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Original Article

The impact of pharmacist intervention on FIM gain in patients with musculoskeletal disorders in Kaifukuki rehabilitation wards

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ABSTRACT

Fujihara H, Kishimoto M, Kose E, Shinonaga H, Tanaka E, Nakamichi M, Mizokami F. The impact of pharmacist intervention on FIM gain in patients with musculoskeletal disorders in Kaifukuki rehabilitation wards. Jpn J Compr Rehabil Sci 2025; 16: 53−59.

Objective: Currently, in Kaifukuki (convalescent) rehabilitation wards, pharmacists' services are not reimbursed under the medical fee system, which has hindered the placement of pharmacists in wards and made it difficult to fully clarify their usefulness. In this study, we classified patients with musculoskeletal disorders into groups that received active pharmacist intervention and those that did not, and evaluated the effect of pharmacist intervention on changes in ADL.

Method: This was a multicenter retrospective cohort study targeting Kaifukuki rehabilitation wards. Participating hospitals were recruited through the website of the Japanese Society of Hospital Pharmacists. The study included patients with musculoskeletal disorders who were discharged from each participating hospital between October 1 and October 31, 2022. The primary outcome measure was FIM gain, which was compared between the active and non-intensive intervention groups.

Results: Responses were received from 140 hospitals, and information was collected from 1,265 patients. After adjusting for propensity scores, 742 patients (371 in the active intervention group and 371 in the non-intensive intervention group) were included in the analysis. When comparing the FIM gains between the two groups, the active intervention group showed significantly higher values than the non-intensive intervention group.

Discussion: Pharmacist intervention in patients with musculoskeletal disorders admitted to rehabilitation wards was significantly associated with improvements in ADL. Pharmacists working in Kaifukuki rehabilitation wards should actively participate in ward activities and contribute to the appropriate use of medications for hospitalized patients, including deprescribing.

Key words: Kaifukuki rehabilitation ward, pharmacist intervention, FIM gain

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Introduction

Many patients admitted to Kaifukuki (convalescent) rehabilitation wards are older and have functional impairments, resulting in frequent polypharmacy [1]. It is also necessary to consider changes in medication not only due to shifts in pharmacotherapy from the

acute phase to the recovery phase but also based on the type of hospital to which the patient will be discharged. In recent years, concepts such as drug-induced geriatric syndromes and medication that may affect rehabilitation outcomes have been proposed [2], and the importance of drug treatment in Kaifukuki rehabilitation wards has increased. However, currently, in Kaifukuki rehabilitation wards, pharmacists' services are not reimbursed under the medical fee system, which has made it difficult to place pharmacists in wards [3,4], and their usefulness has not been fully clarified. In this study, patients with musculoskeletal disorders were classified into groups that received active intervention from pharmacists and groups that did not, and the impact of pharmacist intervention on changes in activities of daily living (ADL) was evaluated. In addition, comparisons between the groups were made regarding changes in the number of medications and adverse drug events during hospitalization.

Method

This study was based on an analysis of data collected in a survey conducted by the Academic Subcommittee of the Japanese Society of Hospital Pharmacists on the usefulness of pharmacist interventions in Kaifukuki wards.

1. Survey Method

1.1 Research design and survey period

This multicenter, retrospective cohort study targeted Kaifukuki rehabilitation wards during the recovery phase. Participating hospitals were recruited through the website of the Japanese Society of Hospital Pharmacists from September 14 to October 14, 2022. Subsequently, the Clinical Research Ethics Review Committee of the Society conducted a comprehensive review of the hospitals and confirmed their willingness to participate in the survey.

The survey was conducted using Google Forms. The survey period was from February 20 to April 14, 2023.

1.2 Patients and survey items

A survey was conducted among patients with musculoskeletal disorders who were discharged from each surveyed hospital between October 1 and October 31, 2022, and covered the items listed in Table 1. For questions related to diseases, respondents were asked to select either "cerebrovascular" or "musculoskeletal" disorders; specific disease names were not asked.

1.3 Exclusion criteria

Deaths, transfers due to sudden changes in condition, hospital stays of less than 7 days, cases deviating from the target conditions (e.g., discharge dates outside the target period), and missing data were excluded.

1.4 Scoring of effectiveness of pharmacist intervention

Based on the survey items, the patients were divided into two groups: those who received active pharmacist intervention and those who did not, using four items that indicated the effectiveness of the intervention (medication counseling, multidisciplinary conferences, consultations from other professionals, and proposals to other professionals).

The four items that indicated the effectiveness of pharmacist intervention were designed with the following in mind:

- Medication counseling: Pharmacists directly explain medications to patients and confirm adherence
- Multidisciplinary conferences: Pharmacists participate in conferences involving multiple professionals, such as physicians, nurses, rehabilitation specialists, and dietitians
- Consultations from other professionals: Specific inquiries or consultations regarding medications are received from physicians, nurses, and rehabilitation specialists, and responses (proposals or advice) are provided
- Proposals to other professionals: Pharmacists proactively provide information or make recommendations regarding medication therapy to other professionals

Table1. Survey items.

Age
Sex
Disease that led to hospitalization (cerebrovascular disease, musculoskeletal disease)
Concomitant diseases and conditions (osteoporosis, higher brain dysfunction, dementia, Parkinson's disease, epilepsy)
Admission and discharge dates
Number of medications used at admission and discharge
FIM scores at admission and discharge
Pharmacist counseling (initial consultation, discharge counseling, medication counseling)
Participation in multidisciplinary conferences
Consultations from other professions and proposals to other professions
Additions or deletions of medications during hospitalization in the rehabilitation ward, and pharmacist involvement in these
Adverse drug reactions during hospitalization in the rehabilitation ward

Regarding grouping, the total score for items I to IV was used to classify the participants into an active intervention group (5, 4 or 3 points) and a non-intensive intervention group (2 points or less).

I. Medication counseling: multiple times, 2 points; once only, 1 point; not implemented, 0 points
II. Multidisciplinary conference participation: participated, 1 point; did not participate, 0 points
III. Consultation from other professionals: received, 1 point; not received, 0 points
IV. Proposals to other professionals: proposed, 1 point; not proposed, 0 points

1.5 Setting covariates

To minimize confounding factors, the covariates for the outcome of FIM gain (FIM at discharge minus FIM at admission) were age, sex, length of hospital stay, number of medications taken at admission, FIM score at admission (motor and cognitive items), and presence of comorbidities (osteoporosis, higher brain dysfunction, dementia, Parkinson's disease, and epilepsy). Matching was performed using propensity score matching (nearest-neighbor matching with a caliper coefficient of 0.2). Variable balance was considered appropriate when the standardized mean difference (SMD) was less than 0.1. Patients with musculoskeletal disorders whose covariates were adjusted using propensity scores were included as the final subjects of this study.

2. Evaluation items

The primary evaluation item was FIM gain, which was compared between the active and non-intensive intervention groups. In addition, as a sub-analysis, changes in the number of medications at admission and discharge, and the occurrence of adverse drug events were compared between the active and non-intensive intervention groups. Furthermore, we compared the FIM gains for the four items representing the effectiveness of pharmacist intervention. Regarding changes in the number of medications, we evaluated changes based on the number of medications at two time points: admission and discharge. Based on this, we classified changes in the number of medications at admission and discharge into three groups: "decrease group," "unchanged group," and "increase group," and compared FIM gains between each group.

3. Statistical analysis

Wilcoxon's signed-rank test was used to compare continuous data between the two groups before and after propensity score adjustment, and Fisher's exact test was used to compare categorical variables.

In the subgroup analysis, Wilcoxon's signed-rank test or Fisher's exact test was used to compare the association between presence or absence of drug-related adverse events, the four items of pharmacist intervention, and FIM gain.

In addition, the Steel-Dwass test was used to compare FIM gain among the three groups based on changes in the number of medications (decreased, unchanged, or increased).

The discriminatory ability of the logistic regression model in estimating the propensity score was evaluated using a receiver operating characteristic (ROC) curve. The significance level for all tests was set at $p < 0.05$, and statistical analyses were performed using JMP® Pro version 16 (SAS Institute Inc., USA).

4. Ethical considerations

This survey was approved by the Ethics Committee of the Japanese Society of Hospital Pharmacists (approval No. 2022-01).

Results

1. Target patients

Responses were received from 140 hospitals, and information was collected from 1,265 patients.

After excluding patients who met the exclusion criteria, 1,116 patients were selected (Figure 1).

Among the 1,116 patients discharged between October 1 and October 31, 2022, 374 were excluded after classification into two groups (active intervention group and non-intensive intervention group) and adjustment for propensity scores: 14 patients in the active intervention group and 360 patients in the non-intensive intervention group.

Therefore, 742 patients (371 in the active and 371 in the non-intensive intervention groups) were included in this analysis.

2. Comparison of patient backgrounds before and after matching

Table 2 shows the patient backgrounds before and after matching using the propensity score method. Before matching, there were significant differences in the presence or absence of dementia, length of hospital stay, and number of medications at admission; however, after matching, no significant differences were found in any of these factors. The standardized differences in each variable after propensity score matching were all less than 0.1, confirming that the groups were well balanced after matching.

3. Comparison of FIM gains after matching

When comparing FIM gains after matching using the propensity score method, the active intervention group (28.80, 95% confidence interval [CI]: 26.96−30.64) showed significantly higher values than the non-intensive intervention group (25.60, 95% CI: 23.88−27.31) (Wilcoxon's signed-rank test: $p = 0.042$) (Table 3). Additionally, an evaluation of the validity of the regression model revealed that the area under the ROC curve was 0.634, which was appropriate.

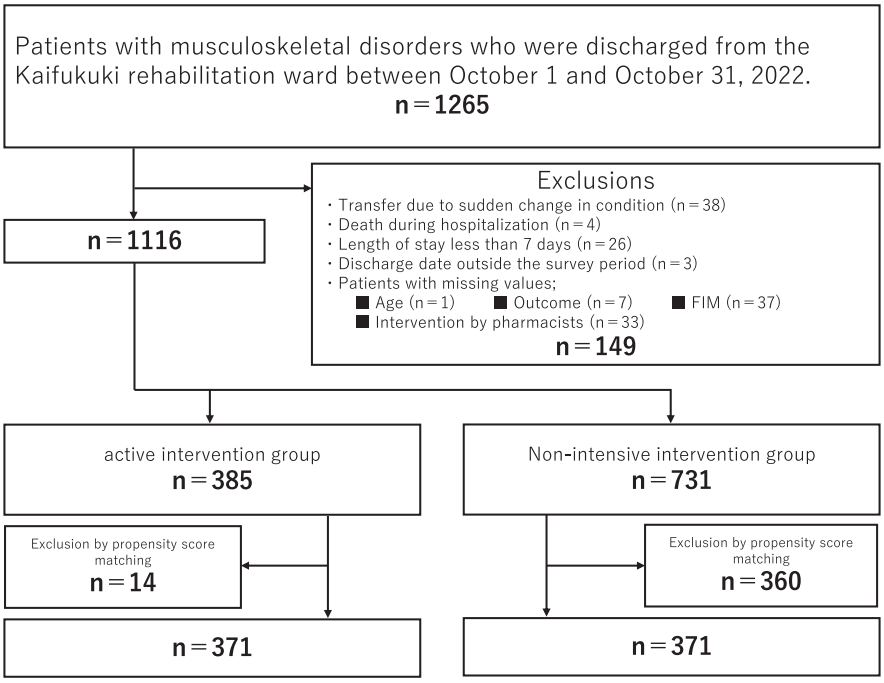

Figure 1. Flowchart of patient selection.

Table2. Comparison between the active intervention group and the non-intensive intervention group in patients with musculoskeletal disorders before and after propensity score matching.

	Overall (before propensity score matching) *n*=1,116	Active intervention group *n*=385	Non-intensive intervention group *n*=731	*p*-value	SMD	Overall (after propensity score matching) *n*=742	Active intervention group *n*=371	Non-intensive intervention group *n*=371	*p*-value	SMD
Age (years)	79.00±12.78	78.56±13.57	79.23±12.34	0.97	0.05	78.66±12.94	78.75±13.55	78.57±12.32	0.23	0.01
Sex (male: female)	300 : 814	112 : 272	188 : 542	0.23	0.08	219 : 523	107 : 264	112 : 259	0.75	0.03
Osteoporosis (yes: no)	329:787	112 : 273	217 : 514	0.89	0.01	228 : 514	111 : 260	117 : 254	0.69	0.04
Higher brain dysfunction (yes: no)	20 : 1,096	4 : 381	16 : 715	0.24	0.09	8 : 734	3 : 368	5 : 366	0.73	0.05
Dementia (yes: no)	163 : 953	42 : 343	121 : 610	0.01※	0.16	77 : 665	40 : 331	37 : 334	0.81	0.03
Parkinson's disease (yes: no)	26 : 1,090	7 : 378	19 : 712	0.53	0.05	15 : 727	7 : 364	8 : 363	1.00	0.02
Epilepsy (yes: no)	19 : 1,097	8 : 377	11 : 720	0.47	0.04	14 : 728	7 : 364	7 : 364	1.00	0.00
Length of hospital stay (days)	55.19±29.96	60.65±28.87	52.32±30.15	<0.01※	0.28	59.09±29.73	59.68±28.22	58.50±31.19	0.48	0.04
Number of medications at admission (doses)	6.68±3.64	7.00±3.66	6.51±3.62	0.04※	0.13	7.06±3.66	6.98±3.59	7.15±3.75	0.60	0.05
Total FIM (motor items) at admission	46.11±19.95	47.38±18.70	45.45±20.56	0.08	0.10	47.71±19.83	47.44±18.74	47.98±20.89	0.77	0.03
Total FIM (cognitive items) at admission	26.84±8.21	27.76±7.41	26.36±8.56	0.05	0.17	27.94±7.59	27.77±7.39	28.11±7.79	0.23	0.04

mean ± S.D.
SMD : Standardized Mean Difference

Table3. Comparison of FIM improvement between the active intervention group and the non-intensive intervention group.

	Active intervention group *n*=371	Non-intensive intervention group *n*=371	*p*-value
FIM gain (mean value (95% confidence interval))	28.80 (26.96–30.64)	25.60 (23.88–27.31)	0.042※

4. Changes in the number of medications after matching and occurrence of adverse drug events during hospitalization

A significant difference was observed in the comparison of changes in the number of medications, and a reduction in medication use due to pharmacist intervention was observed ($p < 0.01$). In addition, in terms of the occurrence of adverse drug events during hospitalization, the active intervention group had a significantly higher incidence of adverse drug events

($p < 0.01$). (Table 4)

5. Comparison of FIM gains in four items indicating the effectiveness of pharmacist intervention

In the comparison of FIM gains in the four items indicating the effectiveness of pharmacist intervention, a significant difference was observed in the presence or absence of proposals to other professionals ($p = 0.03$), but no significant differences were observed in the other items (Table 5).

6. Comparison of changes in the number of medications at admission and discharge with FIM gains

Differences in FIM gains were observed depending on changes in the number of medications during hospitalization (Table 6). In the group with an increase in the number of medications, FIM gains were significantly lower than those in the decrease and unchanged groups (comparison with the decrease group: $p = 0.013$, comparison with the unchanged group: $p = 0.008$). However, no significant difference was observed between the decrease group and unchanged group ($p = 0.999$) (Table 6).

Discussion

This study examined the impact of proactive pharmacist interventions on ADL improvement during rehabilitation. The results showed that proactive pharmacist intervention was significantly associated with ADL improvement in patients with musculoskeletal disorders admitted to the Kaifukuki rehabilitation ward.

In Kaifukuki rehabilitation wards, pharmacists' services are not reimbursed under the medical fee system, resulting in fewer pharmacists available and a limited number of reports on the usefulness of pharmacist interventions. Furthermore, previous studies were limited to single institutions or regions. However, this large-scale, multi-institutional study provides a comprehensive perspective. In addition, reports demonstrating the usefulness of pharmacists in the field of rehabilitation include multiple outcomes such as improved adherence [5], improved self-management rates [4,6], reduced readmission rates [7], reduced drug-related problems [8], and pain relief

Table4. Comparison between the active intervention group and the non-intensive intervention group for other items.

	Active intervention group *n*=371	Non-intensive intervention group *n*=371	*p*-value
Changes in the number of drugs (decrease: no change: increase)	137 : 82 : 152	95 : 151 : 125	<0.01※
Adverse events during hospitalization (yes: no)	43 : 327	10 : 360	<0.01※

Table5. Comparison of four FIM gains indicating the effectiveness of pharmacist intervention.

	Multiple times	Once	0 times	*p*-value
Pharmacist guidance (medication guidance)	28.27±17.59 (283)	26.66±17.28 (151)	26.47±17.54 (309)	0.55

	1 point	0 point	*p*-value
Participation in multidisciplinary conferences	28.43±17.71 (352)	26.08±17.26 (390)	0.08
Consultations with other professions	28.10±17.87 (289)	26.62±17.25 (453)	0.29
Proposals to other professions	28.95±18.31 (346)	25.66±16.63 (396)	0.03※

Values in parentheses indicate the number (n)

Table6. Comparison of changes in the number of medications during hospitalization and FIM gains.

Changes in the number of medications	FIM gain	Decreased group vs unchanged group	Decreased group vs increased group	Unchanged group vs increased group
Decreased group (*n*=232)	28.99±18.38			
Unchanged group (*n*=233)	28.91±17.84	0.999	0.013※	0.008※
Increased group (*n*=277)	24.25±16.07			

[9]. However, the fact that pharmacists were able to contribute to the improvement of ADL, one of the most important outcomes in Kaifukuki rehabilitation wards, is a significant contribution of this study.

As factors contributing to ADL improvement, this study showed that changes in the number of medications, particularly an increase in the number of medications, may have a negative impact on functional recovery. Previous reports have shown that reducing medication use led to improved ADL in older patients with post-stroke sarcopenia [10] and that ADL improvement was achieved through pharmacist-led interventions to reduce medication [11], highlighting the importance of optimizing the number of medications. In the present study, the group with an increase in the number of medications between admission and discharge had significantly lower FIM gains than the group with a decrease or no change in the number of medications. However, no significant difference was observed between the group with no change in the number of medications and the group with a decrease in the number of medications. These results suggest that inappropriate addition of medications may hinder functional recovery. Factors that may inhibit FIM gains due to an increase in the number of medications include the occurrence of adverse drug reactions from polypharmacy and reduced medication adherence due to an increased medication burden. Furthermore, if prescriptions are not reviewed and drugs are added indiscriminately, there is a risk of excessive drug therapy that is inappropriate for the patient's overall condition. In this study, FIM gain was significantly higher in the group where pharmacists actively intervened, suggesting that functional outcomes can be improved through optimization of medication. Pharmacists can contribute to improving the quality of rehabilitation by assessing medication use, monitoring adverse drug reactions, and making recommendations for prescriptions or supporting medication reduction as needed. Therefore, in Kaifukuki rehabilitation wards, pharmacists play an important role in optimizing medication regimens, and such interventions may contribute to functional recovery.

In addition, patients admitted to Kaifukuki rehabilitation wards have diverse backgrounds, including cerebrovascular disorders, musculoskeletal disorders, cardiovascular disorders, and disuse syndromes. However, in patients with musculoskeletal disorders, analgesics and gastric medications used during the acute phase often become unnecessary as physical function improves during the recovery. During medication reviews, proactive pharmacist interventions may help optimize medication regimens, which may positively impact ADL.

In addition, among the pharmacist intervention items, whether proposals were made to other professionals was significantly correlated with FIM gains. This suggests that pharmacist proposals to other professionals, such as physicians, nurses, and rehabilitation specialists, regarding medication adjustments based on medication information and clinical progress obtained by pharmacists may contribute to functional improvement in patients. However, no significant differences were observed in other intervention items, including pharmacist medication guidance, participation in multidisciplinary conferences, and consultations from other healthcare professionals. These findings suggest that the proactive engagement of pharmacists in making proposals to other healthcare professionals may play a particularly important role in improving patient outcomes. Further research focusing on the qualitative aspects of pharmacist involvement is necessary.

In contrast, a significant association was observed between active intervention by pharmacists and the occurrence of adverse drug events during hospitalization. Reports [3,4] indicate that pharmacist duties are not adequately performed in Kaifukuki rehabilitation wards compared to those in acute care settings; however, when adverse drug events occur, pharmacists have more opportunities to be involved in their management and response, which may have led to an increase in intervention frequency. Additionally, it is possible that existing adverse drug events were appropriately identified and managed through pharmacist interventions, resulting in their visibility as reported cases. Currently, due to insufficient pharmacist staffing, only minimal intervention is being performed; however, if adequate staffing of pharmacists is ensured in Kaifukuki rehabilitation wards, it may contribute to the prevention of adverse drug events [12,13].

This study had certain limitations. First, because this was a retrospective cohort study, causality could not be proven. Second, the scoring of the pharmacist interventions used in this study was selected based on their practical usefulness, as in previous studies [14]. However, the validity and reliability of the scoring have not yet been evaluated, which is a task for future research. Third, changes in the number of medications were evaluated at two time points, at admission and at discharge, and did not sufficiently take into account temporary increases or decreases in medications during hospitalization or adjustments due to the influence of the discharge destination. It is necessary to evaluate changes in the number of medications while taking these background factors into consideration and examining the relationship with pharmacist interventions in greater detail. Fourth, adverse drug events in this study were based on medical records, and there is a possibility that the recorders and evaluation criteria were not uniform. Therefore, there are certain limitations to the reliability of the evaluation of adverse events. Fifth, although FIM gain was used as the primary endpoint in this study, FIM consists of motor and cognitive items that are not considered equivalent. However, due to the study design, no detailed analysis distinguishing between these two items was performed.

Therefore, it remains to be investigated whether pharmacist interventions influence motor function, cognitive function, or both.

In conclusion, active intervention by pharmacists was associated with significant improvements in ADL in patients with musculoskeletal disorders undergoing rehabilitation in a Kaifukuki rehabilitation ward. This suggests that the appropriate use of medications may contribute to these improvements. Pharmacists working in Kaifukuki rehabilitation wards are expected to contribute to patients' functional recovery primarily through the appropriate use of medications, which includes active bedside interventions and other ward activities.

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References

1. Ogawa Y, Sakoh M, Mihara K, Ogawa R, Echizen H. Factors influencing the number of drugs among elderly patients hospitalized in a rehabilitation ward. J Pharm Health Care Sci 2016; 42: 56−62. Japanese.
2. Kose E, Wakabayashi H. Rehabilitation pharmacotherapy: A scoping review. Geriatr Gerontol Int 2020; 20: 655−63.
3. Kishimoto M, Kose E, Shinonaga H, Tanaka E, Nakamichi M, Mizokami F, et al. Current Status of the Presence of Hospital Pharmacists and the Implementation of Pharmacist Services in Rehabilitation Wards during Convalescence; J Jpn Soc Hosp Pharm 2025; 61: 45−50. Japanese.
4. Fujihara H, Koinuma M, Yumoto T, Maeda T, Kaneda M, Ayabe Y, et al. A Comparison of Pharmaceutical Practice in the Convalescence Rehabilitation Ward and General Ward: Characterization of Pharmaceutical Job Duties in the Convalescence Rehabilitation Ward; J Jpn Soc Hosp Pharm 2013; 49: 975−80. Japanese.
5. Casper EA, El Wakeel LM, Saleh MA, El-Hamamsy MH. Management of pharmacotherapy-related problems in acute coronary syndrome: Role of clinical pharmacist in cardiac rehabilitation unit. Basic Clin Pharmacol Toxicol 2019; 125: 44−53.
6. Wada S, Hirai T, Seki T. The Effect of Pharmacist's Intervention and Patient's Self-management of Oral Medication in the Convalescent-phase Rehabilitation Ward of Hospitals Employing the Diagnosis Procedure Combination (DPC) System; J Jpn Soc Hosp Pharm 2012; 48: 185−8. Japanese.
7. Kishimoto M, Yashiki D, Chogahara T, Kodama T. Examination of the contribution of hospital pharmacists to medication guidance to avoid unexpected readmissions of patients discharged from hospitals to community-based care wards; Jpn J Community Med Pharm Sci 2022; 9: 36−9. Japanese.
8. Willoch K, Blix HS, Pedersen-Bjergaard AM, Eek AK. Reikvam A. Handling drug-related problems in rehabilitation patients: a randomized study. Int J Clin Pharm 2012; 34: 382−8.
9. Marra CA, Cibere J, Grubisic M, Grindrod KA, Gastonguay L, Thomas JM, et al. Pharmacist-initiated intervention trial in osteoarthritis: a multidisciplinary intervention for knee osteoarthritis. Arthritis Care Res (Hoboken) 2012; 64: 1837−45.
10. Kose E, Matsumoto A, Yoshimura Y. Association between deprescribing from polypharmacy and functional recovery and home discharge among older patients with sarcopenia after stroke. Nutrition 2023; 111: 112040.
11. Kose E, Endo H, Hori H, Hosono S, Kawamura C, Kodama Y, et al. Association of Pharmacist-led Deprescribing Intervention with the Functional Recovery in Convalescent Setting. Pharmazie 2022; 77: 165−70.
12. Harada D, Uchino S, Takinami M. Effectiveness of pharmacist participation in the intensive care unit. J Jpn Soc Intensive Care Med 2014; 21: 147−54. Japanese.
13. Kobayashi Y, Yamaoka R, Mikami R, Yamazaki K, Kumai M, Yamada T, et al. The reality and potential medical economic evaluation by avoiding adverse events of pharmacist intervention in emergency medical care and intensive care area. J Jpn Soc Emerg Med 2020; 23:771−9. Japanese.
14. Kose E, Kishimoto M, Shinonaga H, Tanaka E, Nakamichi M, Mizokami F, et al. Pharmacist intervention for polypharmacy improves activities of daily living in older patients with musculoskeletal disorders: A multicenter retrospective cohort study using propensity score matching. Geriatr Gerontol Int 2025; 25: 932−8.