Effects of Short-Term Educational Hospitalization with Multidisciplinary Approach for Lymphedema on Limb Circumference and Quality of Life

Atomura, Daisuke
Inoue, Junichiro
Okumura, Maho
Sakakibara, Shunsuke

(Citation)
Lymphatic Research and Biology,22(6):285-290

(Issue Date)
2024-12

(Resource Type)
journal article

(Version)
Accepted Manuscript

(1) Title of the article

Effects of Short-Term Educational Hospitalization with Multidisciplinary Approach for Lymphedema on Limb Circumference and Quality of Life

(2) All contributing authors

Daisuke Atomura MD[1,2], Junichiro Inoue MD, PhD[3], Maho Okumura PT, MS[3], Shunsuke Sakakibara MD, PhD[2]

(3) All contributing author affiliations

[1]Department of Plastic Surgery, Kobe University Hospital International Clinical Cancer Research Center, 1-5-1, Minatojimaminamimachi, Chuo-ku, Kobe 650-0047, Japan

[2]Department of Plastic Surgery, Kobe University Graduate School of Medicine, 7-5-2, Kusunokicho, Chuo-ku, Kobe 650-0017, Japan

[3]Division of Rehabilitation Medicine, Kobe University Hospital International Clinical Cancer Research Center, 1-5-1, Minatojimaminamimachi, Chuo-ku, Kobe 650-0047, Japan

(4) Short running title

Effects of Short-Term Educational Hospitalization

(4) Corresponding author

Name: Daisuke Atomura, MD

Address: Department of Plastic Surgery, Kobe University Hospital International Clinical Cancer Research Center, 1-5-1, Minatojimaminamimachi, Chuo-ku, Kobe 650-0047, Japan

Telephone: +81-78-302-7111

Fax: +81-78-302-7147

E-mail: datm0206@gmail.com

(5) Keywords

lymphedema, conservative therapy, hospitalization, quality of life, education

Abstract

Background: Lymphedema is an intractable disease requiring lifelong treatment. Daily self-care by the patient is essential; however, establishing care is often difficult. Our hospital offers a short-term educational hospitalization program that involves intensive, multidisciplinary intervention to develop self-care. This study aimed to evaluate the effectiveness of this program.

Methods and Results: Among the patients diagnosed with primary or secondary lymphedema who underwent educational hospitalization, 31 cases (33 limbs) were included in this study. The upper extremity lymphedema (UEL) index and lower extremity lymphedema (LEL) index was used for objective evaluation, and the Lymphedema Quality of Life Questionnaire was used for subjective evaluation. The therapeutic effects of educational hospitalization were examined before admission, at discharge, and at 6 months post-discharge. The UEL/LEL-index significantly decreased for both the upper and lower limbs after educational hospitalization. In addition, the UEL/LEL-index change rate from pre-hospitalization to 6 months post-discharge was compared between the continued and discontinued exercise groups; the former index showed significantly more improvement than the latter. Comparing the quality of life (QOL) assessments pre- and post-hospitalization, statistically significant improvements were observed in all categories, including function, appearance, symptoms, and psychological state.

Conclusions: Short-term educational hospitalization led to a sustained reduction in the circumference of lymphedema-affected limbs and an improvement in the QOL. The multidisciplinary approach resulted in improved self-efficacy and established daily self-care.

Introduction

Primary or secondary lymphedema following malignant tumor treatment is an intractable disease characterized by fluid and protein accumulation in the interstitial spaces of the upper and lower limbs, causing physical distress, such as heaviness, mental stress, and cellulitis. No curative treatment has existed for lymphedema, and once it develops, complete recovery is impossible, and patients must live with the condition for the rest of their lives. Treatment for lymphedema is mainly conservative, aimed at maintaining the current condition, and complex decongestive therapy (CDT) combines compression therapy using elastic garments, exercise therapy under compression, manual lymphatic drainage, and skincare.[1] Daily self-care by the patient is essential to accomplish these CDTs. However, adherence is insufficient because learning the techniques is a burden and not easily established.[2] Studies on self-care adherence have reported attempts to improve adherence, such as self-recording. Still, the effects should be increased, with adherence level being low at around 40%–50%.[3–5] It is difficult to increase patients' motivation. To improve self-care adherence, patient education and comprehensive support should be provided through multidisciplinary collaboration and encourage patients' self-efficacy.[6] Although several reports focused on factors affecting self-care adherence, only a few have tried to promote adherence. Our hospital provides a short-term lymphedema educational hospitalization program that involves intensive, multidisciplinary intervention for patients who have difficulty establishing self-care during outpatient visits, aiming to improve self-care and self-efficacy. In this study, objective and subjective evaluations were conducted before and after educational hospitalization to evaluate the effectiveness of this hospitalization.

Materials and Methods

Patients

The patients originally received compression therapy using their compression garments and simple lymphedema guidance, and educational hospitalization was performed for those who wanted to review their self-care or further enhance it. Among patients who underwent educational hospitalization treatment diagnosed with primary or secondary lymphedema between July 2021 and March 2024, those who were ≥20 years old and could be followed up for at least 6 months post-discharge were eligible in this study. The exclusion criteria are as follows: (1) patients with active cancer; (2) edema other than lymphedema, such as lipedema, chronic venous insufficiency, heart or renal failure, and vein thrombosis; (3) symptoms/signs of infection in the affected limb; (4) patients who are unable to perform accurate questionnaire evaluations due to mental illness; (5) patients with severe physical disabilities that interfere with daily life; and (6) patients who underwent lymphatic surgical treatment, such as lymphovenous anastomosis.

This study was approved by the Institutional Ethics Committee of the Kobe University Graduate School of Medicine (B230016-I), and all participants provided written informed consent and agreed to the scientific use of their data.

Intervention

Educational hospitalization was conducted for 4 or 9 days, depending on the patient's request, and consisted of exercise therapy, nutritional guidance, compression garments, and skin care guidance. Patients brought their compression garments to the hospital. Before admission, the affected limb was measured, and the compression garment was ensured to have the appropriate compression pressure for the patient. During hospitalization, the patient underwent exercise therapy twice a day for 60 min each while wearing a compression garment according to the guidance of a physical therapist. The patients performed shoulder rotation and elevation exercises for the upper limbs, and flexion/extension exercises for the

105 elbows and wrist joints. For the lower limbs, the patients performed flexion/extension
106 exercises for the hip and knee joints, as well as squat and calf raises. Aerobic exercises were
107 performed using a treadmill or ergometer as appropriate. A nutritionist provided nutritional
108 guidance and reviewed the patient's diet to reduce fat, improve lymph flow, and eliminate
109 swelling. Nurses are adequately guided in wearing compression garments, providing skin
110 care, and living life post-discharge. In addition, we offered learning guidance by watching
111 original videos to acquire basic knowledge about lymphedema. In all cases, thorough
112 individual guidance was provided to the patients to ensure their understanding so they could
113 continue the treatment at home after hospitalization.
114
115 *Measurements*
116 As an objective assessment of the treatment effect, we compared the upper extremity
117 lymphedema (UEL) index or lower extremity lymphedema (LEL) index before admission to
118 the hospital, at the time of discharge, and 6 months post-discharge.[7,8] The UEL/LEL-index is
119 calculated by taking the sum of the squares of the affected limb circumference in five areas of
120 the upper/lower extremity and dividing it by body mass index. Also, we calculated
121 UEL/LEL-index change rate at discharge and 6 months post-discharge compared with the
122 UEL/LEL-index before admission. In addition, we compared the UEL/LEL-index change rate
123 before hospitalization and 6 months post-discharge between the group who continued the
124 exercise taught during hospitalization at home and the group who did not.
125 As a subjective assessment, we compared the results of the Lymphedema Quality of Life
126 Questionnaire (LYMQOL) questionnaire before admission and 6 months post-discharge.
127 LYMQOL was proposed by Keeley et al. as a quality of life (QOL) evaluation method for
128 lymphedema consisting of four domains: function, body image/appearance, symptoms, and
129 mood, and has been translated and widely used in various countries.[9] The self-report

questionnaires consist of 23 statements for the upper limbs and 22 for the lower limbs, and each item is answered on a four-grade Likert-like scale: “Not at all; A little; Quite a bit; A lot.” “Not at all” indicates a high QOL, and “a lot” indicates a low QOL.[10]

Statistical analysis

Descriptive statistics was determined as means ± standard deviation for continuous variables, median (interquartile range 25%–75%) for discrete variables, and number (n) and percentage (%) for qualitative variables. Student’s t-test or Wilcoxon signed-rank test was used to analyze quantitative variables such as UEL/LEL-index depending on the Gaussian distribution. Fisher’s exact test was used to analyze the qualitative variables of LYMQOL. P-values of less than 0.05 were used to denote statistical significance. All statistical analyses were performed using EZR (Saitama Medical Center, Jichi Medical University, Saitama, Japan), a graphical user interface for R (The R Foundation for Statistical Computing, Vienna, Austria, version 4.20). More precisely, it is a modified version of R Commander (version 4.20) designed to add statistical functions frequently used in biostatistics.[11]

Results

A total of 33 limbs of 31 patients were included in the analysis. The demographic profiles and clinical characteristics of patients are shown in Table 1. The median age of the patients was 68 (60–74) years, and all were female. There were 15 upper and 18 lower limbs; two were primary, and 31 were secondary lymphedema. The median duration of lymphedema was 62 (44–91) months. Regarding the severity of lymphedema classified according to the stages of the International Society of Lymphedema, there were no cases of stage I, 11 limbs of stage IIA, 21 limbs of stage IIB, and one limb of stage III.

Figure 1 shows the changes in UEL/LEL-index for the upper and lower limbs before

admission, at discharge, and at 6 months post-discharge. The median upper limb UEL-index was 127.0 (113.5–129.7) before admission, 112.0 (103.7–122.0) at discharge, and 116.3 (111.3–125.1) at 6 months post-discharge, and the median lower limb LEL-index was 260.1 (241.6–284.1) before admission, 238.8 (224.4–261.4) at discharge, and 236.9 (226.9–253.4) at 6 months post-discharge. There was a significant decrease in the circumference of both the upper and lower limbs after the educational hospitalization, and the decreasing effect continued even 6 months post-discharge. Compared with the UEL/LEL-index before admission, the change rate was significantly decreased at discharge and at 6 months post-discharge (Fig. 2).

6 months post-discharge, 20 patients (65%) continued to exercise as instructed during hospitalization at home, and 11 patients (35%) did not. Figure 3 shows the UEL/LEL-index change rate from pre-hospitalization to 6 months post-discharge between the continued and discontinued exercise groups. In both groups, the UEL/LEL-index decreased in most cases from pre-hospitalization to 6 months post-discharge. The average rate of change for the continued exercise group was -7.92 ± 5.74, while for the discontinued exercise group, it was -2.68 ± 5.40; the UEL/LEL-index in the continuous exercise group showed a significant improvement compared to the discontinued exercise group.

Figure 4 compares LYMQOL, which summarizes the results of function, appearance, symptoms, and mood pre-hospitalization and 6 months post-discharge for all cases. Improvements in QOL were observed in all categories and were statistically significant. There were 132 LYMQOL responses for all patients of which 83 (63%) showed improvement before and after the educational hospitalization, 26 (20%) showed no change, and 23 (17%) showed worsening. Improvements in QOL were observed in many cases, with showing improvement of 1–2 scales within each item.

Discussion

Various treatments have been reported for treating lymphedema, and CDT is considered the most effective.[12,13] CDT is useful because it improves patients' function and QOL, and patients themselves actively carry out CDT, so daily self-care is essential. However, more than adherence to self-care is required due to the burden of learning complex procedures and the lack of time in daily life.[2,14] Ridner et al. suggested that less than half of breast cancer survivors with lymphedema perform self-care as directed, and effective lymphedema self-care is necessary to achieve satisfactory health outcomes.[15] Greater self-care adherence was associated with lymphedema controllability, self-efficacy, perceived consequences, and more excellent knowledge; in particular, self-efficacy is said to have a highly positive effect on self-care.[4,16,17] In our educational hospitalization, patients experienced an immediate reduction of limb circumference after exercise, giving them a sense of self-efficacy. In addition, a multidisciplinary approach was taken during hospitalization, and patients learned CDT from medical professionals, helping them solidify their knowledge. This was a reasonable approach to improving adherence to self-care.

There have been several reports of inpatient conservative treatment for lymphedema, but these have required relatively extended hospital stays. Previous reports have shown that a three-week inpatient rehabilitation program improved vitality, mental health, emotional well-being, and interpersonal sensitivity and that an average of 17.0 days of conservative inpatient treatment positively affected the psychological status.[18,19] These results indicate that lymphedema improved after a relatively long period of hospitalization and can be attributed to good adherence to the treatment. However, the medical burden associated with inpatient treatment for lymphedema has become a problem.[20,21] The costs of conservative treatment are a concern, and lymphedema-related hospitalizations are a significant burden to the healthcare system, so long educational hospitalizations may be a waste of medical expenses.[22,23] A short

205 educational hospitalization, as in our treatment, can provide affordable and sufficient
206 self-care skills; it can reduce the frequency of future cellulitis and decrease the frequency of
207 outpatient and inpatient treatment, benefiting the health economy.
208 In recent years, advances in cancer treatment have improved prognosis, and the number of
209 cancer survivors has increased, leading to a new era in which QOL after cancer treatment is
210 increasingly important. Lymphedema is a significant disturbance to the QOL of cancer
211 survivors, and if the care and control of edema are not effective, the patient's QOL will be
212 significantly impaired. When treating lymphedema, the patient's condition should be
213 appropriately evaluated, including their QOL. Patient-reported outcome measures are
214 considered essential for evaluating the QOL of lymphedema, and LYMQOL, Lymphedema
215 Quality of Life Inventory, and Lymphoedema Functioning, Disability and Health
216 questionnaire have been reported.[9,24,25] The LYMQOL was developed in the United Kingdom
217 to evaluate the QOL of patients with lymphedema of both the upper and lower limbs. It is
218 highly correlated with the European Organization for Research and Treatment of Cancer
219 Quality of Life Questionnaire Core 30 (EORTC QLQ-C30), translated into other languages,
220 and is used worldwide.[26] After educational hospitalization, even 6 months post-discharge,
221 QOL often showed improvement in all four categories: function, body image/appearance,
222 symptoms, and mood, with 63% of responses indicating at least one level of improvement in
223 each item within each category. Hara et al. reported that conservative inpatient treatment for
224 lymphedema helped elevate patients' mood by the fifth day of hospitalization despite
225 stressors such as environmental changes and the introduction of compression and exercise
226 therapy.[19] This supports that short-term hospitalization positively affects the patients' mental
227 state rather than negatively. We believe that acquiring knowledge through educational
228 hospitalization and the multidisciplinary approach led to a change in awareness of
229 lymphedema care and a desire to engage in self-care, which positively affected the patient's

QOL.

When comparing the UEL/LEL-index change rate before and 6 months after educational hospitalization, the continued exercise group showed significant improvement compared to the discontinued exercise group. 65% of the overall patients continued to exercise, which was disappointing. However, this study defined continued exercise as continuing what was instructed at our hospital. Because some patients did their strength training and went to the gym, the number of patients who continued to exercise is thought to be higher. Water percentages in the local tissue decrease immediately after compression bandage with exercise, so previous reports have shown that exercise effectively reduces limb and fluid volume.[27,28] The evidence has been established regarding the effect of exercise, so patients should be diligent in engaging in exercise as part of self-care. For patients who cannot perform continuous exercise after educational hospitalization, ways to encourage them to continue exercising should be considered. This study relied on self-reported data on exercise adherence; thus, by incorporating more objective measurement methods, such as activity tracking devices, in future studies may improve the accuracy of such assessments and lead to increased exercise adherence.

This study was conducted at a single institution with a sample size of 31 patients (33 limbs). Thus, multi-center studies or larger sample sizes would help increase the statistical power and generalizability of our findings. Moreover, extending the follow-up period to assess the sustainability of self-care practices and treatment effects would provide more comprehensive insights.

Conclusions

This study revealed that short-term educational hospitalization led to a sustained reduction in the circumference of lymphedema-affected limbs and improved QOL. Enhancing

255 self-efficacy through a multidisciplinary approach during educational hospitalization led to
256 the establishment of daily self-care, improving subjective and objective evaluations. Even
257 short-term educational hospitalization can produce satisfactory results and will contribute to
258 reducing medical costs and savings to the health care system. We want to conduct further
259 follow-up research and examine the medium- to long-term effects.
260

Authors' Contributions

Writing article and statistical analysis: D.A. Data collection and conceptualization: J.I. and M.O. Revision of the article: S.S.

Author Disclosure Statement

No competing financial interests exist.

Funding Information

No funding was received for this article.

References

1. Executive Committee of the International Society of Lymphology. The diagnosis and treatment of peripheral lymphedema: 2020 Consensus Document of the International Society of Lymphology. Lymphology 2020;53(1):3-19.

2. Ridner SH, Fu MR, Wanchai A, et al. Self-management of lymphedema: a systematic review of the literature from 2004 to 2011. Nurs Res 2012;61(4):291-299; doi: 10.1097/NNR.0b013e31824f82b2

3. Ostby PL, Armer JM. Complexities of adherence and post-cancer lymphedema management. J Pers Med 2015;5(4):370-388; doi: 10.3390/jpm5040370

4. Sherman KA, Koelmeyer L. Psychosocial predictors of adherence to lymphedema risk minimization guidelines among women with breast cancer. Psychooncology 2013;22(5):1120-1126; doi: 10.1002/pon.3111

5. Ridner SH, Dietrich MS, Kidd N. Breast cancer treatment-related lymphedema self-care: education, practices, symptoms, and quality of life. Support Care Cancer 2011;19(5):631-637; doi: 10.1007/s00520-010-0870-5

6. Sherman KA, Miller SM, Roussi P, et al. Factors predicting adherence to risk management behaviors of women at increased risk for developing lymphedema. Support Care Cancer 2015;23(1):61-69; doi: 10.1007/s00520-014-2321-1

7. Yamamoto T, Matsuda N, Todokoro T, et al. Lower extremity lymphedema index: a simple method for severity evaluation of lower extremity lymphedema. Ann Plast Surg 2011;67(6):637-640; doi: 10.1097/SAP.0b013e318208fd75

8. Yamamoto T, Yamamoto N, Hara H, et al. Upper extremity lymphedema index: a simple method for severity evaluation of upper extremity lymphedema. Ann Plast Surg 2013;70(1):47-49; doi: 10.1097/SAP.0b013e3182275d23

9. Keeley V, Crooks S, Locke J, et al. A quality of life measure for limb Lyphoedema

(LYMQOL). J Lymphoedema 2010;5(1):26-37.

10. Wedin M, Fredrikson M, Ahlner E, et al. Validation of the Lymphoedema Quality of Life Questionnaire (LYMQOL) in Swedish cancer patients. Acta Oncol 2020;59(3):365-371; doi: 10.1080/0284186X.2019.1701199.

11. Kanda Y. Investigation of the freely available easy-to-use software 'EZR' for medical statistics. Bone Marrow Transplant 2013;48(3):452-458; doi: 10.1038/bmt.2012.244

12. Bergmann A, Baiocchi JMT, de Andrade MFC. Conservative treatment of lymphedema: the state of the art. J Vasc Bras 2021;20:e20200091; doi: 10.1590/1677-5449.200091

13. Brandão ML, Soares HPDS, Andrade MDA, et al. Efficacy of complex decongestive therapy for lymphedema of the lower limbs: a systematic review. J Vasc Bras 2020;19:e20190074; doi: 10.1590/1677-5449.190074

14. Radina ME, Armer JM, Stewart BR. Making self-care a priority for women at risk of breast cancer-related lymphedema. J Fam Nurs 2014;20(2):226-249; doi: 10.1177/1074840714520716

15. Ridner SH, Shih YCT, Doersam JK, et al. A pilot randomized trial evaluating lymphedema self-measurement with bioelectrical impedance, self-care adherence, and health outcomes. Lymphat Res Biol 2014;12(4):258-266; doi: 10.1089/lrb.2014.0017

16. Alcorso J, Sherman KA, Koelmeyer L, et al. Psychosocial factors associated with adherence for self-management behaviors in women with breast cancer-related lymphedema. Support Care Cancer 2016;24(1):139-146; doi: 10.1007/s00520-015-2766-x

17. Jiang W, Chen L. Analysis of the factors and moderating role of self-care ability among patients with breast cancer-related lymphedema. J Clin Nurs 2023;32(5-6):926-940; doi: 10.1111/jocn.16495

18. Angst F, Benz T, Lehmann S, et al. Effects of inpatient rehabilitation in leg lymphedema: a naturalistic prospective cohort study with intra-individual control of effects. Arch Phys Med

322 Rehabil 2023;104(12):2035-2042; doi: 10.1016/j.apmr.2023.06.001
323 19. Hara H, Minagawa H, Mihara M. Psychological changes during inpatient conservative
324 treatment for lymphedema. Lymphat Res Biol 2024;22(1):55-59; doi: 10.1089/lrb.2022.0064
325 20. Basta MN, Fox JP, Kanchwala SK, et al. Complicated breast cancer-related lymphedema:
326 evaluating health care resource utilization and associated costs of management. Am J Surg
327 2016;211(1):133-141; doi: 10.1016/j.amjsurg.2015.06.015
328 21. Roberson ML, Strassle PD, Fasehun LO, et al. Financial burden of lymphedema
329 hospitalizations in the United States. JAMA Oncol 2021;7(4):630-632; doi:
330 10.1001/jamaoncol.2020.7891
331 22. Lopez M, Roberson ML, Strassle PD, et al. Epidemiology of lymphedema-related
332 admissions in the United States: 2012-2017. Surg Oncol 2020;35:249-253; doi:
333 10.1016/j.suronc.2020.09.005
334 23. Bian J, Shen A, Yang W, et al. Financial toxicity experienced by patients with breast
335 cancer-related lymphedema: a systematic review. Support Care Cancer 2023;31(6):354; doi:
336 10.1007/s00520-023-07800-9
337 24. De Vrieze T, Vos L, Gebruers N, et al. Revision of the lymphedema functioning, disability
338 and health questionnaire for upper limb lymphedema (lymph-ICF-UL): reliability and validity.
339 Lymphat Res Biol 2019;17(3):347-355; doi: 10.1089/lrb.2018.0025
340 25. Cornelissen AJM, Kool M, Keuter XHA, et al. Quality of life questionnaires in breast
341 cancer-related lymphedema patients: review of the literature. Lymphat Res Biol
342 2018;16(2):134-139; doi: 10.1089/lrb.2017.0046
343 26. Aaronson NK, Ahmedzai S, Bergman B, et al. The European Organization for Research
344 and Treatment of Cancer QLQ-C30: a quality-of-life instrument for use in international
345 clinical trials in oncology. J Natl Cancer Inst 1993;85(5):365-376; doi: 10.1093/jnci/85.5.365
346 27. Haspolat M, Sakızlı Erdal E, Erturk B, et al. Acute effects of manual lymphatic drainage

and compression with exercise therapy on breast lymphedema following breast-conserving surgery and radiotherapy. Lymphat Res Biol 2023;21(3):283-288; doi: 10.1089/lrb.2022.0037

28. Fukushima T, Tsuji T, Sano Y, et al. Immediate effects of active exercise with compression therapy on lower-limb lymphedema. Support Care Cancer 2017;25(8):2603-2610; doi: 10.1007/s00520-017-3671-2

TABLE 1. Patient demographic profiles and clinical characteristics

Variable	31 patients (33 limbs)
Age, years	68 (60–74)
Gender	
Female	31 (100)
Male	0 (0)
Body mass index, kg/m^2	24.1 ± 4.6
Affected limb	
Upper limb	15 (45)
Lower limb	18 (55)
Unilateral	29 (94)
Bilateral	2 (6)
Etiology	
Primary	2 (6)
Secondary	31 (94)
Lymph node dissection	29 (88)
Radiation therapy	2 (6)
Duration of edema, months	62 (44-91)
ISL stage	
I	0 (0)
IIa	11 (33)
IIb	21 (64)
III	1 (3)

Continuous data are presented as means ± standard deviations or medians (interquartile ranges); categorical data are presented as absolute and relative frequencies, N (%).

ISL, International Society of Lymphedema.

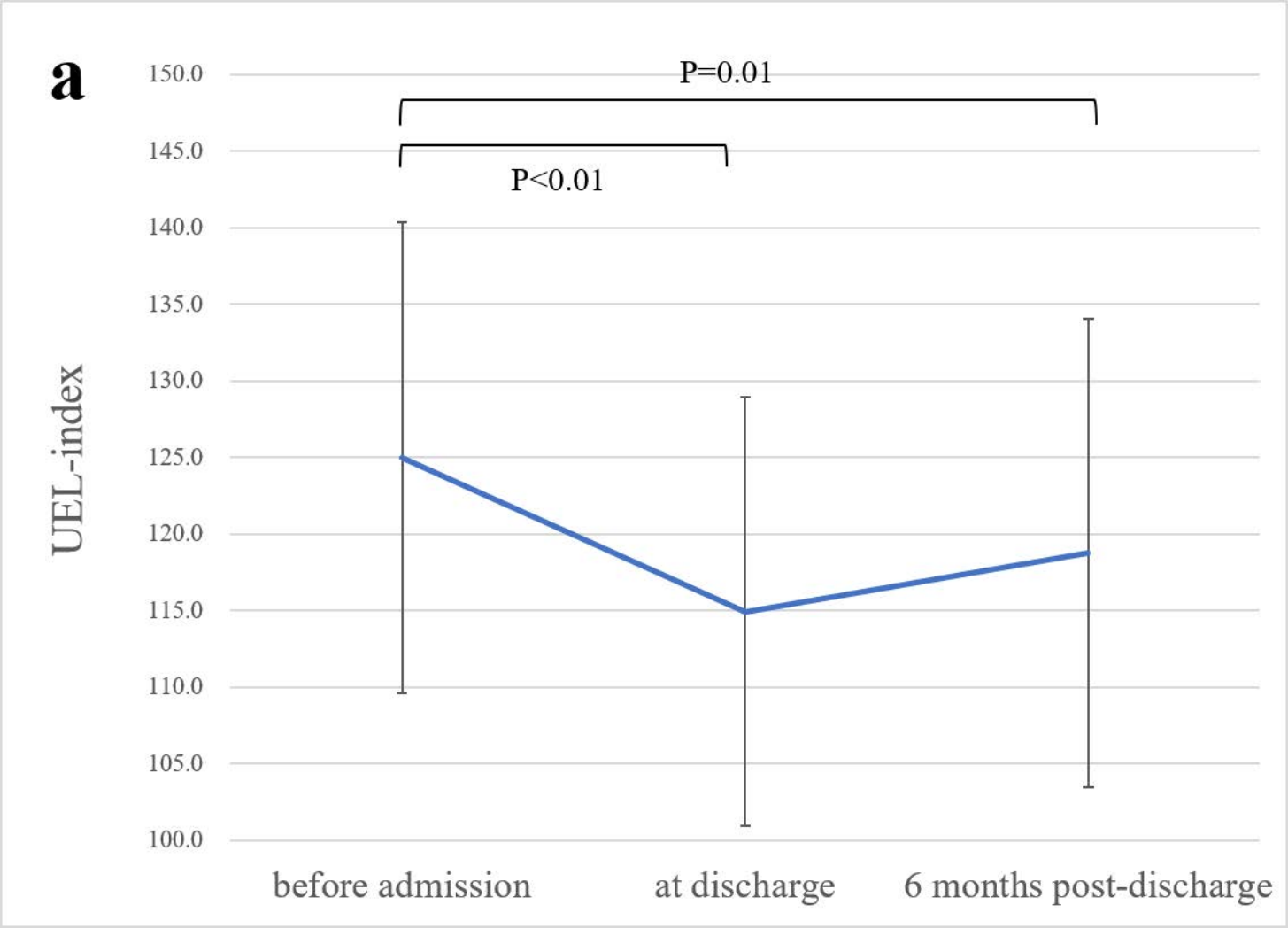
Figure legends

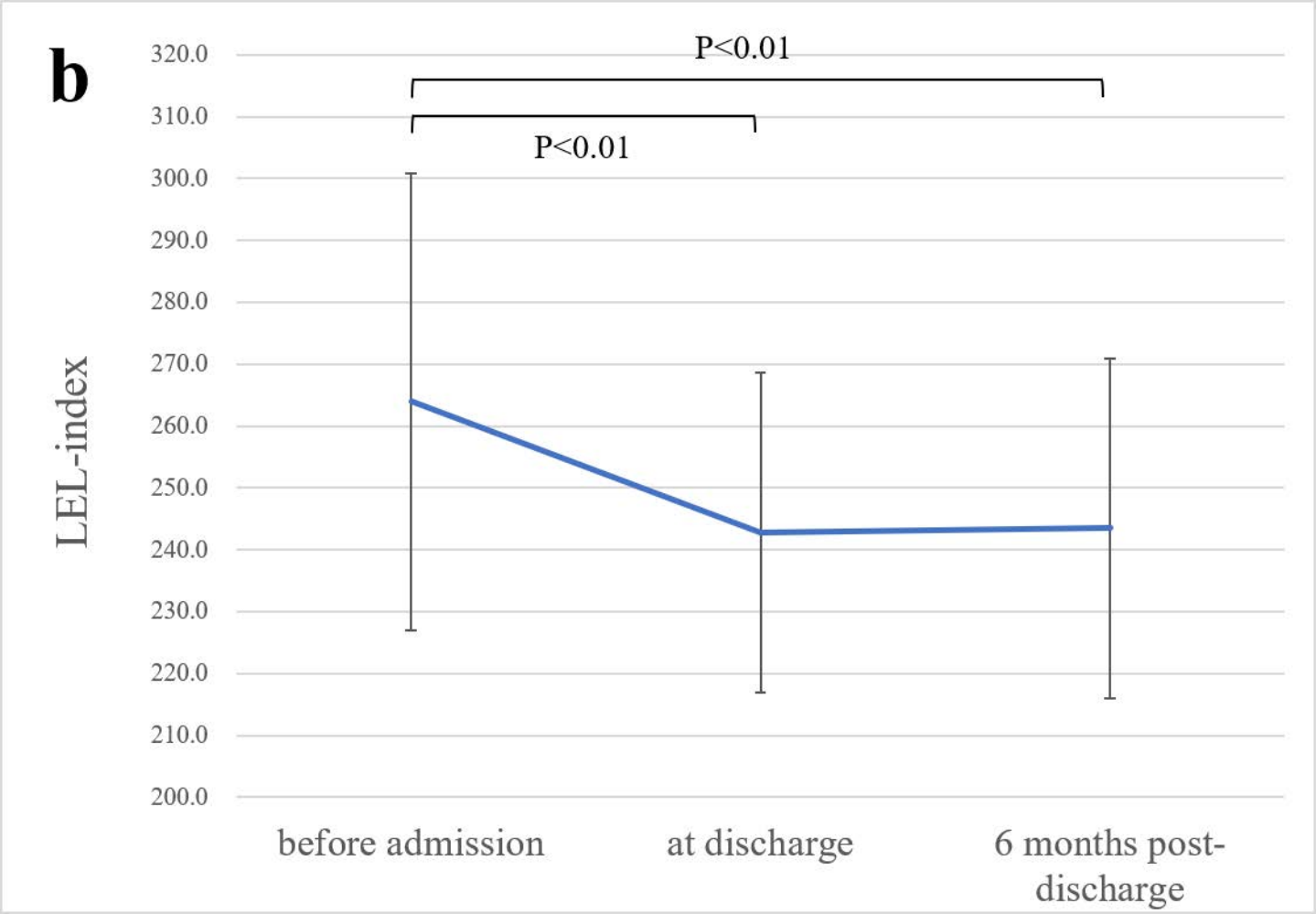
Fig. 1. Changes in (a) the upper extremity lymphedema (UEL) index for the upper limbs and (b) the lower extremity lymphedema (LEL) index for the lower limbs before admission, at the time of discharge, and 6 months post-discharge. The difference in the circumference of both the upper and lower limbs was significant post-hospitalization, and the decreasing effect continued 6 months post-discharge. UEL, upper extremity lymphedema; LEL, lower extremity lymphedema.

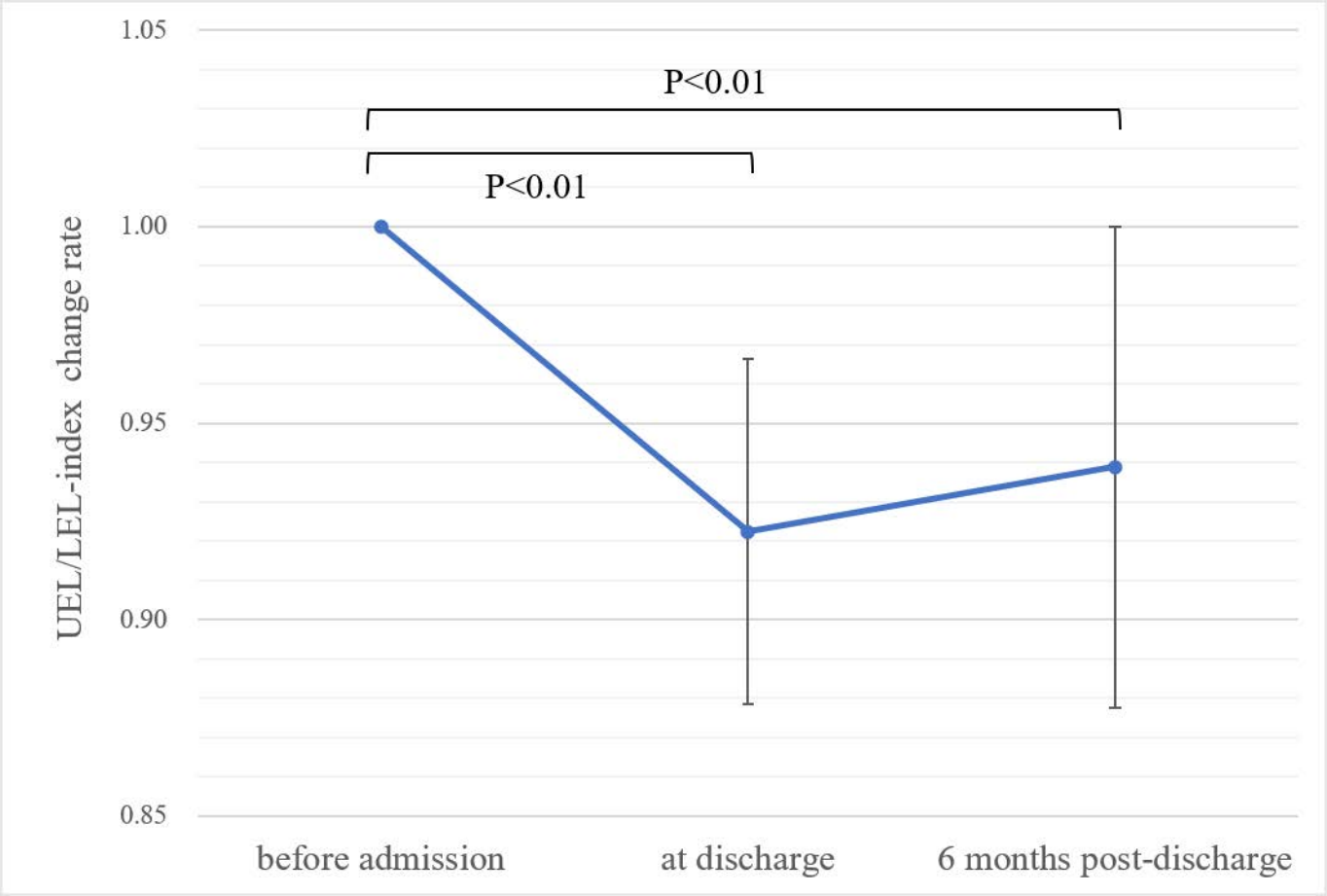
Fig. 2. The UEL/LEL index change rate before admission, at discharge, and 6 months post-discharge. Compared with the index before admission, the index's change rate significantly decreased at discharge and 6 months post-discharge.

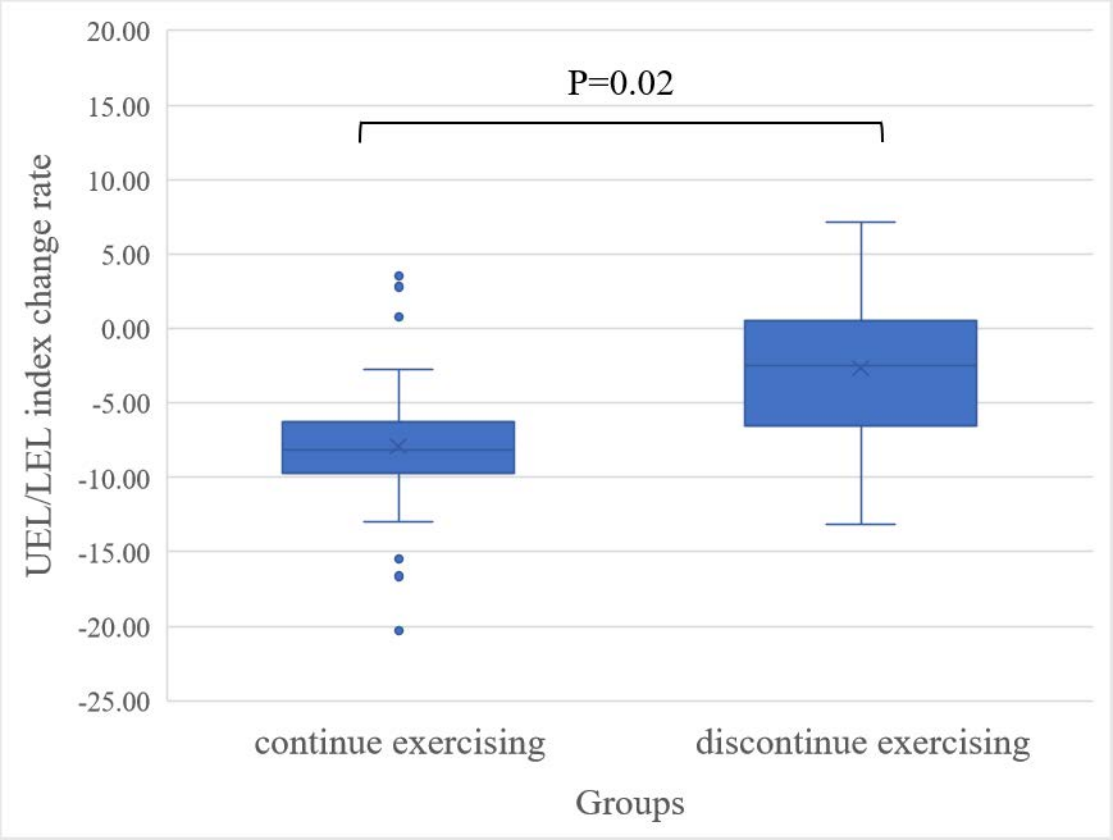
Fig. 3. The UEL/LEL index change rate from pre-hospitalization to 6 months post-discharge between the continued and discontinued exercise groups. The index in the continuous exercise group significantly improved compared with the discontinued exercise group.

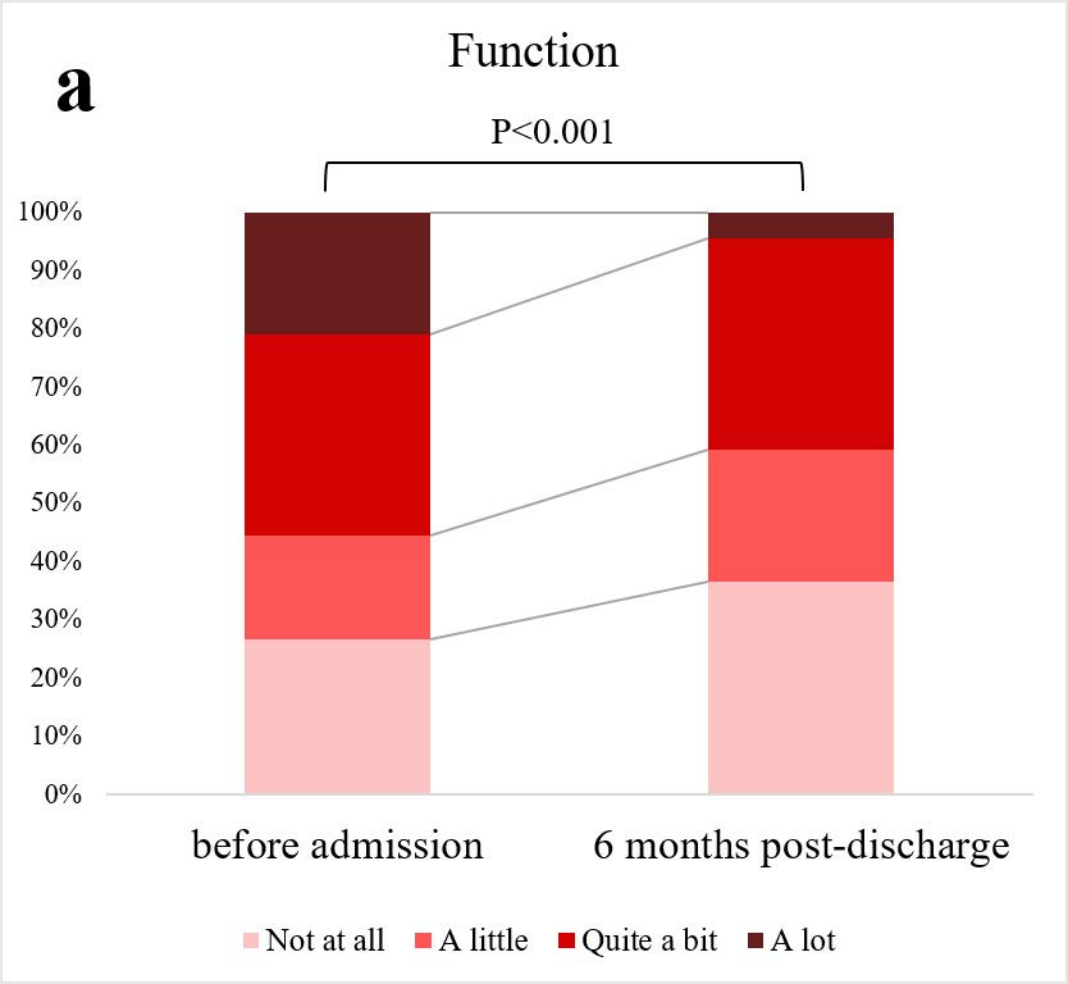
Fig. 4. Comparison of LYMQOL that summarizes the results of (a) function, (b) appearance, (c) symptoms, and (d) mood before admission and 6 months post-discharge. QOL improvement was observed in all categories and was statistically significant.

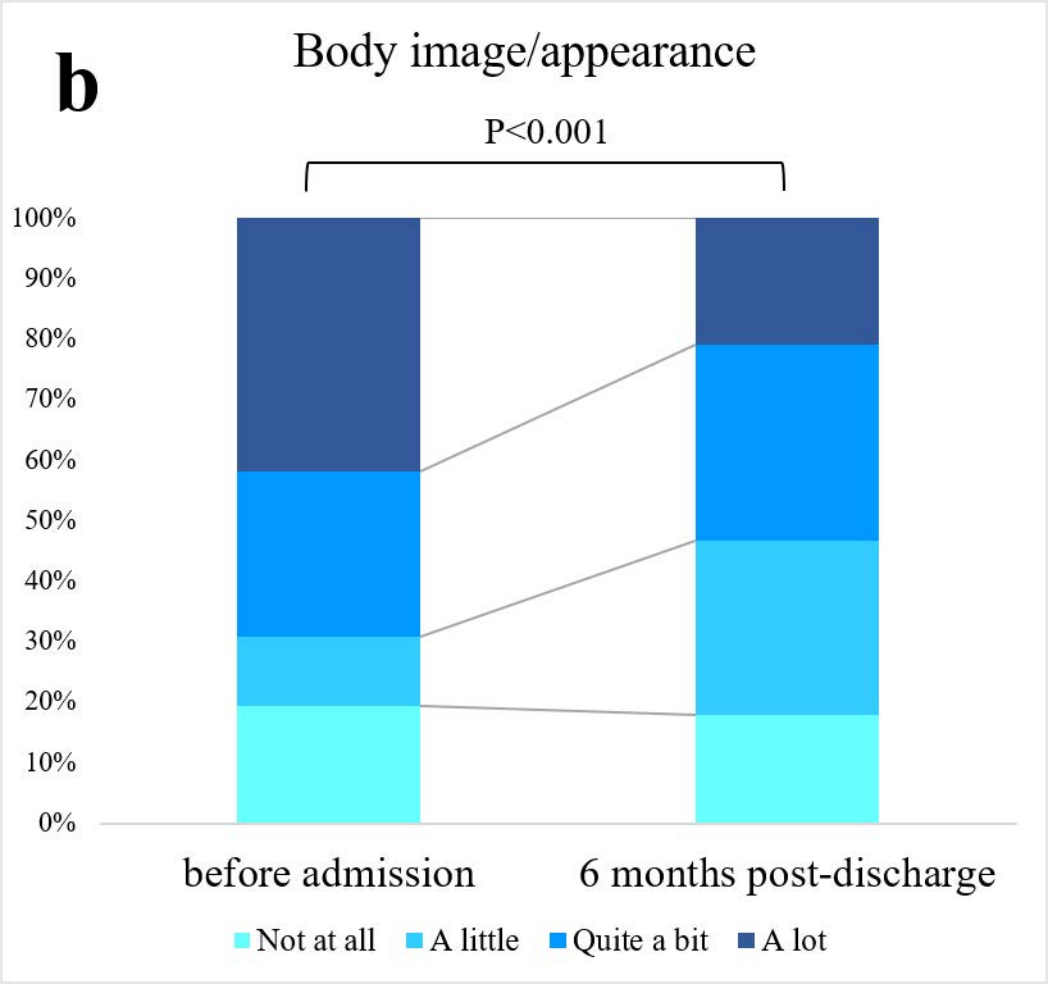

a
P=0.01
P<0.01
150.0
145.0
140.0
135.0
130.0
125.0
120.0
115.0
110.0
105.0
100.0
UEL-index
before admission
at discharge
6 months post-discharge

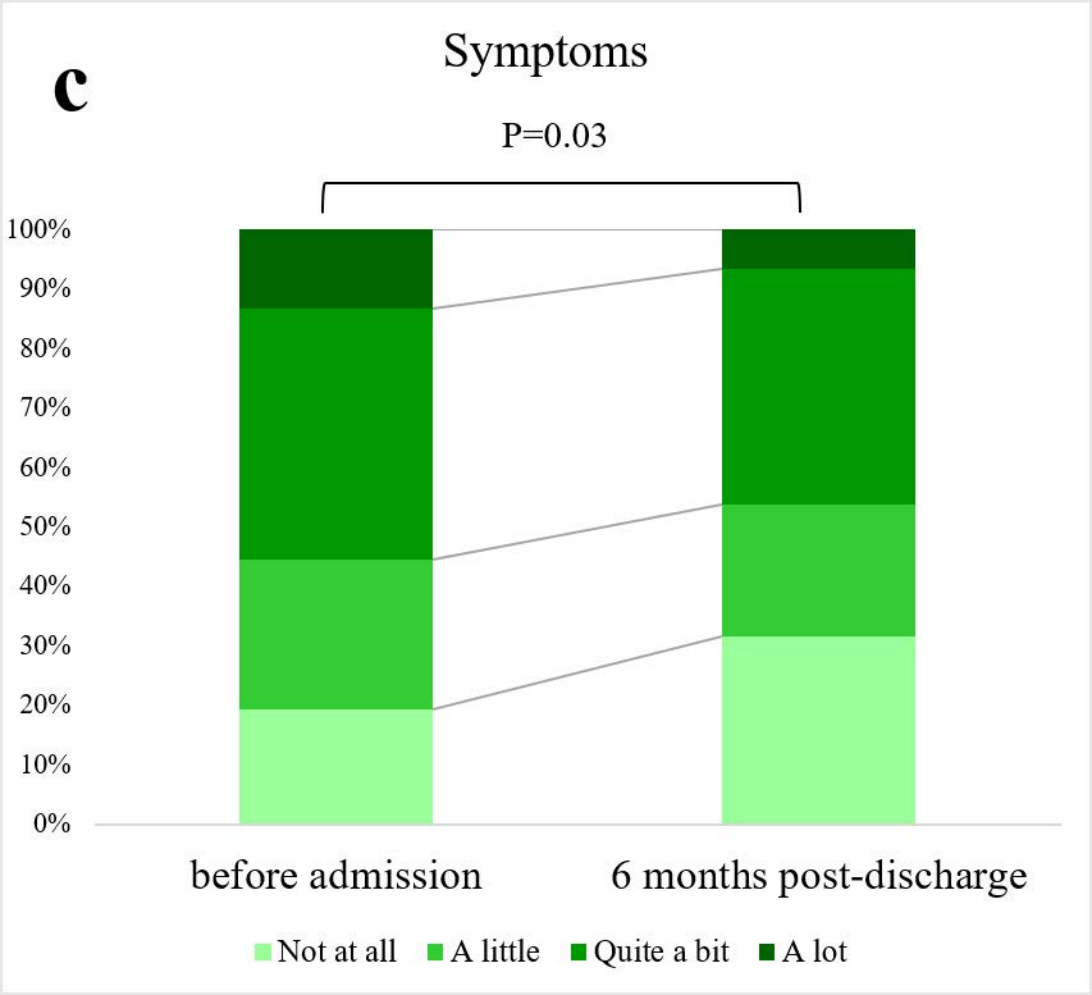

b
P<0.01
P<0.01
320.0
310.0
300.0
290.0
280.0
270.0
260.0
250.0
240.0
230.0
220.0
210.0
200.0
LEL-index
before admission
at discharge
6 months post-discharge

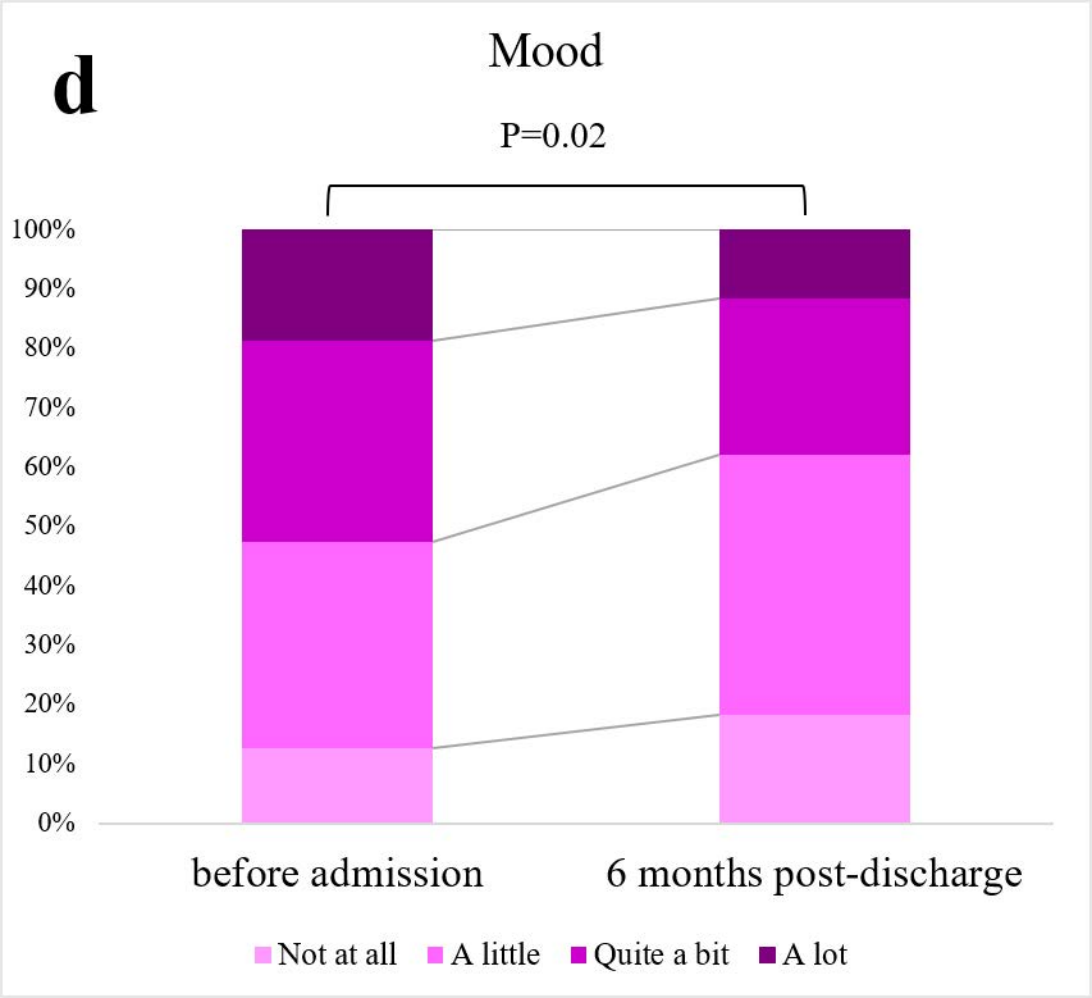

1.05
1.00
0.95
0.90
0.85
UEL/LEL-index change rate
P<0.01
P<0.01
before admission
at discharge
6 months post-discharge


20.00
15.00
10.00
5.00
0.00
-5.00
-10.00
-15.00
-20.00
-25.00
P=0.02
UEL/LEL index change rate
continue exercising
discontinue exercising
Groups


a
Function
P<0.001
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
before admission
6 months post-discharge
Not at all
A little
Quite a bit
A lot


b
Body image/appearance
P<0.001
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
before admission
6 months post-discharge
Not at all
A little
Quite a bit
A lot


c
Symptoms
P=0.03
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
before admission
6 months post-discharge
Not at all
A little
Quite a bit
A lot


d
Mood
P=0.02
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
before admission
6 months post-discharge
Not at all
A little
Quite a bit
A lot