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ORIGINAL ARTICLE

Evaluation of changes in prescription among Japanese elderly patients before and after transition to home care

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Abstract

Background: Most patients receiving home care have multimorbidity and tend to be prescribed multiple drugs with the complicated regimen. Family physicians (FPs) are responsible for patients' prescriptions after transition to home care. This study aimed to assess changes in medication regimen complexity and potentially inappropriate medications (PIMs) made by FPs before and after transition to home care.

Methods: A retrospective cohort study was conducted in six home care clinics in Ibaraki Prefecture, Japan. Data from patients aged 65 years and older taking any medication who initiated home care between April 2018 and March 2019 were collected using medical records. The medication regimen complexity index-Japanese version (MRCI-J) score and the presence of PIMs were assessed before and 3 months after transition to home care.

Results: The mean age of 169 patients was 84.0 years. MRCI-J score and percentage of PIMs remained unchanged between before and 3 months after home care initiation. However, MRCI-J score significantly decreased among patients with polypharmacy, but significantly increased among patients with nonpolypharmacy. In multiple regression analysis, a greater number of medications before home care initiation was associated with a decreasing MRCI-J score, but pharmacist home visit services were not associated with changes in MRCI-J score.

Conclusions: Our results suggest that FPs involved in home care are trying to adjust prescriptions by simplifying the medication regimen of patients with polypharmacy, and adding symptomatic drugs to those with nonpolypharmacy.

KEYWORDS
family physician, home care, medication regimen complexity, polypharmacy, potentially inappropriate medications

1 | INTRODUCTION

Polypharmacy and potentially inappropriate medications (PIMs) have been reported to be associated with adverse drug events, hospitalization, and emergency department visits.[1,2] Therefore, optimizing prescriptions is a challenge in every healthcare setting. Research indicates that medication-related problems are more frequent in home care than in inpatient settings, requiring systematic intervention by professionals.[3,4] Many home-bound elderly patients are multimorbid and thus tend to take multiple medications.[5] In home care settings in Japan, the prevalence of polypharmacy is above 50%,[6] and PIMs make up around 40.4% to 48.4% of prescriptions.[7,8] Although polypharmacy and PIMs are well known among medical providers in Japan, the concept of medication regimen complexity is not well recognized. Medication regimen complexity is a concept that encompasses multiple aspects of a regimen, including the dosage form, number of medications, and additional information for use. The medication regimen complexity index (MRCI), developed in Australia by George et al.,[9] is the most commonly used tool to assess medication regimen complexity. In recent studies, MRCI score has been reported to be associated with adherence[10] and clinical outcomes.[11] Meanwhile, the prevalence of PIMs is typically determined using explicit criteria such as Beers criteria[12] or STOPP criteria[13] to identify drugs, which may be inappropriate for use in elderly people. Therefore, MRCI and PIMs can be considered measures of medication optimization. To our knowledge, no report has assessed medication complexity in the field of home care.

Transition of care provides a good opportunity to review patients' medications. Several studies have focused on changes in prescription at the time of transition of care, namely, on admission to hospital[14] or long-term care facilities.[15] In Japan, family physicians (FPs) play a substantial role in home care and are usually required to review medications when patients initiate home care. However, only one preliminary study in Japan has reported changes over time, before and after initiating home care.[16] Thus, changes in MRCI and PIMs before and after home care initiation remain understudied.

Moreover, factors associated with changes in MRCI before and after transition to home care are largely unknown. A previous study in a hospital setting demonstrated that the pre-admission MRCI score was associated with a decrease in the postadmission MRCI score.[14] In addition, pharmacists play an important role in optimizing prescriptions. Although collaborative intervention by pharmacists has been demonstrated to be effective in reducing medication burden in hospitals[17] and long-term care facilities,[18] no studies have been implemented in home care settings. While home pharmaceutical care (HPC) forms part of the home healthcare system in Japan, pharmacists' contribution to optimizing medication regimen is not well understood in home care settings.[19] Therefore, identifying the factors associated with changes in MRCI around transition to home care, with consideration for the role of pharmacists, will be valuable.

In the present study, we aimed to assess changes in medication regimen complexity and the prevalence of PIMs before and 3 months after transition to home care. The secondary outcome was to explore the factors associated with the change in medication regimen complexity.

2 | METHODS

2.1 | Study design and participants

This was a retrospective cohort study. Participants were home-bound elderly patients who started to receive home care from April 1, 2018, to March 31, 2019, from 6 medical facilities located in Ibaraki Prefecture, which provide home care to patients by FPs. The FPs included in the present study were either certified family physicians or undergoing training to become family physicians. Patients were included if they were 65 years or older and receiving at least one prescription drug at the time of home care initiation. The exclusion criteria were (1) patients who died within 3 months after initiating home care and (2) patients who did not receive any drug prescriptions at either home care initiation or 3 months after.

2.2 | Variables

Age, sex, comorbidities, use of home oxygen therapy, and use of pharmacist home visit services were collected from electronic medical records and entered into the database. The medication regimen written in each prescription was collected to assess medication complexity using MRCI-J and to determine the number of medications before and 3 months after home care initiation. Injections such as insulin, intravenous hyperalimentation, and subcutaneous infusion that were prescribed via a written prescription were included in both the assessment of the number of medications and MRCI-J. In contrast, home oxygen therapy was only included in the assessment using MRCI-J. Comorbidity was assessed using the Charlson Comorbidity Index (CCI).[20] The use of pharmacist home visit services was defined as use of home pharmaceutical care (HPC) at least once during a 3-month period. Data collection was conducted from October 1, 2019, to April 30, 2020.

The primary outcome measure was evaluated by comparing changes in medication regimen complexity assessed using MRCI-Japanese version (MRCI-J)[21] before and 3 months after home care initiation. MRCI was translated into Japanese in the previous study and was confirmed its validity and reliability.[21] MRCI-J comprises three sections: section A, dosage forms; section B, dosage frequency; section C, additional instructions, which generate a continuous score, with a higher score indicating more complex medication regimen, with no upper limit. PIMs were defined in this study using the Screening Tool for Older Persons' appropriate Prescriptions for Japanese (STOPP-J).[22] The presence of PIMs was determined as a prescription for at least one PIM defined by STOPP-J. We counted the number of medications among regularly prescribed medications used to determine the MRCI-J score. Self-medications including over-the-counter drugs and supplements were excluded from

medication counts and the MRCI-J score because the purpose of the study was to assess changes in practice around transition of care. Polypharmacy was defined as the prescription of five or more medications.[23]

2.3 | Ethical consideration

Informed consent was obtained in the form of opt-out on the website. This study was approved by the Ethics Committee of University of Tsukuba (No. 1428) and associated facilities. The investigation was conducted in accordance with the Declaration of Helsinki.

2.4 | Statistical analysis

Patients' background data were assessed using descriptive statistics. Changes in the number of medications and MRCI-J score were assessed using a paired *t* test. We further analyzed changes in MRCI-J score by stratifying patients by the presence of polypharmacy (number of medications before initiating home care ≥ 5: polypharmacy group; number of medications before initiating home care ≤ 4: nonpolypharmacy group), because the change in MRCI-J score differed according to the number of medications before starting home care. Change in MRCI-J score was calculated by subtracting the post-transition MRCI score (3 months after home care initiation) from the pre-transition MRCI score (just before home care initiation). The association between the number of medications before home care initiation and changes in MRCI-J score was evaluated using multiple regression analysis with adjustment for covariates. We also evaluated changes in the presence of any PIM before and 3 months after home care initiation by comparing the prevalence of PIM prescriptions using McNemar's test. Cases with incomplete medication regimen because of lack of information on dosage or frequency before starting home care were excluded from the analysis. *P* values less than 0.05 were considered significant. Analyses were performed using IBM SPSS software (version 26).

The meaningful change in MRCI-J was set as 2 points based on the previous study,[14] and sample size was calculated for one-sample pair *t* test and we estimated that 99 patients were required for the analysis.

3 | RESULTS

Participants' demographic data at home care initiation are summarized in Table 1. The mean age of 169 patients was 84.0 years old, and 59.2% were females. Patients' most common underlying diseases were dementia, musculoskeletal disease, and malignancy, and the median CCI was 2. About 26.6% of patients used pharmacist home visit services.

TABLE 1 Characteristics of home care patients

Variable ($n = 169$)	
Age (years), mean ± SD	84.0 ± 8.2
Sex	
Male, *n* (%)	69 (40.8)
Female, *n* (%)	100 (59.2)
Primary health condition	
Malignancy, *n* (%)	22 (13.0)
Dementia, *n* (%)	53 (31.4)
Musculoskeletal disease, *n* (%)	27 (16.0)
Respiratory disease, *n* (%)	15 (8.9)
Cardiac disease, *n* (%)	12 (7.1)
Cerebrovascular disease, *n* (%)	9 (5.3)
Liver/renal/neurological disease, *n* (%)	6 (3.6)
Other (mental, disuse syndrome)	25 (14.8)
Charlson Comorbidity Index, median (IQR)	2 (1–3)
Use of pharmacist home visit services	
No, *n* (%)	116 (68.6)
Yes, *n* (%)	45 (26.6)
Unknown, *n* (%)	8 (4.7)

Abbreviations: IQR, interquartile range; SD, standard deviation.

The average number of medications just before home care initiation was 6.93. The average MRCI-J score before and 3 months after home care initiation was 22.4 and 21.1, respectively. The prevalence of PIMs assessed by STOPP-J changed from 60.9% to 55.6%. The changes in these variables were not statistically significant overall (Table 2). Among patients with polypharmacy, MRCI-J score significantly decreased 3 months after home care initiation, although the prevalence of PIMs did not change (Table 2). In contrast, patients with nonpolypharmacy showed a significant increase in MRCI-J score 3 months after home care initiation, while the prevalence of PIMs remained unchanged (Table 2). Analyses of changes in each section scores of MRCI-J revealed that changes in section A and section B scores were significant in both polypharmacy group and nonpolypharmacy group (Table 2).

3.1 | Factors associated with changes in MRCI-J score

There was a negative correlation between the number of medications before home care initiation and change in MRCI-J score ($r = -0.43$, $p < 0.001$). In multiple regression analysis, increasing the number of medications just before home care initiation was associated with a negative change in the MRCI-J score ($p < 0.001$; Table 3). Other variables including the use of pharmacist home visit services were not significantly associated with changes in MRCI-J score. Additional analysis that included musculoskeletal diseases, which

TABLE 2 Changes in prescription before and after transition to home care

Overall	*N*	Before transition	3 months after	*p* value
Number of medications, mean ± SD	169	6.93 ± 3.73	6.72 ± 3.27	0.33*
MRCI-J, mean ± SD (*n* = 160)	160	22.40 ± 11.96	21.09 ± 10.70	0.33*
Section A		4.45 ± 4.24	4.13 ± 2.61	0.27*
Section B		10.36 ± 6.05	9.74 ± 5.78	0.11*
Section C		7.59 ± 4.52	7.22 ± 4.25	0.18*
PIMs (STOPP-J)	169	103 (60.9%)	94 (55.6%)	0.073**
Patients with polypharmacy				
Number of medications, mean ± SD	129	8.18 ± 3.36	7.58 ± 3.06	0.024*
MRCI-J, mean ± SD	123	26.20 ± 10.79	23.65 ± 10.37	0.004*
Section A		5.07 ± 4.47	4.35 ± 2.66	0.040*
Section B		12.24 ± 5.58	11.04 ± 5.76	0.011*
Section C		8.89 ± 4.28	8.26 ± 4.16	0.064*
PIMs (STOPP-J), *n* (%)	129	87 (67.4)	80 (62.0)	0.17**
Patients with nonpolypharmacy				
Number of medications, mean ± SD	40	2.88 ± 1.07	3.95 ± 2.21	0.001*
MRCI-J, mean ± SD	37	9.77 ± 4.88	12.58 ± 6.64	0.008*
Section A		2.38 ± 2.43	3.38 ± 2.30	0.026*
Section B		4.12 ± 2.12	5.45 ± 3.22	0.010*
Section C		3.27 ± 1.74	3.76 ± 2.23	0.18*
PIMs (STOPP-J), *n* (%)	40	16 (40.0)	14 (35.0)	0.63**

Note: Section A: dosage forms, Section B: dosage frequency, Section C: additional instructions.

Abbreviations: MRCI-J, medication regimen complexity index-Japanese version; PIMs, potentially inappropriate medications; SD, standard deviation; STOPP-J, Screening Tool for Older Persons' appropriate Prescriptions for Japanese.

*Paired *t* test, ** McNemar's test.

TABLE 3 Factors associated with changes in MRCI-J score assessed using multiple regression analysis (*n* = 155)

Variable	β	SE	*p* value
Age	0.014	0.088	0.87
Sex, female	−1.54	1.46	0.30
CCI	0.11	0.36	0.77
Use of pharmacist home visit services	1.04	1.54	0.50
Number of medications before initiating home care	−1.09	0.18	<0.001

Abbreviations: CCI, Charlson Comorbidity Index; MRCI-J, medication regimen complexity index-Japanese version; SE, standard error.

are excluded from the CCI but form a major reason for home visits, as an independent variable did not change the results.

3.2 | Potentially Inappropriate Medications before and 3 months after home care initiation

The majority of PIMs were loop diuretics, benzodiazepines, nonsteroidal anti-inflammatory drugs (NSAIDs), aldosterone antagonists, antipsychotic drugs, histamine H2 receptor antagonists, and antidiabetic drugs, namely, biguanides, sulfonylureas, α-glucosidase inhibitors, thiazolidine derivatives, and sodium-glucose cotransporter 2 (SGLT-2) inhibitors (Table S1). Most drugs identified as PIMs, including diuretics, were continued after home care initiation. While NSAIDs, H2 receptor antagonists, and antidiabetic drugs tended to be deprescribed after home care initiation, benzodiazepines were likely to be added after home care initiation.

4 | DISCUSSION

We demonstrated that FPs involved in home care tend to decrease medication regimen complexity for patients taking more than 5 medications, and adding medications for those taking less than 4

medications around transition to home care. In contrast, the prevalence of PIMs did not significantly change between before and 3 months after home care initiation.

Overall, there were no significant changes in medication regimen complexity or the prevalence of PIMs before and after transition to home care. Previous studies conducted in hospital settings reported that the number of medications and medication complexity increased after admission, while the prevalence of PIMs decreased.[14] However, a report on Japanese long-term care facilities indicated that the average number of oral medications is 4.7 on admission and 3.5 at 3 months after admission.[15] These variable results suggest that changes in prescription at the time of transition of care are affected by patients' settings.

An intriguing finding in the present study was the opposing trend in changes in medication complexity among patients with polypharmacy compared with nonpolypharmacy, with the statistically significant difference in the individual groups canceling each other out in the analysis of total patients. Thus, the number of medications at the time of transition of care was related to changes in MRCI score. This result is consistent with that of a previous study, which demonstrated that the number of medications at the initial assessment is related to deprescribing.[14] This may be explained by physicians' reluctance to prescribe more medications to patients who are already taking a large number of medications.[14] In contrast, physicians may think that additional prescriptions are acceptable for patients taking fewer medications. Changes in section A and section B scores of MRCI-J were significant in both polypharmacy group and nonpolypharmacy group, suggesting that FPs involved in home care commonly change the dosage form and dose frequency after initiation of home care. The results should be interpreted with caution because the changes in prescriptions may reflect changes in patient status rather than physicians' proposals. However, a 3-month follow-up is reasonable for assessing changes in prescription, as follow-up for longer periods would make it more difficult to differentiate between whether a change in prescription was because of changes in patient status or medication review.

The prevalence of PIMs among home care patients is reportedly 48.8% in Japan,[7] which is lower than the prevalence found in the current study. A previous study reported that STOPP-J detected significantly more patients with PIM than STOPP criteria version 2,[24] which may explain the discrepancy in findings. In the present study, the prevalence of PIMs remained unchanged before and 3 months after home care initiation. This result suggests that FPs involved in home care may experience challenges and barriers toward deprescribing PIMs. Among the identified PIMs, diuretics were the most prevalent both before initiating home care and after 3 months. The fact that diuretics were a common PIM is consistent with findings from a previous study.[25] Although a prescription for diuretics is justifiable in cases of heart failure or renal failure to alleviate overload-related symptoms, it is likely that more than just a few cases may be misdiagnosed with heart failure and unnecessarily prescribed loop diuretics.[26] The second most prevalent PIM was benzodiazepines, with prescriptions for benzodiazepines increasing 3 months after compared with before home care initiation, although the change was not statistically significant. As prescriptions for benzodiazepines are associated with negative health outcomes such as falls and cognitive dysfunction,[27] FPs should consider deprescribing BZAs. However, our results suggest that FPs are faced with an increased demand from caregivers attempting to manage the sleep problems of home-bound patients. In home care settings, symptom relief and patients' quality of life tend to be given greater priority compared with other settings. In addition, patient-centered decision making is dominant and caregiver burden is considered more so than in other settings.[28] Therefore, in home care settings, medical practitioners should optimize medications not only from medical but also patients' and caregivers' perspectives.

The physicians included in the present study were either certified FPs or undergoing training to become FPs; thus, they were highly conscious of the need to optimize medications.[29] Consequently, we speculate that trained FPs are trying to adjust prescriptions by simplifying medication regimen for patients with polypharmacy, and adding drugs required for treatment for those with nonpolypharmacy.

In the present study, pharmacist home visit services were not associated with changes in MRCI-J score. This result suggests that pharmacist home visit services do not contribute to changes in prescription around transition to home care. Unlike in hospital settings, pharmacists' involvement in medication management is limited in home care unless patients or caregivers use HPC services in which pharmacists visit patients' homes to supply medicines and conduct medication review through written documents to the responsible physicians. Although the use of HPC services has increased, HPC is not always provided by clinically well-trained pharmacists, leading to differences in service quality.[30] In addition, the hierarchical relationship between physicians and pharmacists and the lack of understanding of each other's skills and knowledge pose a challenge to interprofessional collaboration.[31] Given the increasing role of pharmacists in home care, challenges associated with the HPC system and the relationship between physicians and pharmacists described above should be addressed to improve prescription quality in home care settings.

Several limitations warrant mention. First, we used a before–after study design without a comparison group. Therefore, the changes observed in prescriptions may not only be because of the introduction of home care. However, it is possible to speculate that there would be no such change in the absence of home care initiation. Second, selection bias is possible because the study was conducted in a small number of facilities in Japan and the patients in the present study were managed by certified or trained FPs belonging to a group of associated medical institutions. This can lead to biases in demographic data and medication regimen, and changes in prescription before and after home care initiation can be unclear in cases where physicians are not well trained. Third, it is possible that under the Japanese healthcare system some patients receiving home care may visit specialists such as dentists and dermatologists, who themselves may provide the patients with prescriptions. Such incidence of multiple prescribers can lead to an underestimation of

prescriptions. However, we expect that the results should be valid for prescriptions provided by FPs.

Despite these limitations, this study provides valuable evidence of changes in patients' prescriptions before and after transition to home care. In addition, the results of our study add significant findings and highlight the challenges associated with optimizing medications in home care settings.

In conclusion, MRCI-J score significantly decreased 3 months after home care initiation among patients with polypharmacy, and it significantly increased among those with nonpolypharmacy. The prevalence of PIMs remained unchanged before and after home care initiation. These results suggest that FPs involved in home care are trying to adjust prescriptions by simplifying medication regimen for patients with polypharmacy and adding symptomatic drugs for those with nonpolypharmacy. However, interprofessional collaboration between physicians and pharmacists during transition to home care is challenging. FPs involved in home care and community pharmacists must recognize each other's practice and collaborate to optimize medications around transition to home care. Further research is needed to generalize the results to other regions and to evaluate the effect of prescription changes.

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CONFLICT OF INTERESTS

The authors have stated explicitly that there are no conflicts of interest in connection with this article.

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SUPPORTING INFORMATION

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