**Title:** Inpatient step counts, symptom severity and perceived health status after lung resection surgery

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Abstract

BACKGROUND: The clinical relevance of in-patient step counts following lung surgery remains unknown.

OBJECTIVE: To identify those factors related to physical activity measured by step count, during the inpatient stay and its relationship with symptom severity and perceived health status at hospital admission, discharge and one month after discharge.

METHODS: We studied the inpatient step count of 73 participants who underwent lung resection surgery. The number of steps was measured using a triaxial accelerometer. The health status and the severity of symptoms were examined at hospital admission, discharge and one month after discharge.

RESULTS: Of the 73 participants, 35 were active and 38 sedentary during the hospitalization. The mean number of steps walked during three inpatient days was 6689 ± 3261 and 523 ± 2273 (p<.001) for active and sedentary groups respectively. The dyspnea and fatigue scores in the sedentary group across data collection points (hospital admission, discharge and follow-up) were significantly worse (p<.01). In regard to pain, the sedentary group presented worse results at discharge and follow-up (p<0.01), than the active group. The correlation analysis indicated significant but weak correlations (r<0.500) between inpatient steps per day and symptom severity at one month follow-up (T2) after surgery.

CONCLUSION: Inpatient step count may be a risk factor for symptom severity and perceived health status during hospitalization and within the first month following lung resection surgery.

IMPLICATIONS FOR PRACTICE: Nurses should consider recommending physical activity during hospitalization for patients after lung resection.

Key words: Lung cancer, symptoms, health status, pulmonary surgical procedures, fitness trackers, exercise.

Manuscript

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# INTRODUCTION

Lung cancer is the leading cause of cancer death among both men and women worldwide, with more than one million people dying from it each year.1 The development of targeted therapy is

essential for these patients. Accumulating evidence suggests that the sequelae of lung cancer

continue to demand health resources, including the period after completion of active treatment that brings its own set of unique, and in some cases, still poorly understood challenges.2

Several studies have reported that numerous lung cancer survivors experience persistent

symptoms of cancer and treatment including pain, dyspnea, fatigue, depression and sleep disturbances.3,4,5 These symptoms may persist for years,6,7 decreasing health-related quality of

life (HRQOL) and negatively impact the ability to perform daily activities after the conclusion of primary treatment.8,9 Moreover, persistent signs and symptoms can act as a continuous reminder of cancer that may lead to increased psychological morbidity.10

Physical activity among healthy people has been related to benefits in many of the same physical and psychological symptoms that are challenging to cancer survivors.11 In this sense,

physical activity is a factor of great importance that may help patients cope with and recover

from treatments and diminish the risk of problematic long-term symptoms of cancer survivors.

Some studies that focused on HRQOL in survivors of several cancers have previously reported

that the maintenance of physical activity levels after cancer treatment was an important predictor of health status.12 Moreover, physical activity during hospitalization has been previously studied in other populations,13,14 showing that it could be an important predictor of

recovery. Little research, however, has been directed to the importance of physical activity

during hospitalization as a prognostic factor for subsequent levels of symptoms or perceived health status of lung resection patients.15

**Theoretical framework**

The American Cancer Society16 and the American College of Sports Medicine17 recommend a physically active lifestyle for cancer survivors with the aim of improve physical function and quality of life outcomes.18 Our model relies heavily on assumptions and concepts outlined in both as it assumes that physical activity plays an important role in decreasing cancer treatment side-effects, speeding recovery after a cancer diagnosis, and enhancing survival.19 Previous studies have shown the beneficial effects of physical activity in a reduction of body fat and beneficial changes in immune function, or inflammation.20 However, the relative protective effects of pre-diagnosis physical activity on symptoms and health status of lung resection patients remain unknown. The knowledge of lifestyle choices for cancer survivors becomes particularly important in nursing programs because patients often seek self-care strategies to improve their long-term outcomes.

To our knowledge, no previous studies have identified a relationship between physical activity in hospitalized patients undergoing lung surgery and post-operative prognosis. Thus, the purpose of this study was to identify those factors related to physical activity measured by step count, during the inpatient stay after lung surgery and to evaluate the relationship between the number of inpatient steps and the severity of symptoms and perceived health status at discharge and in the following month.

# METHODS

**Study design and participants**

We conducted a three data point, observational prospective cohort study. The study protocol was reviewed and approved by the University of Granada Ethics Committee (Granada, Spain).

Patients undergoing virtual video-assisted thoracoscopic surgery (VATS) were recruited from the Thoracic Surgery Service of the “Hospital Virgen de las Nieves” (Granada), between September 2016 and May 2018. All were between 18 and 80 years of age, were informed of the study and signed the informed consent. This study was done in accordance with the Declaration of Helsinki 1975, revised Hong Kong 1989. Patients were excluded if they presented with one of the following conditions: mental instability, orthopedic pathologies which could affect the primary outcome, cognitive impairment or neurologic pathologies limiting voluntary mobility.

# Group assignment

Patients were divided into two groups according to their physical activity level, as assessed by the number of steps, which were recorded the three last days of hospitalization, by a wrist- mounted triaxial accelerometer (Fitbit). The Fitbit can analyze unfiltered and filtered acceleration signals to accurately classify locomotive and household activities. The mean number of steps walked during the last three inpatient days was calculated for study analyses. The cut-off point in steps per day was 4000 steps/day as proposed by Dronkers and colleagues21 and was used to distribute participants into active (>4000 steps/day) or less active (≤4000 steps/day) groups.

# Outcome measures

Data collection occurred at three discrete times: hospital admission (prior to the lung resection), at discharge and one month after discharge. Data collected from the medical history at admission

included comorbidities, anthropometric data, intervention modality, operative duration and length of hospital stay. Lung function with spirometry was performed following the rules of the American Thoracic Society and the European Respiratory Society;22 the Comorbidity index was recorded using the Charlson index,23 and strength was measured by handgrip dynamometry.24 The nutritional status was assessed by the Mini Nutritional Assessment (MNA)25 and the level of functional independence using the Barthel index.26

*Primary outcomes*

The primary study outcomes were symptoms (dyspnea, fatigue and pain) and perceived health status. Dyspnea was evaluated by the Borg modified scale,27 and pain was measured by the Brief Pain Inventory (BPI). The BPI is an 11-item pain assessment tool validated in cancer populations,28 that measures two domains of pain: a 4-item severity dimension and 7-item interference dimension. Patients rate their pain intensity at its worst and least during the previous week, on average, and at the time of data collection. Patients rate their level of pain interference in 7 contexts: (1) work, (2) activity, (3) mood, (4) enjoyment, (5) sleep, (6) walking, and (7) relationships.29 Fatigue was measured by the Fatigue Severity Scale (FSS), consisting of nine items developed to measure the impact of disabling fatigue on daily functioning.30 Respondents answer using a Likert scale ranging from 1 (completely disagree) to 7 (completely agree), with higher scores indicating a higher level of fatigue.

Perceived health status included anxiety and depression, sleep disorders and self-perceived quality of life and was measured by three questionnaires: the Hospital Anxiety and Depression Scale (HADS), the Pittsburgh Sleep Quality Index (PSQI), and the EuroQol-5 Dimensions (EQ-

5D).

The HADS is a 14-item self-report screening measure with previous reliability and validity studies in a Spanish population.31 The HADS measures the presence of anxiety and

depression, including with coexisting general medical conditions,32 and has been used in cancer populations.33 The HADS contains 14 statements, ranging from 0–3, divided into two subscales: HADS-A for anxiety (0–21) and HADS-D for depression (0–21). A cut off score of 8 is used to indicate possible anxiety or depression.34

The PSQI is a tool used to assess sleep35 in different populations including cancer.36 This questionnaire has established reliability and validity in a Spanish population.37 The PSQI is a

self-reported questionnaire that evaluated sleep quality and sleep disorders over a 1-month period and has 24 questions, with response options of 0 to 3 (0 represents the best and 3 the worst), which generate seven component scores.

Self-perceived quality of life was assessed by the EQ-5D,38 which is divided into two sections. The first part measures health in five dimensions: mobility, self-care, usual activities, pain/discomfort and anxiety/depression. Patients can choose between “no problems”, “some problems” or “extreme problems”. The second section consist on a visual analogue scale (VAS) score, which records the responder’s self-evaluated health status between 0 (the worst imaginable health) and 100 (the best imaginable health). This questionnaire has established reliability and was validated in Spanish by Badia et al.38

# Statistical analysis

The G\*Power 3.1.9.2 software was used to calculate the sample size. This calculation was performed based on a pilot study (unpublished) of seven subjects (effect size of 0.70), including a statistical power of 85% and considering a p-value <0.05 to be statistically significant. The final obtained a sample size was 62 subjects (31 per group). Taking into account possible

attrition, 70 patients were required. A p-value <0.05 was considered statistically significant. Data were analysed using IBM SPSS version 20.0. Prior to statistical analysis, the Kolmogorov- Smirnov test was performed to assess the normality of the variables. All numerical variables were expressed as the mean ± standard deviation (SD). A between group comparison was performed after subjects were grouped by activity status with active (>4000 steps/day) and less active (<4000steps/day) groups. A within group analysis was done in order to analyze change in each group from each data point. A bivariate correlation analysis was conducted between steps per day and symptom scores. Spearman’s rho was used to determine the association between the steps per day, and symptom measures. The strength of the correlations was based on the criteria described by Portney39: values < 0.25 indicate little or no relationship; 0.25-0.50 suggests fair relationship; 0.50-0.75 represents a moderate to good relationship, and values above 0.75 indicate an excellent relationship. A p-value <0.05 was considered statistically significant.

# RESULTS

Ninety-eight patients undergoing lung resection were assessed for eligibility in this study. Eleven patients were excluded, five were unable to regain independent walking and five patients did not want to carry the activity monitor as required. Eighty-seven were fully eligible and all gave their informed consent to participate. Ten participants presented an incomplete evaluation at discharge and five did not complete the evaluation at follow-up. Finally, 72 patients completed the evaluation at all three data collection points and were analyzed (Figure).

# Please, insert Figure.

The clinical characteristics of the patients are summarized in [Table 1](https://www.sciencedirect.com/science/article/pii/S0914508715000192#tbl0005). Of the seventy-two patients enrolled, 42 underwent video-assisted surgery, and 30 patients underwent thoracotomy. **Please, insert table 1.**

The study sample had an average BMI of 27.07 and a Charlson index of 4.45. The operation duration presented an average of 192.43 minutes and the average length of hospital stay was 7.63 days with 56.3% of patients undergoing lobectomy, 33.2% segmental resection and 8.7% segmentectomy. Except for the number of comorbidities, age, nutritional status, handgrip strength and steps per day, the other hospital admission scores (sex, BMI, duration and type of surgery, length of hospital stay, spirometric values and Barthel index) were similar between groups (p>.05). Primary outcomes at hospital admission, at discharge and in the follow-up are presented in Table 2.

# Please, insert table 2.

The primary symptom outcomes between groups at each data point are presented in Table 2. At hospital admission, patients in the less active group presented statistically significant differences in all measurements except pain measurement, sleep disturbance subscore, self-care subscore and pain subscore, than the active group. At discharge, less active patients also presented significant differences in severity of pain, fatigue and dyspnea and PSQI score, including sleep quality (p=.014), duration (p=.036), efficiency (p=.012), medications (p=.022), daytime dysfunction (p=.004) and total sleep score (p<.001). Anxiety and depression, and self-perceived health status also presented significant differences between groups at discharge. One month after discharge, all measures except subjective sleep quality, sleep duration and sleep disturbance subscores as well as perceived health status, personal care and pain presented statistically significant differences between groups.

In the within group analysis, significant positive differences were found in the active group in pain (severity: p=0.041 and interference: p<0.001), the HADS score (anxiety: p=0.036 and total: p<0.001) and self-perceived health status (p<0.001) at discharge. The less active group also presented significant positive differences when comparing admission scores and discharge scores in pain (p<0.001), HADS (anxiety: p<0.001), depression: p=0.034 and total: p=0.025) and self- perceived health status (p<0.05). One month after discharge, in the within groups analysis, both groups presented significant positive changes in pain severity (active: p=0.007 and less active: p<0.001) and interference (p<0.001) since discharge. In regards to HADS, the within group analysis showed significant positive change in anxiety in both groups (active: p=0.038, less active: p=0.042) and the total score only for the active group (p=0.019) at follow-up. Regarding discharge, significant differences were also found in the within groups analysis for the EQ-5D subscales one month after discharge: mobility (less active: p=0.031), activities of daily life (less active: p<0.001), care (active: p<0.001 and less active: p=0.016), pain (less active: p=0.026) and VAS (less active: p<0.001).

Correlational analysis revealed at follow-up a modest inverse correlation between inpatient steps and dyspnea (r=-0.384, p=.002), fatigue (r=-0.575, p<.001), pain severity and interference (r=- 0.374, p=.002 and r=-0.398, p=.001 respectively), sleep quality (r=-0.376, p=.002) and mood (r=-0.374, p=.002). In the case of perceived health status the relationship was positive (r=0.264, p=.049).

# DISCUSSION

This study sought to identify factors related to physical activity, as measured by step count, during the inpatient stay after lung surgery, as well as to examine the relationship between the

inpatient steps walked and symptom severity at hospital admission, discharge and one month after discharge. As hypothesized, a greater number of steps per day was associated with less physical symptoms and higher levels of perceived health status. Our results indicate that several peri- and postoperative patient characteristics are related to the inpatient step count, and continue to be related one month after discharge.

Our study results showed that less active patients present more anxiety and depression at admission, discharge and one month after discharge, than the active group. This finding has been explored in several studies,40,41 however, to our knowledge, this is the first study which investigated physical activity specifically during hospitalization secondary to lung resection.

Jones et al.42 studied a sample of cancer survivors showing significant and relevant relationships among food choices, physical activity, dietary supplement use, and complementary nutritional therapies with speed recovery, reduce risk of recurrence, and improved quality of life. Our study results are in keeping with these studies. Our findings additionally included that anxiety, depression and sleep quality are also related to the number of steps per day. Moreover, less active patients presented a poorer recovery in these measures, while active patients significantly reduced their anxiety and depression levels one month after discharge. Physical activity has been previously related to an improvement in anxiety and depression symptoms, which could be responsible for the difference between groups.43

Different studies involving patients with cancer have found that depression and distress are related to sleep disorders44,45 but these studies examined patients during treatments like chemotherapy, or other adjuvant treatments. Other studies have suggested an association between surgery and poor sleep quality.46,47 Surgical stress, pain, and medications have been suggested to cause poor sleep quality.46,47 Our study found disturbed sleep in both groups, but

this was more prevalent in the less active group and persisted through follow-up. Kredlow et al.48 carried out a meta-analytic review and concluded that regular physical activity has benefits for sleep quality, which is relevant to our results.

Previous studies in lung cancer patients have indicated that the postoperative experience can adversely affect their quality of life (QOL).49 Lung cancer patients have a poor QOL before surgery50 that persists after surgery4. One factor related to quality of life in older people could be physical activity, as suggested previous studies.51,52 Our study found small differences between groups on self-perceived health status subscores at hospital admission and at discharge, but these differences increased at follow-up with poorer subscores in less active patients.

Limited information has been available on patients' symptoms and predictors of symptom occurrence and severity after lung cancer surgery. Our study found that less active patients presented an increase in dyspnea levels at three data points, compared with the active group. As regards to pain, both groups reported increased pain severity and interference at discharge and a decrease in both scores at the follow-up. However, the less active group presented higher or worse scores at both data points. Previous reports on lung cancer surgery have investigated the impact of comorbidities on patients' symptom experience,53 showing a significant relationship with the Self-Administered Comorbidity Questionnaire-19. In our study, the comorbidity score was significantly higher in the sedentary group with more symptom severity. Additionally, we found a significant relationship between steps per day during hospitalization and symptom severity that continued one month after discharge.

Similar to dyspnea and pain, and consistent with previous reports,4,6,54 the occurrence of fatigue in our sample increased from before surgery through one month after discharge. Our results showed an additional relationship between hospitalization activity and fatigue; this can be

explained partially by the co-occurring sleep disturbances in the less activity group as has been proposed previously,55 and attributed to the reported desynchronization of the circadian rhythm56 in cancer patients.

The trajectory of cancer survivors has been previously described in three phases: active treatment and recovery; living after recovery; and advanced cancer and end of life.57 The results of our study confirm the importance of physical activity. Studies of healthy populations have found determinants for physical activity, but in the case of cancer survivors those haven’t been found.58,59

Based on the current evidence and perhaps due to the adjuvant treatment-related symptoms, fewer than 10% of cancer survivors are active during their primary treatments and only about 20% to 30% will be active after they recover from treatments.60,61 Our study shows that the less active patients tend to be older, have more comorbidities and have a lower nutritional status than the more active patients. Of note, cancer-related surgery variables were not different between groups at hospital admission. The differences in age or comorbidities between groups could be due to older persons tending to decrease their physical activity levels because of the presence of more musculoskeletal problems.62 Nutrition could be associated to the lower physical activity level because people who have a healthy lifestyle often give careful attention to nutrition and physical activity.

Future studies should focus on motives, barriers, and preferences for physical activity.57 A useful strategy to improve recovery could be to help patients improve or maintain physical activity through the plan of care, especially in older people who present lower levels of physical activity. Nurses have the most frequent and consistent contact with cancer patients during hospitalization.63 Moreover, they are in a position to encourage lifestyle change and to motivate

patients to be more active during hospitalization, i.e., suggesting ways to integrate increased physical activity into the patients’ routine. Knowing the benefits of walking during an inpatient stay gives nurses important information to guide patients. Nurses trained in palliative care and symptom management likely have the skill and knowledge necessary to integrate health promotion messages into their nursing care.64

# Limitations

Only dyspnea, pain, fatigue, anxiety and depression, sleep quality and health status were included in the analyses whereas other patient characteristics (i.e., nutritional status or exercise) have been reported in other studies.42 In addition, a longer assessment period would have added to our understanding of symptom evolution. Different factors likely influence patients' ratings of symptom occurrence and severity secondary to the recent surgery, and these factors and their degree of influence can change over time.

# Conclusions

The findings from this study provide a more complete picture of the symptom experience of lung resection cancer patients before discharge and to one month after discharge in terms of symptoms and activity level. Taken together, these findings suggest that the symptoms of patients before and after lung resection are related to activity. An important finding is that the activity level seems to play a role in the occurrence of the symptoms from before to after surgery. Therefore, the findings from this study can be used by nurses to identify patients who are at higher risk for more severe symptoms before and after lung cancer surgery and to initiate different management interventions.

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# Tables legends

**Table 1.** Characteristics of the Participants Included, Compared by Group.

**Table 2.** Primary Variables at Hospital Admission, Discharge and Follow-Up Compared by Group

# Figure legends

**Figure.** Flow diagram of the distribution of participants.

Table(s)

**Table 1.** Characteristics of the Participants Included, Compared by Group

|  |  |  |  |
| --- | --- | --- | --- |
|  | Active group(N=34) | Less active group(N=38) | p |
| Mean ± SD | Mean ± SD |
| Age (years) | 48.92 ± 11.8 | 60.06 ± 11.72 | <.001d |
| Male [n (%)] | 28 (82) | 31 (81.5) | .852 |
| BMI (Kg/m2) | 26.08 ± 4.14 | 27.84 ± 3.76 | .064 |
| Duration of surgery(minutes) | 176 ± 45.06 | 222.83 ± 73.94 | .189 |
| Type of intervention (%) |
| Lobectomy | 58.3 | 51.6 | .753 |
| Segmental resection | 35 | 29 | .841 |
| Segmentomy | 6.7 | 10 | .796 |
| Length of hospital stay |  |  |  |
| Lobectomy | 8.53 ± 2.67 | 9.86 ± 3.19 | 0.049 |
| Segmental resection | 6.28 ± 3.69 | 8.45 ± 2.41 | 0.068 |
| Segmentomy | 6.07 ± 2.77 | 7.88 ± 3.69 | 0.036 |
| FVCa | 97.39 ± 16.83 | 97.30 ± 14.59 | .984 |
| FEV1b | 84.97 ± 21.6 | 90.61 ± 15.02 | .247 |
| Handgrip strength | 381.7 ± 79.5 | 305.1 ± 79.4 | <.001d |
| Comorbidities score | 1.95 ± 2.01 | 5.76 ± 2.62 | <.001d |
| Barthel | 100 | 99.12 ± 3.52 | .133 |
| Nutritional status | 27.55 ± 2.28 | 25.69 ± 2.85 | .003c |
| Steps per day (hospitalization) | 6689 ± 3261 | 523 ± 2273 | <.001d |

Abbreviations: BMI, Body Index Mass; FEV, forced expiratory volume; FVC, forced vital capacity; min, minutes; SD, standard deviation; VATS, Video-Assisted Thoracoscopic Surgical Technique.

a % Predicted Forced Vital Capacity

b % Predicted Forced Expiratory Volume in one second.

cp<.05 dp<.001

Data expressed as mean ± standard deviation or percentage.

**Table 2.** Primary Variables at Hospital Admission, Discharge and Follow-Up Compared by Group.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Admission | Discharge | One month follow-up |
|  | Active group (N=34) | Less active group(N=38) | p | Active group (N=34) | Less active group(N=38) | p | Active group (N=34) | Less active group(N=38) | p |
| Mean ± SD | Mean ± SD | Mean ± SD | Mean ± SD | Mean ± SD | Mean ± SD |
| *Symptoms* |
| Dyspnea | 0.5 ± 0.23 | 1.53 ± 2.29 | <.001d | 0.4 ± 0.84 | 1.76 ± 2.02 | .047c | 0.21 ± 0.70 | 2.33 ± 3.21 | <.001d |
| Fatigue | 10.11 ± 3.58 | 31.3 ± 20.56 | <.001d | 15.0 ± 6.63 | 36.6 ± 20.84 | .027c | 11 ± 6.92 | 34.3 ± 21.15 | <.001d |
| Pain | Severity subscore | 0.4 ± 0.23 | 0.1 ± 1.3 | .147 | 5.4 ± 4.83a | 15.6 ± 9.44a | .003c | 0.61 ±1.55b | 5.11 ± 7.8b | .001c |
| Interference subscore | 0.25 ± 2.65 | 0.64 ± 1.69 | .278 | 19.30 ± 25.2ª | 21.54 ± 19.5ª | .755 | 0.21 ± 0.9b | 12.33 ± 17.5b | <.001d |
| *Perceived health status* |
| HAD | Anxiety subscore | 2.87 ± 3.19 | 8.41 ± 5.7 | <.001d | 1.6 ± 2.21a | 5.24 ± 4.78a | .027c | 2.66 ± 3.02b | 5.41 ± 4.4b | .004c |
| Depression subscore | 0.74 ± 1.3 | 2.0 ± 2.27 | .005c | 1.9 ± 1.37 | 3.86 ± 2.46a | .022c | 0.68 ± 1.02 | 3.04 ± 3.6 | <.001d |
| HAD total score | 3.61 ± 4 | 10.4 ± 7.5 | <.001d | 3.5 ± 3.2a | 9.1 ± 6.39a | .012c | 3.34 ± 3.6b | 8.44 ± 7.5 | .001c |

|  |
| --- |
| Sleep quality |
| Subjective quality subscore | 2.04 ± 0.87 | 1.26 ± 0.43 | .022c | 1.62 ± 0.88 | 0.52 ± 1.23 | .014c | 0.82 ± 0.60 | 1.07 ± 0.82 | .152 |
| Latency subscore | 0.71 ± 1.14 | 1.24 ± 1.2 | .059 | 0.71 ± 1.14 | 1.24 ± 1.2 | .059 | 0.68 ± 1.41 | 1.30 ± 1.03 | .030c |
| Duration subscore | 1 ± 1.09 | 1.58 ± 1.17 | .036c | 1 ± 1.09 | 1.58 ± 1.17 | .036c | 1.05 ± 1.06 | 1.48 ± 1.12 | .123 |
| Habitual efficiency subscore | 0.74 ± 1.18 | 1.48 ± 1.25 | .012c | 0.74 ± 1.18 | 1.48 ± 1.25 | .012c | 0.74 ± 1.08 | 1.52 ± 1.15 | .007c |
| Sleep disturbances subscore | 1 ± 0.33 | 1.03 ± 0.46 | .750 | 1.0 ± 0.33ª | 1.03 ± 0.46 | .860 | 1.11 ± 0.45 | 1.15 ± 0.53 | .728 |
| Medications to sleep | 0.26 ± 0.6 | 0.82 ± 1.3 | .022c | 0.26 ± 0.6 | 0.82 ± 1.3 | .022c | 0.45 ± 0.92 | 1.22 ± 1.4 | .011c |
| Daytime Dysfunction | 0.16 ± 0.37 | 0.64 ± 0.89 | .004c | 0.16 ± 0.37 | 0.64 ± 0.89 | .004c | 0.11 ± 0.31 | 0.7 ± 0.912 | <.001d |
| Total score | 4.76 ± 3.6 | 7.85 ± 4.15 | .001c | 4.76 ± 3.6 | 7.85 ± 4.15 | .001c | 5.0 ± 3.43 | 8.41 ± 4.43 | .001c |
| Self-perceived quality of life |
| Mobility subscore | 1 | 1.13 ± 0.33 | .027c | 1.33 ± 0.5 | 1.37 ± 0.49 | .863 | 1 | 1.53 ± 0.51b | <.001d |
| Activities of daily livingsubscore | 1.05 ± 0.23 | 1.25 ± 0.44 | .027c | 2a | 2.16 ± 0.60a | .443 | 1.16 ± 0.37 | 1.47 ± 0.69b | .033c |
| Care subscore | 1 | 1.0 ± 0.12 | .985 | 1.78 ± 0.44ª | 1.53 ± 0.5a | .218 | 1b | 1.02 ± 0.11b | .918 |
| Pain subscore | 1.11 ± 0.32 | 1.21 ± 0.41 | .319 | 1.78 ± 0.44a | 1.84 ± 0.37 | .692 | 1.27 ± 0.45 | 1.53 ± 0.84b | .142 |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Anxiety/depression subscore | 1.24 ± 0.43 | 1.67 ± 0.63 | .003c | 1.11 ± 0.33 | 1.53 ± 0.51ª | .036c | 1.24 ± 0.43 | 1.63 ± 0.49 | .004c |
| VAS score | 84.59 ± 16.8 | 65.42 ± 25.9 | .001c | 83.33 ± 12.2 | 53.1 ± 17.01 | <.001d | 84.32 ± 16.7 | 74.21 ± 18.8b | .045c |

Abbreviations: HAD, Hospital Anxiety and Depression Index; SD, standard deviation.

Data expressed as mean ± standard deviation or percentage.

a Significant changes within group from admission to discharge (p<.05).

b Significant changes within group from discharge to follow up (p<.05).

c p<.05

d p<.001

Figure



**CONSORT 2010 Flow Diagram**

**Allocation**

Less active group (n=43)

* Incomplete evaluation (n=4)

Active group (n=44)

* Incomplete evaluation

(n=6)

Excluded (n=11)

* Unable to regain independent walking (n=5)
* Not wearing the activity monitor as required (n=6)

Assessed for eligibility (n=98)

Analysed (n=34)

Analysed (n=38)

Lost to follow-up (incomplete evaluation) (n=1)

Lost to follow-up (incomplete evaluation) (n=4)

**Follow-Up**

**Enrollment**

**Analysis**