


BMJ Open Use of psychotropic drugs and drugs with anticholinergic properties among residents with dementia in intermediate care facilities for older adults in Japan: a cohort study

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ABSTRACT

Objectives To evaluate the prescription and discontinuation of psychotropic drugs (PD) and drugs with anticholinergic properties (DAP) in residents with dementia admitted to Roken, a major type of long-term care facility in Japan.

Design Cohort study.

Setting A nationwide questionnaire survey across 3598 Roken in Japan in 2015 (up to five randomly selected residents per facility).

Participants This study included 1201 residents from 343 Roken (response rate: 10%). We determined the presence and severity of dementia using a nationally standardised measure.

Primary and secondary outcome measures

Prescriptions of PD and DAP at admission and 2 months after admission were evaluated. Multivariable logistic regression was used to evaluate the associations of residents' baseline characteristics with prescriptions or discontinuation.

Results Prescription rates decreased for antedementia drugs (19.4% to 13.0%), hypnotics (25.1% to 22.6%) and anxiolytics (12.3% to 10.7%), whereas those for other PD, such as antipsychotics (13.2% to 13.6%), antidepressants (7.4% to 6.7%), antiepileptic drugs (7.1% to 7.8%) and DAP (35.2% to 36.6%) did not statistically significantly decrease. Some factors were associated with the prescriptions, for example, for antipsychotics, older age (≥ 85 years) (adjusted OR (aOR), 0.60; 95% CI 0.43 to 0.85) and being bedridden (aOR 0.67; 95% CI 0.47 to 0.97) were associated with a lower use of antipsychotics, whereas severe dementia was associated with a higher use of antipsychotics (aOR 3.26; 95% CI 2.26 to 4.70). At an individual level, a quarter of residents prescribed PD or DAP at admission had discontinued at least one PD or DAP, respectively, 2 months after admission. Antedementia drug use in severe dementia (aOR 1.86; 95% CI 1.04 to 3.31) and PD use in older age (aOR 1.61; 95% CI 1.00 to 2.60; in residents with disabling dementia) were associated with discontinuation.

Conclusions There is possible scope for deprescribing PD and DAP in Roken residents with dementia to mitigate the risks of adverse events.

Strengths and limitations of this study

- This analysis was undertaken using the largest available dataset on drug use in Roken facilities.
- The presence and severity of dementia were determined using a nationally standardised measure.
- The study sample analysed cannot be considered representative of Roken residents nationwide because the survey response rate on medication was only approximately 10%.
- Data were not analysed according to facility-level or medical director-level because too few residents were studied per facility.
- The generalisability of our findings may be limited to similar types of nursing homes or long-term care facilities only.

INTRODUCTION

There are approximately 50 million people with dementia worldwide, and this number is projected to triple in the next 30 years.¹ Dementia and cognitive impairment are well-evidenced predictors of nursing home (NH) placement,² and the prevalence of dementia is considerably higher in NH residents compared with community-dwelling older adults.³ Most NH or long-term care facility (NH/LTCF) residents have dementia.^{3–5} People with dementia manifest not only memory impairments but also typically exhibit a variety of behavioural and psychological symptoms of dementia (BPSD), including aggression, agitation, depression, psychosis and sleep problems.^{6 7} The complexity involved in managing BPSD remains a major challenge in dementia care.

Residents of NH/LTCFs are commonly prescribed a large number of drugs (ie, polypharmacy) including potentially inappropriate medications (PIM) for older adults,^{8 9}

and optimisation of medication use is often required for better clinical outcomes. Although non-pharmacological approaches should first be considered for the management of BPSD,¹⁰ pharmacological treatments, such as antipsychotics, benzodiazepines and antidepressants, have been commonly administered to NH/LTCF residents despite safety concerns and limited effectiveness.^{11–19} Furthermore, wide variations in the use of these types of drugs have been reported among different countries.²⁰

In terms of safety concerns related to medication for BPSD management, the following issues have been reported. Antipsychotic use in individuals with dementia was associated with greater risks of cerebrovascular events and mortality.²¹ The use of psychotropic drugs (PD), such as sedatives/hypnotics, antidepressants and benzodiazepines, was associated with an increased risk of falls.²² Moreover, an increased number of PD prescribed was associated with the greater risks of fall injuries, hospitalisations and mortality.²³ Drugs with anticholinergic properties (DAP) were associated with greater risks for cognitive impairment, falls and mortality.²⁴ Given that NH/LTCF residents are frail and more susceptible to adverse events compared with community-dwelling older people, careful pharmacological management approaches should be undertaken.

Intermediate care facilities for older adults with long-term care (LTC) needs (Geriatric Health Service Facilities or Roken) are a major type of LTCFs in Japan. The main role of these facilities is providing medical and LTC services, including pharmacotherapy and rehabilitation, to improve residents' functioning and to facilitate their return home. We previously reported that the prescription of antidementia drugs decreased after admission, whereas antipsychotic prescription remained stable after admission to Roken²⁵; however, dementia severity had not been considered. We also reported that residents with severe dementia were less likely to be prescribed drugs to prevent and treat cardiovascular diseases, such as antihypertensives and lipid-modifying drugs.²⁶ However, data on the use of PD and DAP in Roken residents are scarce. Therefore, we aimed to evaluate the utilisation of PD and DAP in Roken residents with dementia in Japan. We also aimed to identify factors associated with prescription and discontinuation of PD and DAP among Roken residents.

METHODS

Setting

Roken is one of three types of LTCFs in Japan covered by public LTC insurance systems, and >90% of Roken are private sector operated.²⁷ According to a national survey conducted in 2015, namely, the 'Survey of Institutions and Establishments for long-term care,' the total capacity of Roken facilities was 368 201 residents nationwide.²⁸ This figure corresponded to approximately 1% of older people aged ≥65 years or 8% of older people with LTC needs. The majority of older adults are admitted to a facility after discharge from a hospital.²⁷ Roken residents

are stable in terms of medical conditions, but they require specific care and rehabilitation prior to returning home. The mean length of stay has been reported to be approximately 10 months.²⁷ General services in Roken comprise routine medical and LTC services, with some exceptions.

Fees for medical, including pharmacotherapy and rehabilitation, and LTC services provided in Roken are paid to the facility as a bundled payment from public LTC insurance systems. The fees have been determined based on LTC needs for individual residents, the facility subtype of Roken, and on additional services, but not on drug costs. Out-of-pocket payment rates for Roken services generally comprise 10% of total expenditures. Therefore, in most cases, changes to medication do not affect residents' out-of-pocket payments.

In general, a full-time medical director in a facility is in charge of and responsible for medication, and pharmacists, nurses and other staff contribute information to support decisions concerning residents' medication. Information regarding medication prescribed at admission is generally obtained from a drug information sheet issued by a physician in charge of an individual prior to admission to a facility. Social workers and other facility staff may obtain additional information from staff members in a hospital prior to admission or from primary care professionals.

Data source

We sent questionnaires via mail to obtain data regarding drug utilisation to 3598 Roken in 2015. Details on the survey have been previously reported.²⁵ This data collection method was applied at that time because medical claims data for drugs were not generally issued for Roken residents and most Roken facilities had not introduced standardised electronic systems to record drug prescriptions.

Briefly, we collected data for up to five randomly selected individuals per Roken who were admitted between August and October 2015. The survey was conducted after approval from the ethics committee of the Japan Association of Geriatric Health Services Facilities (No. 30 in 2015 and No. 37 in 2016). All participants or their representatives provided written informed consent, and all data were collected after anonymisation at each facility. Medical directors or facility managers in individual Roken facilities were responsible for responding to the survey. No residents or their families were involved in completing the survey.

Definition of dementia

We previously reported that about half of the residents had dementia in this dataset, based on reported diagnoses of any types of dementia and/or prescription of antidementia drugs.²⁵ However, because the diagnosis of dementia had not been always reported and because only a subset of residents with dementia had been treated with antidementia drugs,^{4 29} we identified residents with dementia in the present study using a nationally

standardised measure to assess cognitive function ('Independence Degree of Daily Living for the Dementia').³⁰ This unique measure in Japan has been verified to identify dementia and has relatively high sensitivity and specificity.³¹ Therefore, we expected to identify residents with dementia while avoiding the inclusion of residents without dementia. More specifically, we selected residents with dementia if they had rank I (having dementia but almost independent for daily living) or higher based on this measure; this cut-off was previously reported to have a sensitivity of 65% and a specificity of 93%.³¹ Dementia severity was categorised into two groups for this study: mild-to-moderate (rank I and rank II (having daily life-disturbing symptoms, behaviours and problems in communication but independent for daily life if watched by someone)) and severe (rank III (requiring assistance), rank IV (requiring assistance frequently) and rank M (marked psychiatric symptoms requiring expert management)). A recent study also used this measure to identify older adults with dementia and to estimate the prevalence of antipsychotic use.³²

Study participants

The selection of study participants has been previously described.^{25 26} From data collected using the survey on 1510 residents at 368 Roken (response rate: 10.2%), we first selected residents aged ≥ 65 years who had stayed at the same facility for at least two consecutive months after admission. Residents with missing demographic data and those with no record of any drugs prescribed both at admission and 2 months after admission (possible missing data for drug prescriptions) were excluded. Accordingly, data from 1324 participants at 350 facilities were obtained after removing data due to ambiguous drug names, strengths and dosages. We selected 1318 residents with records of physical and cognitive functions assessed using nationally standardised measures.³⁰ Finally, among them, we selected 1201 residents (91.1%) with dementia (as defined above) from 343 Roken facilities for further analyses.

Drugs of interest

In the survey, we asked to collect data on regularly scheduled medications only; however, as-needed drugs were occasionally reported. In this study, we omitted the data on as-needed drugs due to inconsistent reporting from facilities. Therefore, we evaluated the utilisation of regular drugs administered at admission and at 2 months after admission.

Four marketed antidementia drugs were examined, namely, three acetylcholinesterase inhibitors (donepezil, galantamine and rivastigmine) and one N-methyl-D-aspartate receptor antagonist (memantine). PD comprised the following six categories: antipsychotics (first generation and second generation), antidepressants, hypnotics, anxiolytics, antiepileptic drugs and lithium (online supplemental table S1). In addition, the use of yokukansan, a traditional Japanese Kampo medicine, was

also studied although this drug was not included in the PD categories. A meta-analysis of randomised controlled trials showed that yokukansan had beneficial effects on some symptoms related to dementia, including delusions, hallucinations and agitation/aggression.³³

Various scales to identify and assess anticholinergic burdens have been developed and validated, but with relatively low concordance.³⁴ We identified drugs in 11 DAP categories, which were available in Japan, for screening purposes according to drugs listed in the 'Guidance of Appropriate Medication for Elderly Patients' released in May 2018 in Japan,³⁵ the Anticholinergic Risk Scale³⁶ and/or the Beers criteria (online supplemental table S2).³⁷

Statistical analysis

Descriptive statistics were used to summarise the characteristics of the study participants and prescriptions of drugs. Physical status was categorised as non-bedridden (ranks J and A) and bedridden (ranks B and C).³⁰ The bedridden group included residents who lay in bed most of the day but were able to sit (rank B).³⁰ The characteristics of residents according to dementia severity were compared using a χ^2 test, and a Wilcoxon rank sum test was also used for age. Changes in prescriptions from admission to 2 months after admission were tested using the McNemar test. We defined discontinuation as no prescription for antidementia drugs or individual categories of PD as well as a decrease in the number of PD or DAP at 2 months after admission among users of the corresponding drugs at admission. Multivariable logistic regression analysis was used to evaluate the associations between residents' baseline characteristics and prescription or discontinuation of antidementia drugs, PD and DAP, and relevant adjusted odds ratios (aOR) and 95% CI were reported. Independent variables included age group (65–84 and ≥ 85 years), sex, dementia severity (mild-to-moderate and severe) and physical disability (non-bedridden and bedridden). As a sensitivity analysis, we repeated the above analyses in residents with 'disabling' dementia (ranks II or higher).^{30 31} All analyses were conducted using Stata V.14 (StataCorp).

Patient and public involvement

No patients or members of the public were involved in the study design, conduct, reporting, or dissemination plans in relation to this research.

RESULTS

Baseline characteristics

Study participants' baseline characteristics are shown in table 1 and in online supplemental table S3. This study included 1201 residents with dementia, of whom 47% exhibited severe dementia, 75% were women and 60% were ≥ 85 years old. Residents with severe dementia were more likely to have a physical disability (ie, be bedridden) compared with those with mild-to-moderate dementia ($p < 0.001$).

Table 1 Characteristics of residents with dementia at admission according to dementia severity

	Overall (n=1201)	Dementia severity		P value
		Mild-to-moderate (n=642)	Severe (n=559)	
Age (years)				
65–74	97 (8.1)	54 (8.4)	43 (7.7)	0.815
75–84	381 (32.7)	209 (32.6)	172 (30.8)	
85–94	612 (51.0)	319 (49.7)	293 (52.4)	
95+	111 (9.2)	60 (9.3)	51 (9.1)	
Mean±SD	86±7	85±7	86±7	0.483
Sex				
Men	298 (24.8)	150 (23.4)	148 (26.5)	0.213
Women	903 (75.2)	492 (76.6)	411 (73.5)	
Physical disability				
Non-bedridden	398 (33.1)	274 (42.7)	124 (22.2)	<0.001
Bedridden	803 (66.9)	368 (57.3)	435 (77.8)	

SD, standard deviation

Drug utilisation

The utilisation of antidementia drugs, PD and DAP is shown in table 2 and in online supplemental table S4. The use of antidementia drugs decreased from admission to 2 months

after admission in all participants and according to dementia severity (all $p < 0.001$). The relative decrease was more pronounced in residents with severe dementia (23.8% to 14.3%; 39.9% decrease) than in those with mild-to-moderate dementia (15.6% to 11.8%; 24.4% decrease).

At least one category of PD was prescribed to >40% of the residents. The most frequently prescribed drug category was hypnotics, followed by antipsychotics, anxiolytics, antidepressants and antiepileptic drugs. Among residents with antiepileptic drugs, 23 (27.1%) residents at admission and 24 (25.5%) residents at 2 months after admission had a recorded diagnosis of symptomatic epilepsy. Lithium was rarely prescribed. The prescription rates for hypnotics and anxiolytics decreased from admission to 2 months after admission. The use of yokukansan did not change from admission (n=63, 5.2%) to 2 months after admission (n=56, 4.7%) (exact $p = 0.248$).

When benzodiazepines and Z-drugs, categorised as hypnotics or anxiolytics, were evaluated together, the proportion of residents receiving these kinds of drugs decreased from 29.8% (n=358) at admission to 27.8% (n=334) at 2 months after admission ($p = 0.012$) in all participants. The overall decrease observed in all participants was attributed to a decrease in prescriptions for residents with mild-to-moderate dementia (n=213 (33.2%) to n=193 (30.1%), $p = 0.003$), in contrast to those with severe

Table 2 Utilisation of antidementia drugs, psychotropic drugs and drugs with anticholinergic properties

	Admission n (%)	Month 2 n (%)	P value	Discontinuation n (% of users at admission)
Antidementia drugs	233 (19.4)	156 (13.0)	<0.001	84 (36.1)
Psychotropic drugs	532 (44.3)	514 (42.8)	0.089	113 (23.2)*
Hypnotics	301 (25.1)	272 (22.6)	0.002	58 (19.3)
Antipsychotics	158 (13.2)	163 (13.6)	0.535	30 (19.0)
First generation	68 (5.7)	70 (5.8)	0.715	14 (20.6)
Second generation	101 (8.4)	105 (8.7)	0.564	22 (21.8)
Anxiolytics	148 (12.3)	128 (10.7)	0.003	33 (22.3)
Antidepressants	89 (7.4)	81 (6.7)	0.134†	15 (16.9)
Antiepileptic drugs	85 (7.1)	94 (7.8)	0.049†	4 (4.7)
Lithium	2 (0.2)	2 (0.2)	NA	0 (0.0)
Drugs with anticholinergic properties	423 (35.2)	440 (36.6)	0.141	77 (26.1)*
Frequently prescribed drugs‡				
H2-receptor antagonists	162 (13.5)	191 (15.9)	<0.001	20 (12.3)
Antipsychotics	106 (8.8)	113 (9.4)	0.336	23 (21.7)
Drugs for overactive bladder	73 (6.1)	69 (5.7)	0.541†	14 (19.2)
Drugs for Parkinson's disease	56 (4.7)	54 (4.5)	0.774†	7 (12.5)
Antidepressants	55 (4.6)	55 (4.6)	1.000†	8 (14.5)

*Discontinuation of psychotropic drugs (PD) or drugs with anticholinergic properties (DAP) overall was defined as a decrease in the number of drug categories from PD or DAP, from admission to month 2, respectively.

†Exact p values are shown in cases where a small number of residents (less than 30 residents) changed the prescription.

‡See online supplemental table S2 for specific drugs included in each drug category.

NA, not available.

dementia where no such decrease was observed (n=145 (25.9%) to n=141 (25.2%), p=0.564).

More than one-third of study participants were prescribed DAP, and this proportion did not change from admission to 2 months after admission (for all participants, 35.2% to 36.6%, p=0.165). H2-blockers were the most frequently prescribed DAP, and the prescription rate increased from admission to 2 months after admission in all participants (13.5% to 15.9%, p<0.001). Famotidine accounted for 80% of H2-blockers at admission and 2 months after admission. Related to the increased use of H2-blockers, the prescription of proton pump inhibitors decreased from 32.2% (n=387) at admission to 26.3% (n=316) at 2 months after admission. Antipsychotics and muscarinic receptor antagonists for overactive bladder were also frequently prescribed DAP.

Regarding changes in the use of drugs at an individual level, more than one-third of residents who were prescribed antedementia drugs at admission and >20% of residents who were prescribed PD or DAP at admission were discontinued the corresponding drugs at 2 months after admission. Only seven residents started antedementia drugs after admission, but the number of residents who started antipsychotics (n=35) or DAP (n=94) was comparable to those who discontinued (n=30 or 113, respectively). The number of residents who started hypnotics, anxiolytics, or antidepressants was about half the number of residents who discontinued.

Factors associated with prescriptions

The associations between residents' baseline characteristics and the prescriptions of antedementia drugs, PD and DAP are shown in table 3. Older age (≥85 years) was associated with fewer prescriptions of antipsychotics, hypnotics, anxiolytics, antidepressants, antiepileptic drugs and DAP. Women were more likely to receive antedementia drugs and tended to receive anxiolytics more frequently. Residents with severe dementia were more likely to be prescribed antedementia drugs, antipsychotics, antiepileptic drugs and DAP. In addition, they tended to receive anxiolytics less frequently. Bedridden residents were less likely to be prescribed antedementia drugs and antipsychotics and tended to receive hypnotics less frequently. Similar results were obtained from the sensitivity analysis in residents with disabling dementia (online supplemental table S5).

Factors associated with discontinuation

Discontinuation of antedementia drugs was more likely in residents with severe dementia (aOR, 1.86; 95% CI 1.04 to 3.31; p=0.035) (table 4). In residents with disabling dementia, those aged ≥85 years were more likely to have discontinued the use of PD (aOR, 1.61; 95% CI 1.00 to 2.60; p=0.049) (online supplemental table S6).

DISCUSSION

In this study, we examined the utilisation of antedementia drugs, PD and DAP in Roken residents and identified

Table 3 Associations of residents' characteristics at admission with the prescriptions 2 months after admission

Factors	Age, ≥85 years (ref. 65–84)		Women (ref. men)		Severe dementia (ref. mild-to-moderate)		Bedridden (ref. not bedridden)	
	aOR (95% CI)	P value	aOR (95% CI)	P value	aOR (95% CI)	P value	aOR (95% CI)	P value
Antedementia drugs	0.91 (0.64 to 1.29)	0.590	1.60 (1.03 to 2.49)	0.038	1.52 (1.07 to 2.16)	0.019	0.44 (0.31 to 0.63)	<0.001
Antipsychotics	0.60 (0.43 to 0.85)	0.004	1.34 (0.89 to 2.01)	0.166	3.26 (2.26 to 4.70)	<0.001	0.67 (0.47 to 0.97)	0.033
First generation	0.57 (0.35 to 0.93)	0.026	1.21 (0.68 to 2.16)	0.526	2.72 (1.60 to 4.60)	<0.001	0.71 (0.42 to 1.19)	0.195
Second generation	0.62 (0.41 to 0.93)	0.022	1.38 (0.84 to 2.27)	0.206	3.05 (1.96 to 4.74)	<0.001	0.67 (0.44 to 1.04)	0.075
Hypnotics	0.68 (0.52 to 0.91)	0.008	0.85 (0.62 to 1.17)	0.324	0.95 (0.72 to 1.26)	0.719	0.78 (0.58 to 1.04)	0.085
Anxiolytics	0.68 (0.46 to 0.99)	0.042	1.54 (0.96 to 2.47)	0.072	0.71 (0.48 to 1.04)	0.081	1.10 (0.74 to 1.65)	0.626
Antidepressants	0.48 (0.30 to 0.76)	0.002	1.28 (0.74 to 2.22)	0.369	1.10 (0.69 to 1.75)	0.690	0.77 (0.47 to 1.24)	0.275
Antiepileptic drugs	0.22 (0.14 to 0.36)	<0.001	0.72 (0.45 to 1.14)	0.157	1.59 (1.02 to 2.47)	0.041	1.49 (0.89 to 2.49)	0.125
Drugs with anticholinergic properties	0.64 (0.50 to 0.82)	<0.001	1.05 (0.79 to 1.39)	0.730	1.32 (1.03 to 1.68)	0.026	1.01 (0.78 to 1.31)	0.946

Factors associated with prescribing of lithium could not be evaluated because of the small number of participants who had been prescribed this drug. aOR, adjusted OR.

Table 4 Associations of residents' characteristics at admission with discontinuation during the first 2 months after admission

Factors	Age, ≥85 years (ref. 65–84)		Women (ref. men)		Severe dementia (ref. mild-to-moderate)		Bedridden (ref. not bedridden)	
	aOR (95% CI)	P value	aOR (95% CI)	P value	aOR (95% CI)	P value	aOR (95% CI)	P value
Antidementia drugs	0.91 (0.52 to 1.60)	0.750	0.95 (0.47 to 1.90)	0.881	1.86 (1.04 to 3.31)	0.035	1.03 (0.59 to 1.81)	0.913
Psychotropic drugs*	1.42 (0.92 to 2.20)	0.113	0.97 (0.58 to 1.59)	0.890	0.73 (0.47 to 1.12)	0.151	1.24 (0.78 to 1.97)	0.363
Drugs with anticholinergic properties*	0.91 (0.54 to 1.53)	0.733	0.85 (0.48 to 1.50)	0.569	0.85 (0.50 to 1.42)	0.526	1.56 (0.86 to 2.85)	0.143

*Discontinuation of psychotropic drugs (PD) or drugs with anticholinergic properties (DAP) overall was defined as a decrease in the number of drug categories from PD or DAP, from admission to month 2, respectively.
aOR, adjusted OR.

factors associated with prescription or discontinuation of these drugs. These findings have further characterised drug utilisation in Roken residents in addition to our findings from previous studies.^{25 26 38 39} We previously reported that residents with severe dementia received a smaller number of drugs and were less frequently prescribed antihypertensives or lipid-modifying drugs compared with those with better cognitive function.²⁶ Despite our observations concerning the discontinuation of PD and DAP, some drugs, especially antipsychotics and DAP, were commonly initiated. Antidementia drugs for severe dementia and PD for older aged residents (with disabling dementia) were identified as being associated with discontinuation. Larger studies are needed to evaluate discontinuation of individual drug categories in relation to PD or DAP.

Antidementia drugs were discontinued in about one-third of residents receiving these drugs at admission, and residents with severe dementia were more likely to have had their antidementia drugs discontinued. This may be explained as due to the expected limited effectiveness of antidementia drugs, especially for those with severe dementia, or due to intolerability or issues concerning adverse effects. The proportion of residents who received antidementia drugs was higher in our study, despite the decrease after admission, than in studies involving NH residents with dementia or those not limited to dementia that have been conducted in other countries.^{12 16 17} We did not obtain any information on non-pharmacological approaches in this dataset, but some residents who discontinued antidementia drugs may have received rehabilitation for dementia.⁴⁰ Another plausible reason for discontinuation of antidementia drugs might have been to reduce the financial burden incurred by a facility due to the bundled payment system, including drug costs, applying to Roken.²⁵

Compared with a study conducted in some different types of NH/LTCFs in Japan, the prevalence of antipsychotics was slightly lower in our study sample, whereas the prevalence of antidepressants and hypnotics/anxiolytics was comparable.¹⁸ We observed a decreased use of hypnotics and anxiolytics in residents with mild-to-moderate dementia, which led to a decrease in regularly prescribed PD after admission to Roken. The decrease may result from adjustment of the use of hypnotics and anxiolytics in response to symptom changes.¹⁸ In contrast, there were no changes in the prescription of PD in residents with severe dementia found in our study. Therefore, our results suggest that challenges concerning the management of BPSD in residents with severe dementia still remain.

Several studies have been conducted to evaluate the utilisation of PD and DAP in NH/LTCF residents with and without dementia in other countries. Studies conducted in Europe and Australia have reported that half to three-quarters of NH/LTCF residents received at least one PD, which was more frequent than in our study.^{11 14 16 17 20} The prevalence of antipsychotics varied between studies,

ranging from about 10%–60% of residents.^{11 12 14 16 17 20} The relatively low prescription rate of antipsychotics in Roken residents is encouraging, especially because of the lower likelihood of their being prescribed to the older population as well as to those with reduced physical function. However, greater efforts to avoid the use of antipsychotics may be possible in Roken, with improved staffing, resources and staff education.^{6 41} Some successful measures to reduce antipsychotic prescriptions in NHs have been reported in other countries, such as the USA and Canada^{42 43}; however, similar regulatory initiatives have not yet been implemented in Japan.

Hypnotics were found to be the most frequently prescribed PD in the present study, with a decrease in prescription after admission to a facility. In total, a quarter of Roken residents were prescribed hypnotics, which was comparable to findings in a study involving NH/LTCF residents in Norway (22.9% in 2009),¹⁴ but nearly double the prevalence of hypnotics reported in a study in Germany and in Austria (9.9% to 13.3%).¹¹ In Japan, the frequent use of hypnotics is not limited to NH/LTCF residents, as it has also been reported in the outpatient setting.^{44 45} Taken together, the frequent use of hypnotics in Roken residents suggests the need for continuous monitoring of the appropriate use of hypnotics in NH/LTCFs and other community or hospital settings.

The prevalence of anxiolytics in our study was similar to that found in studies from European countries. It was reported that the prevalence of anxiolytics in NH residents was 22.2% in Austria and 10.9% and 12.9% in two different cohorts in Germany, and men were less likely to use anxiolytics.¹¹ Furthermore, a study from Norway observed an increase in the use of anxiolytics from 14.9% in 1997 to 21.9% in 2009, and reported that women and younger residents (age, <80 years) were more likely to use anxiolytics.¹⁴ Therefore, the associations of sex and age with the prescription of anxiolytics observed in our study are consistent with those previous findings.^{11 14}

About 7% of Roken residents with dementia were prescribed antidepressants, and no apparent changes in prescription were observed during 2 months of observation. The prevalence of antidepressants was twice as high as that in older outpatients aged ≥ 75 years (3.7%) in Japan.⁴⁵ However, the prescription rate in our study was considerably lower compared with that reported in studies conducted in other countries, with approximately one-fifth to two-thirds of NH residents with or without dementia reported to have received antidepressants.^{11–17 20} We also found that older age was associated with infrequent use of antidepressants, which is consistent with findings from previous studies; however, we did not observe a significantly greater use of antidepressants in women, which has been reported in previous studies.^{11 14} The lower prevalence of antidepressants may be attributed to the preferred use of anxiolytic benzodiazepines instead of antidepressants for residents with mild depression or anxiety.^{13 46} Future studies are needed to verify the appropriateness of prescribing antidepressants,

including the possibility of underuse, in relation to diagnosis and severity of depression and other indications.^{13 15}

We conducted screening for DAP with reference to lists provided in Japan's national guidelines document ('Guidance of Appropriate Medication for Elderly Patients'), the Anticholinergic Risk Scale and Beers criteria, without quantification of anticholinergic burdens. We found that more than one-third of Roken residents with dementia received DAP. In a study from Helsinki, half of the residents of NHs or assisted living facilities received DAP based on the Anticholinergic Risk Scale.¹⁹ In our study, frequently prescribed DAP included H2-blockers, antipsychotics, and muscarinic receptor antagonists for overactive bladder. Some proton pump inhibitors were replaced with H2-blockers, possibly due to safety concerns, such as kidney diseases, infections, and fractures.⁴⁷ Anticholinergic burden due to H2-blockers should also be considered, especially in the case of concomitant use of other DAP. The prevalence of muscarinic receptor antagonists for overactive bladder was similar to that found in a nationwide study of Roken residents (5.7%).⁴⁸ Given that two-thirds of Roken residents had urinary incontinence,⁴⁸ the prescription rate might be too low. A study involving NH residents in the USA indicated the possibility of an unmet need for treating urinary incontinence in NH/LTCF residents.⁴⁹

This study has several limitations. First, the appropriateness of the prescribed medications could not be determined because we did not collect data regarding the indications for each drug or the duration of treatment. However, most of the drugs studied were PIM, and thus have been considered inappropriate for this population.⁵⁰ Similarly, we did not determine the processes or reasons for the discontinuation of drugs, and further studies are needed to evaluate the appropriateness of drug discontinuation. Second, we did not analyse the data according to facility-level or medical director-level because too few residents were studied per facility. Therefore, there may be variations in prescriptions among different facilities, as previously observed in antipsychotic prescription rates reported in the USA.⁵¹ Third, we could not ensure the representativeness of the present study sample in terms of residents of Roken nationwide because the survey response rate on medications was only approximately 10%. However, the current dataset analysed was the largest available on drug use in Roken facilities. Fourth, our study findings are dependent on the accuracy of the data collected and the items covered. Directions for as-needed drug use by medical directors might not always have been reported. We considered that these limitations may cause overestimation of the prevalence of drugs because of drugs without directions possibly being included as regularly scheduled drugs, or underestimation in cases involving as-needed drugs, which may have been important components of usual medications. As-needed drugs should also be considered as part of complex drug regimens for NH/LTCF residents in future studies.⁵² Fifth, we identified associations

between residents' characteristics and prescriptions, but only limited variables were considered; therefore, there is a possibility of residual confounding, such as in relation to the types of dementia involved. Finally, the generalisability of our findings may be limited to similar types of NH/LTCFs only.

In conclusion, PD and DAP were commonly prescribed for Roken residents with dementia. Taken together, there appears to be scope for deprescription of PD and DAP in Roken residents with dementia to mitigate the risks of adverse events, through engaging in careful reviews, including reviewing current indications and conducting assessments of adverse effects, because the risks in prescribing these drugs may outweigh the benefits.

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