity | | | −0.195 (0.173) | .264 | 0.003 (0.019) | .861 | −0.065 (0.126) | .605 | | |

B, unstandardized beta regression coefficient; N, number of inpatients; **Δ,** delta.
Comorbidity = Cumulative Illness Rating Scale score.
*Additionally adjusted for baseline physical performance as baseline physical performance was not an effect-modifier and therefore analyses were not stratified. $P < .05$ presented in bold.

**Supplementary Table 8**
Descriptives of Objectively Measured Sedentary Behavior and Physical Activity Measures and the Change in Physical and Functional Performance Stratified by Baseline Physical Performance (SPPB Score)

| | | Low Baseline Physical Performance (n = 72) | High Baseline Physical Performance (n = 64) | *P* |
|---|---|---|---|---|
| Objectively measured physical activity | N | | | |
| Wearing time (d) | 136 | 6 [6–6] | 6 [4–6] | 1.000 |
| Nonupright time (h/d)* | 136 | 23.5 [22.7–23.7] | 22.4 [21.2–23.2] | **<.001** |
| Sitting time (h/d)* | 136 | 7.7 [0.8–11.4] | 10.1 [6.4–12.0] | **.033** |
| Lying time (h/d)* | 136 | 14.5 [11.4–22.6] | 11.9 [8.7–15.8] | **.002** |
| Upright time (min/d)* | 136 | 29.5 [12.3–78.8] | 98.0 [48.6–170.0] | **<.001** |
| Standing time (min/d)* | 136 | 26.7 [11.3–68.3] | 79.5 [39.0–156.1] | **<.001** |
| Stepping time (min/d)* | 136 | 1.7 [0.2–6.1] | 13.1 [8.4–22.1] | **<.001** |
| Steps (number/d)* | 136 | 84 [9–326] | 807 [489–1476] | **<.001** |
| Sit-to-Stand transitions (number/d)* | 136 | 12 [4–21] | 25 [20–34] | **<.001** |
| Change in physical and functional performance during geriatric rehabilitation | | | | |
| Hand grip strength (kg) | 113 | 0.50 [−1.50 to 4.00] | 0.00 [−2.00 to 3.00] | .514 |
| SPPB score [0-12] | 116 | 2 [0–4] | 1 [0–2] | **.001** |
| Gait speed (m/s) | 120 | 0.27 [0.00–0.43] | 0.08 [−0.01 to 0.19] | **.005** |
| ADL score [0-6] | 137 | 1 [0–3] | 2 [0-3] | .246 |
| IADL score [0-8] | 136 | 0 [0-3] | 2 [0–4] | **.001** |

Mann-Whitney U-test for non-normally distributed variables. $P < .05$ presented in bold.
*The mean of the objectively measured sedentary behavior/physical activity measure over measurement days.

**Supplementary Table 9**
Results of the Adjusted (n = 132) Models for Patterns of Objectively Measured Sedentary Behavior and Physical Activity Measures Over Days, Including the Effect of Baseline Physical Performance (SPPB score).

| | Nonupright Time (min/d) | Sitting Time (min/d) | Lying Time (min/d) | Upright Time (min/d) | Standing Time (min/d) | Stepping Time (min/d) | Steps (number/d) | STS (number/d) |
|---|---|---|---|---|---|---|---|---|
| | *P* | *P* | *P* | *P* | *P* | *P* | *P* | *P* |
| Day | .141 | .241 | .271 | .057 | .150 | **<.001** | .664 | .976 |
| Physical performance | .203 | .485 | .348 | .211 | .349 | **.014** | .076 | .600 |
| Day * physical performance | .485 | .072 | .067 | .323 | .390 | **.010** | .962 | .987 |
| Age | .176 | .618 | .447 | .189 | .208 | .350 | .558 | .622 |
| Sex | .305 | .240 | .190 | .314 | .280 | .983 | .737 | .072 |
| Comorbidity | .025 | .409 | .804 | .023 | .054 | .002 | .002 | .100 |
| Ambulation status | .002 | .055 | .014 | .001 | .003 | .003 | <.001 | <.001 |
| Weekend d | .007 | .990 | .729 | .012 | .024 | .027 | .002 | .001 |

CIRS, Cumulative Illness Rating Scale; FAC, Functional Ambulation Classification; STS, sit-to-stand transitions.
Performance, binary low vs high based on SPPB score; Comorbidity = CIRS score; Ambulation status = FAC score. $P < .05$ presented in bold.

**Supplementary Table 10**
Patterns of Stepping Time Over Measurement Days, Stratified by Baseline Physical Performance

| Day | Stepping Time (min/d), Unadjusted n = 136 | | | Stepping Time (min/d), Adjusted n = 132 | | |
|---|---|---|---|---|---|---|
| | Low Baseline Performance n = 72 | | | Low Baseline Performance n = 71 | | |
| | Coefficient | 95% CI | *P* | Coefficient | 95% CI | *P* |
| 2 vs 1 | 0.278 | −0.759 to 1.315 | .599 | 0.373 | −0.638 to 1.384 | .469 |
| 3 vs 1 | 0.492 | −0.545 to 1.529 | .352 | 0.308 | −0.703 to 1.319 | .549 |
| 4 vs 1 | 0.241 | −0.812 to 1.293 | .653 | 0.423 | −0.605 to 1.450 | .419 |
| 5 vs 1 | 0.485 | −0.600 to 1.570 | .380 | 0.855 | −0.212 to 1.921 | .116 |
| 6 vs 1 | 1.513 | 0.398 to 2.629 | **.008** | 1.594 | 0.506 to 2.681 | **.004** |
| 7 vs 1 | 1.591 | −2.266 to 5.448 | .418 | 1.276 | −2.455 to 5.008 | .502 |
| 8 vs 1 | n/a | | | n/a | | |
| 9 vs 1 | n/a | | | n/a | | |
| | High baseline performance n = 64 | | | High baseline performance n = 61 | | |
| 2 vs 1 | 1.279 | −1.354 to 3.912 | .340 | 1.393 | −1.289 to 4.075 | .308 |
| 3 vs 1 | 2.991 | 0.286 to 5.696 | **.030** | 2.109 | −0.720 to 4.937 | .143 |
| 4 vs 1 | 1.740 | −1.088 to 4.567 | .227 | 1.634 | −1.291 to 4.559 | .273 |
| 5 vs 1 | −0.834 | −3.740 to 2.072 | .573 | −0.999 | −3.957 to 1.959 | .507 |
| 6 vs 1 | 5.175 | 2.182 to 8.168 | **.001** | 5.092 | 2.047 to 8.137 | **.001** |
| 7 vs 1 | 12.370 | 4.205 to 20.535 | **.003** | 12.014 | 3.857 to 20.171 | **.004** |
| 8 vs 1 | 7.665 | −1.694 to 17.025 | .108 | 7.751 | −1.561 to 17.063 | .102 |
| 9 vs 1 | 4.023 | −7.277 to 15.323 | .484 | 4.340 | −6.936 to 15.617 | .449 |

Physical performance: binary low vs high based on SPPB score at admission.

**Supplementary Table 11**
Results of the Adjusted Models for Patterns of Objectively Measured Sedentary Behavior and Physical Activity Measures Over Days Including the Ending PJ Paralysis Effect, Stratified for Inpatients With Low vs High Baseline Physical Performance (SPPB Score) (n = 132)

| | Nonupright Time (min/d) | | Sitting Time (min/d) | | Lying Time (min/d) | | Upright Time (min/d) | | Standing Time (min/d) | | Stepping Time (min/d) | | Steps (number/d) | | STS (number/d) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *P* | | *P* | | *P* | | *P* | | *P* | | *P* | | *P* | | *P* | |
| | Low | High | Low | High | Low | High | Low | High | Low | High | Low | High | Low | High | Low | High |
| | n = 71 | n = 61 | n = 71 | n = 61 | n = 71 | n = 61 | n = 71 | n = 61 | n = 71 | n = 61 | n = 71 | n = 61 | n = 71 | n = 61 | n = 71 | n = 61 |
| Day | .487 | .272 | .060 | .370 | **.049** | .467 | .058 | .310 | **.045** | .583 | .124 | **.002** | .580 | .952 | .947 | .996 |
| Ending PJ Paralysis | .618 | .391 | .780 | .952 | .845 | .739 | .623 | .419 | .694 | .432 | .412 | .600 | .981 | .623 | .861 | .683 |
| Day* Ending PJ Paralysis | .835 | .425 | .349 | .623 | .350 | .732 | .468 | .444 | .502 | .467 | .837 | .322 | .776 | .997 | .998 | .950 |
| Age | .875 | .173 | .161 | .215 | .186 | .537 | .924 | .199 | .852 | .186 | .573 | .673 | .708 | .661 | .943 | .479 |
| Sex | .618 | .396 | .303 | .485 | .293 | .387 | .716 | .369 | .682 | .369 | .854 | .657 | .694 | .995 | .668 | .003 |
| Comorbidity | .072 | .114 | .622 | .685 | .822 | .847 | .057 | .111 | .086 | .203 | .057 | **.008** | .067 | **.002** | .162 | .382 |
| Ambulation status | **<.001** | .171 | .096 | .870 | **.037** | .565 | **<.001** | .144 | **<.001** | .186 | **<.001** | .122 | **<.001** | .122 | **<.001** | .348 |
| Weekend d | **.003** | .315 | .920 | .887 | .674 | .979 | **.002** | .407 | **.007** | .432 | **<.001** | .578 | **.005** | .212 | **.003** | .065 |

CIRS, Cumulative Illness Rating Scale; FAC, Functional Ambulation Classification; STS, sit-to-stand transitions. Physical performance, binary low vs high based on SPPB score; Comorbidity = CIRS score; Ambulation status = FAC score.
$P < .05$ presented in bold.

**Supplementary Table 12**
Comparison of Patterns of Objectively Measured Sedentary Behavior and Physical Activity Measures Over Measurement Days Between Non-PJ and PJ Groups, Stratified by Baseline Physical Performance

| Day | Low Baseline Performance | | | High Baseline Performance | | |
|---|---|---|---|---|---|---|
| | Nonupright Time (min/d), Adjusted n = 71 | | | Nonupright Time (min/d), Adjusted n = 61 | | |
| | PJ Group vs Non-PJ Group Intervention vs Control | | | PJ Group vs Non-PJ Group Intervention vs Control | | |
| | Coefficient | 95% CI | *P* | Coefficient | 95% CI | *P* |
| 2 vs 1 | 6.270 | −12.574 to 25.114 | .513 | 8.089 | −18.018 to 34.197 | .542 |
| 3 vs 1 | 10.035 | −8.810 to 28.879 | .296 | 5.911 | −20.945 to 32.767 | .665 |
| 4 vs 1 | 12.177 | −6.949 to 31.302 | .211 | 8.595 | −19.570 to 36.760 | .549 |
| 5 vs 1 | 10.116 | −9.631 to 29.864 | .314 | −17.226 | −45.944 to 11.491 | .239 |
| 6 vs 1 | 10.706 | −9.577 to 30.988 | .300 | −10.454 | −40.100 to 19.191 | .488 |
| 7 vs 1 | n/a | | | n/a | | |
| 8 vs 1 | n/a | | | n/a | | |
| 9 vs 1 | n/a | | | n/a | | |
| | Sitting time (min/d), adjusted n = 71 | | | Sitting time (min/d), adjusted n = 61 | | |
| 2 vs 1 | −104.288 | −275.855 to 67.280 | .233 | −12.006 | −168.750 to 144.737 | .880 |
| 3 vs 1 | −119.948 | −291.522 to 51.625 | .170 | −1.661 | −162.485 to 159.163 | .984 |
| 4 vs 1 | 22.857 | −151.252 to 196.967 | .796 | 76.788 | −91.573 to 245.150 | .370 |
| 5 vs 1 | 0.303 | −179.442 to 180.047 | .997 | −17.076 | −188.732 to 154.581 | .845 |
| 6 vs 1 | 40.382 | −144.214 to 224.978 | .667 | −96.700 | −273.921 to 80.522 | .284 |
| 7 vs 1 | n/a | | | n/a | | |
| 8 vs 1 | n/a | | | n/a | | |
| 9 vs 1 | n/a | | | n/a | | |
| | Lying time (min/d), adjusted n = 71 | | | Lying time (min/d), adjusted n = 61 | | |
| 2 vs 1 | 110.042 | −61.374 to 281.458 | .208 | 20.066 | −137.495 to 177.627 | .802 |
| 3 vs 1 | 129.475 | −41.946 to 300.897 | .138 | 9.977 | −151.809 to 171.763 | .903 |
| 4 vs 1 | −11.344 | −185.304 to 162.616 | .898 | −66.954 | −236.416 to 102.509 | .437 |
| 5 vs 1 | 9.154 | −170.443 to 188.751 | .920 | 2.011 | −170.773 to 174.794 | .982 |
| 6 vs 1 | −30.313 | −214.761 to 154.136 | .747 | 87.627 | −90.754 to 266.008 | .334 |
| 7 vs 1 | n/a | | | n/a | | |
| 8 vs 1 | n/a | | | n/a | | |
| 9 vs 1 | n/a | | | n/a | | |
| | Upright time (min/d), adjusted n = 71 | | | Upright time (min/d), adjusted n = 61 | | |
| 2 vs 1 | −6.273 | −22.988 to 10.442 | .461 | −7.970 | −35.444 to 19.504 | .569 |
| 3 vs 1 | −4.687 | −21.402 to 12.028 | .582 | −5.931 | −34.190 to 22.329 | .680 |
| 4 vs 1 | −8.547 | −25.512 to 8.418 | .322 | −13.484 | −43.118 to 16.151 | .371 |
| 5 vs 1 | −16.747 | −34.265 to 0.771 | .061 | 15.905 | −14.311 to 46.121 | .301 |
| 6 vs 1 | −13.962 | −31.955 to 4.031 | .128 | 9.021 | −22.172 to 40.214 | .570 |
| 7 vs 1 | n/a | | | n/a | | |
| 8 vs 1 | n/a | | | n/a | | |
| 9 vs 1 | n/a | | | n/a | | |
| | Standing time (min/d), unadjusted n = 71 | | | Standing time (min/d), adjusted n = 61 | | |
| 2 vs 1 | −5.078 | −21.456 to 11.299 | .542 | −12.289 | −37.579 to 13.000 | .340 |
| 3 vs 1 | −4.208 | −20.586 to 12.169 | .614 | −7.294 | −33.307 to 18.719 | .581 |
| 4 vs 1 | −8.292 | −24.915 to 8.330 | .327 | −15.144 | −42.422 to 12.135 | .275 |
| 5 vs 1 | −15.563 | −32.727 to 1.601 | .075 | 9.837 | −17.977 to 37.651 | .487 |
| 6 vs 1 | −13.337 | −30.966 to 4.292 | .138 | 4.727 | −23.985 to 33.440 | .746 |
| 7 vs 1 | n/a | | | n/a | | |
| 8 vs 1 | n/a | | | n/a | | |
| 9 vs 1 | n/a | | | n/a | | |
| Day | Low Baseline Performance | | | High Baseline Performance | | |
| | Stepping Time (min/d), Adjusted n = 71 | | | Stepping Time (min/d), Adjusted n = 61 | | |
| | PJ Group vs Non-PJ Group Intervention vs control | | | PJ Group vs Non-PJ Group Intervention vs control | | |
| | Coefficient | 95% CI | *P* | Coefficient | 95% CI | *P* |
| 2 vs 1 | −1.192 | −3.227 to 0.843 | .250 | 4.301 | −1.068 to 9.669 | .116 |
| 3 vs 1 | −0.476 | −2.512 to 1.559 | .646 | 1.282 | −4.238 to 6.802 | .648 |
| 4 vs 1 | −0.248 | −2.313 to 1.818 | .814 | 1.549 | −4.238 to 7.337 | .599 |
| 5 vs 1 | −1.169 | −3.302 to 0.965 | .282 | 5.946 | 0.046 to 11.847 | **.048** |
| 6 vs 1 | −0.630 | −2.821 to 1.562 | .572 | 4.175 | −1.916 to 10.267 | .178 |
| 7 vs 1 | n/a | | | n/a | | |
| 8 vs 1 | n/a | | | n/a | | |
| 9 vs 1 | n/a | | | n/a | | |
| 9 vs 1 | n/a | | | n/a | | |
| Day | Steps (number/d), adjusted n = 71 | | | Steps (number/d), adjusted n = 61 | | |
| | Rate Ratio | 95% CI | *P* | Rate Ratio | 95% CI | *P* |
| 2 vs 1 | 0.950 | 0.280 to 3.218 | .934 | 1.099 | 0.567 to 2.129 | .780 |
| 3 vs 1 | 0.958 | 0.282 to 3.252 | .946 | 1.029 | 0.522 to 2.027 | .935 |

(*continued on next page*)

**Supplementary Table 12** (*continued*)

| Day | Steps (number/d), adjusted n = 71 | | | Steps (number/d), adjusted n = 61 | | |
|---|---|---|---|---|---|---|
| | Rate Ratio | 95% CI | *P* | Rate Ratio | 95% CI | *P* |
| 4 vs 1 | 1.252 | 0.362 to 4.334 | .722 | 1.009 | 0.496 to 2.052 | .980 |
| 5 vs 1 | 0.702 | 0.195 to 2.534 | .588 | 1.176 | 0.570 to 2.426 | .659 |
| 6 vs 1 | 0.472 | 0.127 to 1.752 | .261 | 1.141 | 0.541 to 2.408 | .728 |
| 7 vs 1 | n/a | | | n/a | | |
| 8 vs 1 | n/a | | | n/a | | |
| 9 vs 1 | n/a | | | n/a | | |
| | STS (number/d), adjusted n = 71 | | | STS (number/d), adjusted n = 61 | | |
| 2 vs 1 | 0.881 | 0.443 to 1.753 | .719 | 0.916 | 0.603 to 1.391 | .679 |
| 3 vs 1 | 0.978 | 0.493 to 1.941 | .950 | 0.877 | 0.572 to 1.345 | .547 |
| 4 vs 1 | 1.004 | 0.499 to 2.021 | .991 | 1.085 | 0.694 to 1.697 | .719 |
| 5 vs 1 | 1.031 | 0.499 to 2.129 | .934 | 1.025 | 0.649 to 1.619 | .916 |
| 6 vs 1 | 0.925 | 0.441 to 1.942 | .837 | 0.996 | 0.622 to 1.595 | .987 |
| 7 vs 1 | n/a | | | n/a | | |
| 8 vs 1 | n/a | | | n/a | | |
| 9 vs 1 | n/a | | | n/a | | |

STS, sit-to-stand transitions.

Adjusted for age, sex, comorbidity, ambulation status, and weekend day. Physical performance assessed by Short Physical Performance Battery. n/a: Comparison between non-PJ and PJ group is not applicable as all patients wearing the ActivPAL for 7 days or more were part of the PJ group.