

Short-term Changes in Activities of Daily Living and Physical Activity Level of Inpatients Undergoing Rehabilitation Treatment

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**Research fields: physical activity, acute rehabilitation,
muscle fatigability, cytokine,**

Introduction

The Global Recommendations on Physical Activity for Health published by the WHO in 2010 identified

“Physical Inactivity”

as the fourth leading risk factor for global mortality!!

World Health Organization. Global Recommendations on Physical Activity for Health. 2010

Physical activity and health

Increasing physical activity is essential for maintaining and promoting health and prolonging lifespan.

- Maintaining physical and cognitive functioning**
- Preventing the development of new diseases**

Water
Medical University etc.

Piercy KL, et al. JAMA. 2018.

“Rehabilitation treatment”

that the Japanese Association of Rehabilitation Medicine proposes

- ◆ **Return function,**
- ◆ **Overcome disability,**
- ◆ **Cultivate activity**

Rehabilitation Medicine Core Text 2018

Rehabilitation treatment for patients

Purpose: To improve physical functioning, activities of daily living (ADL), and increase the quality of life in patients with physical disabilities.

Types of rehabilitation treatment:

Physical therapy, occupational therapy, and speech therapy, etc.

Many inpatients were found to have low physical activity.

Baldwin C, et al. Phys Ther. 2017.

Even if the ADL temporarily improve during hospitalization for inpatients undergoing rehabilitation treatment and their physical activity does not simultaneously improve, patients may return to physical inactivity after discharge leading to decreased motor and cognitive functioning, falls, and the development or exacerbation of other illnesses.

Evaluation of physical activity and ADL

Physical activity

- the International Physical Activity Questionnaire**
- activity monitor with an internal triaxial accelerometer**

ADL

- Barthel Index (BI)**
- Functional Independence Measure (FIM), etc.**

FEEDING**0 = unable****5 = needs help cutting, spreading butter, etc.,
or requires modified diet****10 = independent****BATHING****0 = dependent****5 = independent****GROOMING****0 = needs to help with personal care****5 = independent face/hair/teeth/shaving****DRESSING****0 = dependent****5 = needs help but can do about half unaided****10 = independent****BOWELS****0 = incontinent****5 = occasional accident****10 = continent****BLADDER****0 = incontinent, or catheterized and unable to manage alone****5 = occasional accident****10 = continent****TOILET USE****0 = dependent****5 = needs some help, but can do something alone****10 = independent****TRANSFERS****0 = unable, no sitting balance****5 = major help, can sit****10 = minor help****15 = independent****MOBILITY****0 = immobile or < 50 yards****5 = wheelchair independent, including corners, > 50 yards****10 = walks with help of one person > 50 yards****15 = independent > 50 yards****STAIRS****0 = unable****5 = needs help****10 = independent**

Medical treatment in Japan

In Japan, it is both medically and financially optimal for acute phase hospitals to discharge or transfer patients as quickly as possible.

About our hospital

- Number of days spent in hospital: less than 14 days**
- Inpatient care may be continued for patients for whom intensive rehabilitation treatment is found to be effective.**

Purpose

In this system, evaluating the short-term ADL and physical activity level is vital to determine the efficacy of rehabilitation treatment.

The purpose of this study was to evaluate the changes over one week in the BI and physical activity level of inpatients undergoing rehabilitation treatment and investigate the correlations between these factors.

Methods

PARTICIPANTS: 8 inpatients undergoing intensive rehabilitation treatment at Iwate Medical University Hospital

The main causes of hospitalization

cerebral hemorrhage (n=2)

surgery for osteoarthritis of the hip (n=3)

surgery for osteoarthritis of the knee (n=2)

surgery for cervical spondylotic myelopathy (n=1)



Intensive rehabilitation treatment

All participants underwent at least two hours of rehabilitation treatment daily, including at least one hour of both physical therapy and occupational therapy.

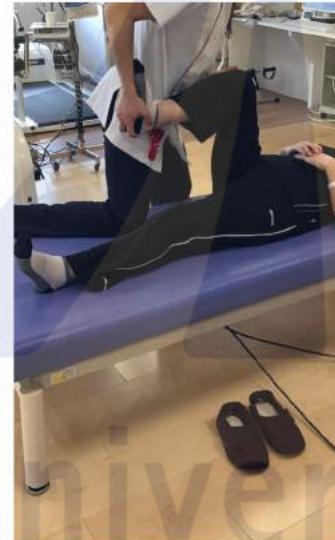
The main exercise therapies



Muscle
strengthening
exercises



Aerobic
exercise



Joint range
of motion
exercises



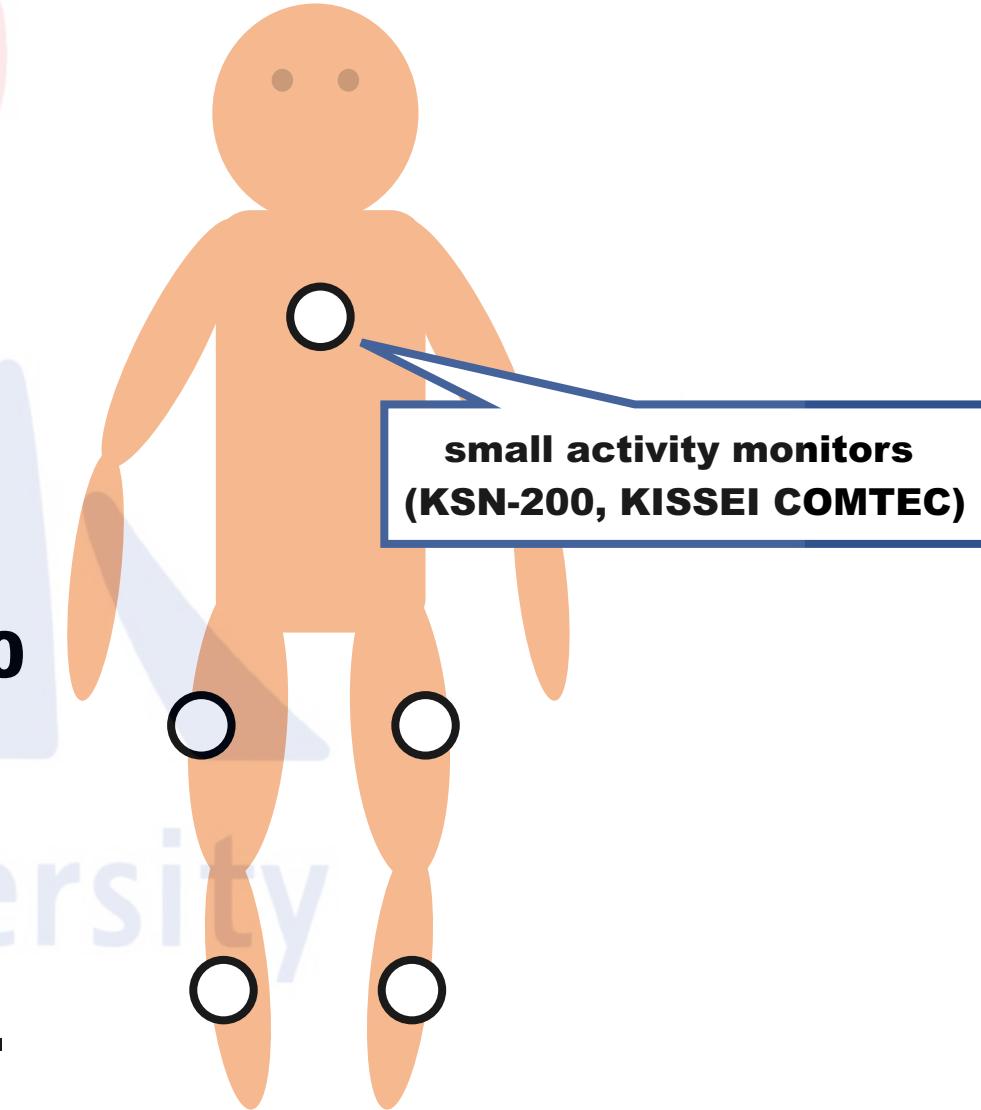
ADL training

Measurement of physical activity

□Physical activity levels were measured for all participants using small activity monitors with internal triaxial accelerometers two times with an interval of one week between the measurements.

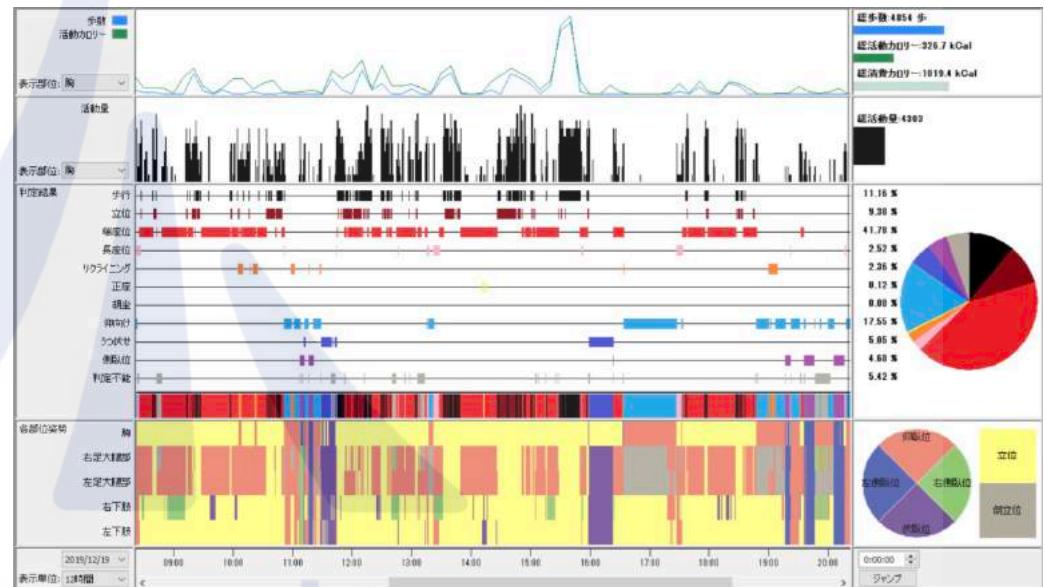
□Physical activity was measured continuously for twelve hours from 8:00 a.m. to 8:00 p.m.

□The attending physical therapist evaluated the current BI on measurement days of physical activity.



Calculation of physical activity

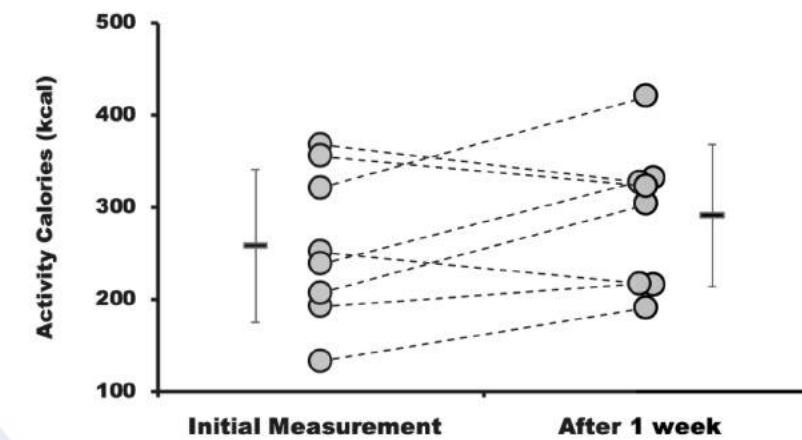
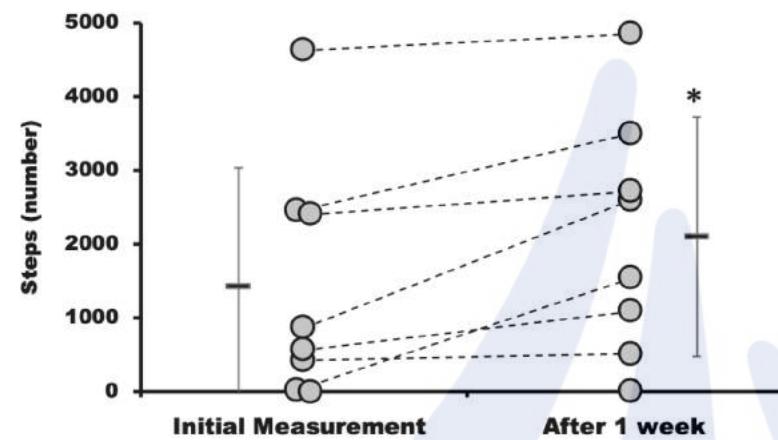
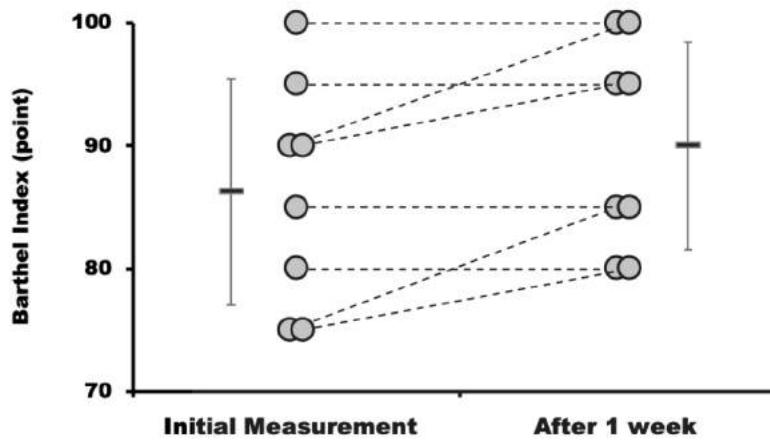
- The number of steps, activity calories, and activity type as calculated from the activity monitor were used as indicators of physical activity level.
- Concerning activity type, the eleven activities configured in the activity monitor were classified into walking, standing, sitting, or lying down, and the duration was calculated for each.



Statistical analysis

- **The differences in BI score, steps, activity calories and duration for each activity between the initial measurement and after one week was evaluated by the Wilcoxon signed-rank test.**
- **Correlations between the variability (the difference between initial measurement and measurement after one week) in physical activity and BI were analyzed by using the Spearman's rank correlation coefficient.**
- **A p-value of less than 0.05 was considered significant.**

Comparison of values at initial measurement and after one week for Barthel Index, steps, and activity calories



* $p < .05$.

- The steps increased significantly after one week compared to the initial measurement ($P = .012$).
- There was no significant difference after one week for BI score and activity calories (BI score: $P = .063$; activity calories: $P = .208$).

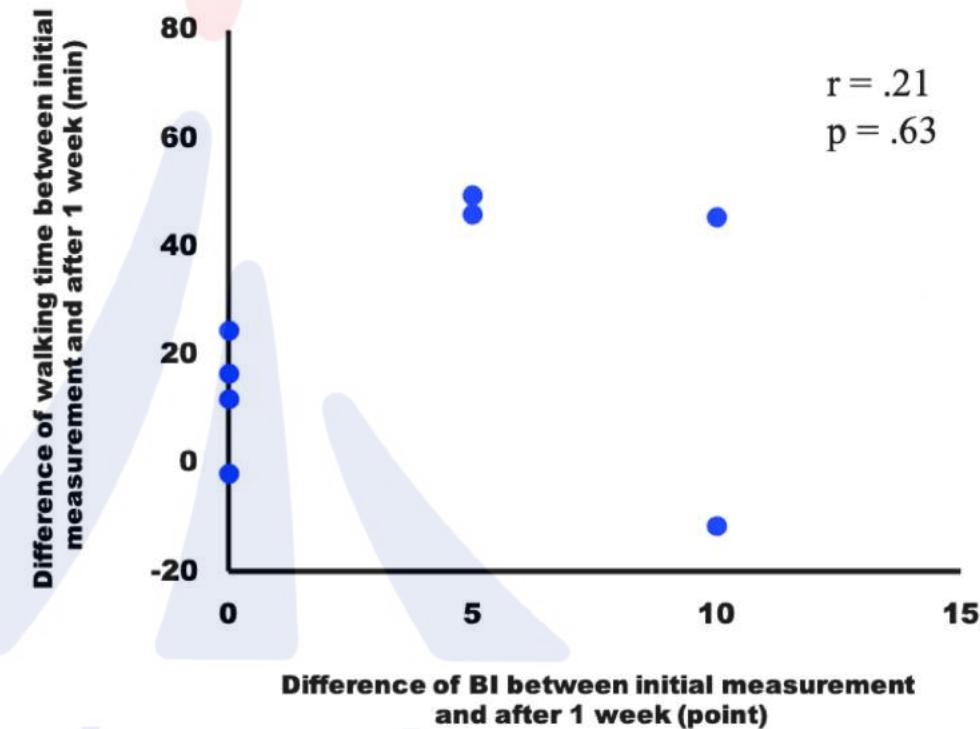
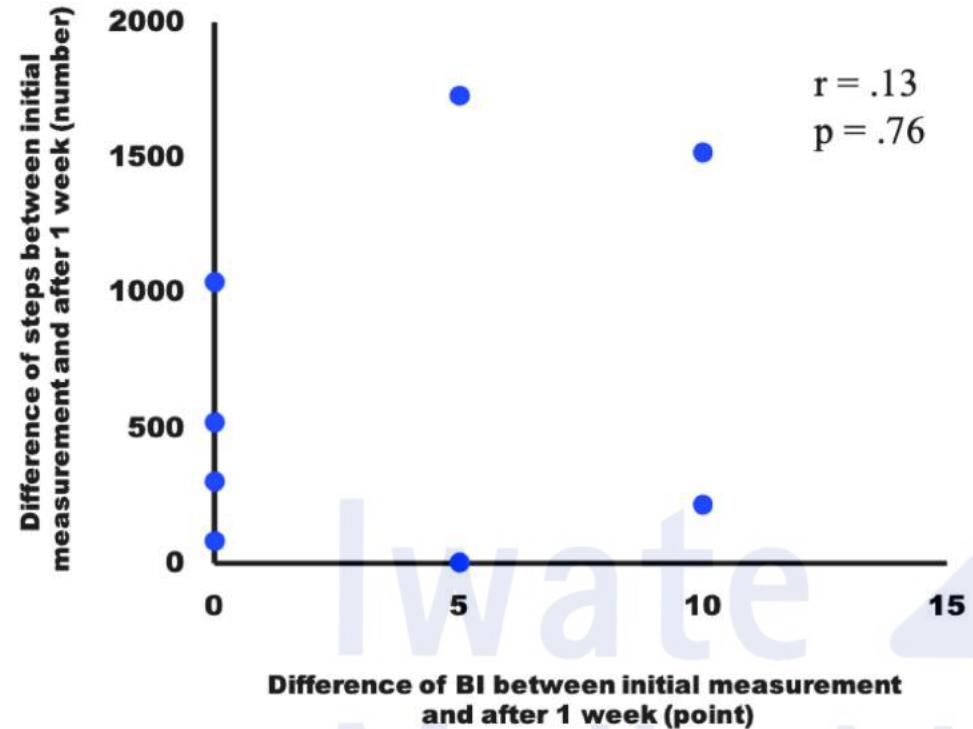
Comparison of values at initial measurement and after one week for activity durations

| | Activity Time (min) | | | | | | | |
|-----------------|---------------------|-----------|----------|----------|-----------|-----------|------------|-----------|
| | Walking | | Standing | | Sitting | | Lying down | |
| | 1st | 2nd | 1st | 2nd | 1st | 2nd | 1st | 2nd |
| no. 1 | 4 | 50 | 5 | 38 | 546 | 541 | 160 | 78 |
| no. 2 | 30 | 55 | 20 | 16 | 286 | 368 | 184 | 52 |
| no. 3 | 27 | 39 | 20 | 31 | 366 | 328 | 260 | 291 |
| no. 4 | 40 | 57 | 65 | 109 | 450 | 451 | 49 | 11 |
| no. 5 | 0 | 50 | 153 | 100 | 341 | 377 | 209 | 189 |
| no. 6 | 92 | 80 | 56 | 68 | 374 | 337 | 138 | 196 |
| no. 7 | 16 | 62 | 15 | 31 | 313 | 304 | 24 | 131 |
| no. 8 | 58 | 56 | 38 | 45 | 300 | 362 | 271 | 231 |
| mean± SD | 33± 30.2 | 56± 12.1* | 46± 47.8 | 54± 34.1 | 372± 87.3 | 383± 77.0 | 162± 90.2 | 147± 96.1 |

1st= initial measurement; 2nd = after one week; *p < .05 vs 1st.

- Walking time increased significantly after one week compared to the initial measurement ($P = .036$).
- Time spent standing, sitting, and lying down was not significantly different after one week (standing: $P = .208$; sitting: $P = .779$; lying down: $P = .575$).

Correlation of increase in steps and walking time with Barthel Index improvement



- There was no significant correlation between BI variability and variability in steps and walking time.

Discussion

The main findings

- **The both the number of steps and walking time increased over one week in inpatients undergoing intensive rehabilitation treatment.**
- **There was no significant difference in BI score between initial measurement and after one week.**
 - The best possible score of BI is 100 points, and all inpatients had got relatively high BI score at initial measurement.
 - However, 4 out of 8 inpatients showed the BI improved, and no inpatient who showed a worsened BI.
 - Also, the p value of BI between initial measurement and after one week was .063 in spite of small sample size.
 - Therefore, we assume that to increase sample size will significantly improves BI.

Health Japan 21, a strategy for health promotion from the Ministry of Health, Labor and Welfare, proposed an increase in average steps per day.

| | Current values | Target values |
|--------------------------------|-----------------------|-----------------------|
| men aged 65 and older | 5628 steps/day | 7000 steps/day |
| women aged 65 and older | 4585 steps/day | 6000 steps/day |

Source: The National Health and Nutrition Survey 2010

Miyachi M. J Phys Fitness Sports Med. 2012.

However, many studies had reported that inpatients are inactive.

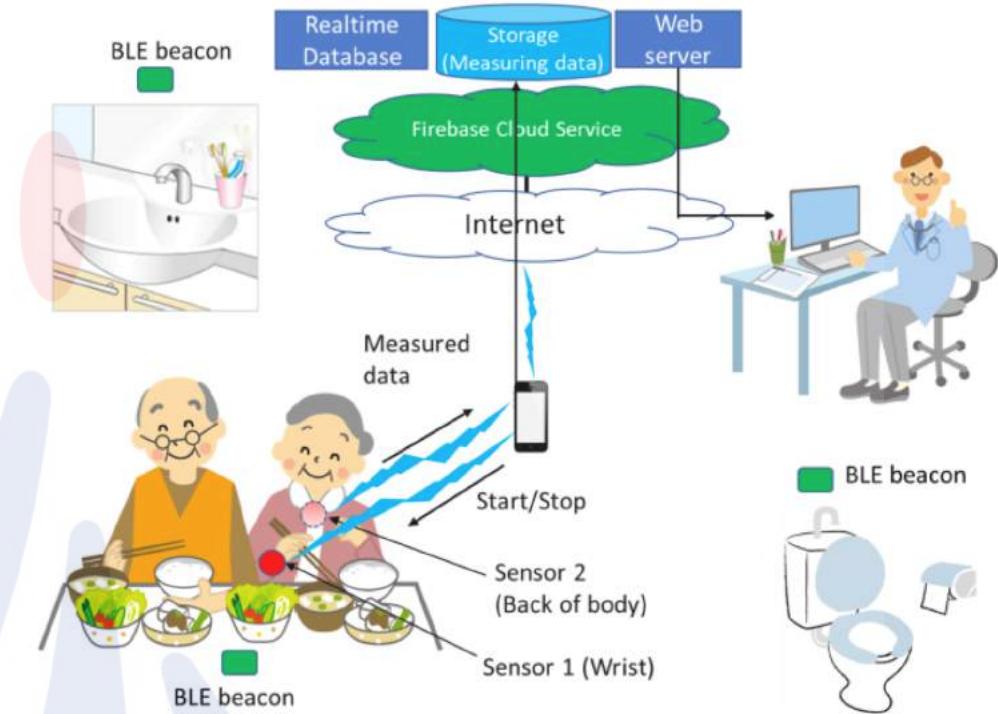
Our suggestion

- Although ADL ability improved and both steps and walking time increased over one week for inpatients in this study, BI variability and variability in steps and walking time were not correlated.
- This result suggests that improved ADL does not necessarily mean that the physical activity level will increase.
- Therefore, besides medically controlling symptoms such as pain that inhibits physical activity, strengthening muscles and cardiopulmonary function, patient education and environmental adjustments are essential approaches.

Our suggestion

- **Further, there are patients for whom ADL improves during hospitalization, but who become inactive after discharge, which leads to a decrease in ADL.**
- **Recognizing patients at risk for this and addressing it preemptively, is necessary.**
- **However, to the best of our knowledge, there are no studies that report such risk factors.**

- We reported a data collection system in which movements are analyzed using Google Firebase service and a wearable device equipped with a gyrosensor .
- Popularizing this system will lead to big data, which could potentially establish evidence of many issues from physical activity levels during hospitalization and after discharge.
- Further, existing activity monitors require professional staff and time to put on and can interfere with inpatient tests and bathing.
- As such, we believe there is a demand for a device capable of easily measuring physical activity levels.



Murata Y, Nishimura Y, Tsuboi H, et al. International Journal on Advances in Life Sciences, vol. 11, no. 3&4, 2019.

Limitations

- 1. The number of subjects was relatively small.**
- 2. Physical activity was measured only once at each measurement, however, the reliability of data is unclear.**

Conclusion and future work

- One week of inpatient intensive rehabilitation treatment increased both steps and walking time.**
- However, BI variability and variability in steps and walking time were not correlated.**
- A future study with an increased sample size divided by medical conditions is necessary.**