

《 Original Article 》

Effect of Education by Pharmacists on Knowledge of Medications among Care Workers and Incidence of Medical Accident

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Although several studies on pharmacists assisting care workers with patient compliance instructions have been reported, few studies have been reported on the outcomes of pharmacists' interventions. In this study, 28 care workers underwent training on medication administration assistance and medication effect in a special nursing home for the elderly. Thereafter, surveys were conducted before and after the training sessions to assess the current status of medication assistance, interest in knowledge on medicines, and effect of training on the appropriate use of medicines. All care workers felt the need to deepen their knowledge of medicine and interest in the medicines administered to residents. Pharmacists' training significantly improved their understanding of medicines and the willingness of care workers to learn. Both medicine-related and non-medicine-related medical accidents significantly decreased after the training. From our findings, training of nursing staff by pharmacists was useful and can contribute to appropriate use of medical supplies and reduction in medical accidents. Therefore, cooperation between staff of facilities and pharmacists is necessary in medication administration assistance.

Key words; Nursing home, Pharmacist, Educational assistance, Care worker, Medical accident

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1. Introduction

Since elderly individuals often have comorbidities, they tend to use several medicines. Factors to be considered in geriatric medication do

not only side effects and effects on activities of daily living but also a decrease in adherence due to aging-associated dementia. Additionally, the risk of falls increases with increasing prescriptions¹⁾. The most common dysgeusia in individuals aged > 70 years are caused by medicines²⁾. Medicines are

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considered to be the major factor in aggravating peripheral symptoms among elderly individuals with dementia³). Therefore, medicines should be used minimally and judiciously. In realizing this, the direct involvement of care workers and healthcare providers in home care and group home care is especially important. Care workers are often required to provide medication assistance based on accurate knowledge on medicines⁴⁻⁶). Therefore, cooperation between pharmacists and care workers may improve medication administration assistance and promote appropriate use of medicines.^{7,8})

Although several studies on nursing care workers' assistance in medicine administration have been reported⁹⁻¹²), few studies on intervention by pharmacists in nursing facilities, such as education and training for quality improvement and assistance technology for home medical care and promotion of visiting medicine management guidance, have been reported^{13,14}). Furthermore, no quantitative study has been conducted to assess the effect of education provided by pharmacists to caregivers and the usefulness of this education on clinical practice, specifically the effect on the incidence of medical accidents.

In this survey among 28 caregivers at Seikoen, a special nursing home for the elderly in Yubari City, Hokkaido, we investigated the current status of medication assistance, interest in knowledge on medicines, and effect of training on the appropriate use of medicines.

2. Methods

1. Survey participants and methods

Twenty-eight care staff at Seikoen, a special nursing home in Yubari City, Hokkaido,

participated in an educational seminar on medication assistance. To support the education of care workers, these 30-minute group training sessions have been held monthly since February 2011. Findings from the survey were those from the first training session. During the first workshop, participants were educated on medication administration and effect. Regarding administration, instructors provided information on timing of administration before and after meals, volume of water, and restriction to water but not other fluids in administration. Information on the effect of medications included role of sex differences in effect of medicines and differences in effect based on the type of laxative. Thereafter, the second and subsequent training sessions were conducted according to the wishes of the participants, as stated in the questionnaire after the first seminar. The theme of the second session was adverse drug reactions. The lecture covered the following aspects of the theme: definition of side effects, classification of side effects, side effects of drug use, peptic ulcers as side effects of analgesics, aspirin and asthma, oculomucocutaneous syndrome, and toxic epidermal necrolysis.

Two surveys were conducted before and after the seminar in anonymity (Figures 1, 2). In the questionnaire before the seminar, the following were investigated: Attribute, experience of patient compliance to instructions and interest in medications, actual condition of patient compliance assistance, and extent of understanding on judicious use of medicines. After the seminar, the questionnaire assessed the effect of the education on participants' understanding of the judicious use of medicines. The questions on the appropriate use of drugs assessed medication administration before

Occupation (Please check): Nurse, Caregiver, Consultant, Other ()

Q1 Age
 ≤19 years 20-29 years 30-39 years 40-49 years 50-59 years ≥60 years

Q2 Gender Male Female

Q3 Education
 High school graduate Vocational school graduate Junior college graduate University graduate
 Other ()

Q4 Qualifications
 Home helper level 1 Home helper level 2 Home helper level 3 Care worker Care support specialist
 Social worker Registered nurse Registered associate nurse Other ()

Q5 Experience
 Less than 1 year More than 1 year to less than 3 years More than 3 years to less than 5 years More than 5 years to less than 10 years More than 10 years (about__year)

Q6 Number of users currently served (__persons)

Q7 Number of users currently taking medication (__persons)

1. Actual condition of medication assistance

Q8 Do you have experience in assisting patients to take their medication?
 Yes, I have experience No, I have no experience

Q9 (For those who answered "experienced" in Q8) Medication assistance (multiple answers allowed)
 Sorting medications by dose Confirming that the patient has taken the medication Giving the medication
 Applying compresses Applying ointments Suppositories Eye drop assistance Nasal spray assistance
 Ear drops assistance Inhalant medication assistance Enema assistance Assistance with self-injection (insulin) Other ()

Q10 (For those who answered "experienced" in Q8) To improve medication assistance (multiple answers allowed)
 Crushing tablets Splitting tablets Dissolving powder in water Mixing medicines with meals
 Wrapping medicines in oblates Taking tablets, etc. out of their covers Sorting medicines by day or time
 Keeping medication records Others ()

Q11 (For those who answered 1 to 6 in Q10) Did patient's physical condition change during the devising process?
 Always gets unwell Sometimes gets unwell Never gets unwell Others ()

Q12 Have you ever consulted someone about how to help users take their medication?
 Yes, I have. No, I have not.

Q13 (For those who answered "have consulted" in Q12) Who did you consult? (Multiple answers allowed)
 Doctor Pharmacist Nurse Care specialist Care worker Social worker Supervisor Colleague
 Other ()

Q14 Have you ever checked if the device for medication assistance is correct? Yes, I have checked No, I have not checked

Q15 (For those who answered "Yes, I have checked" in Q14) Who did you check with? (Multiple answers allowed)
 Doctor Pharmacist Nurse Care specialist Care worker Social worker Supervisor
 Colleague Other () No check

Q16 (For those who answered "have confirmed" in Q14) How did you confirm? (Multiple answers allowed)
 In person with the person to whom you confirmed in Q15 Personal computer Smart phone Mobile phone
 Book (book title:) Other ()

Q17 Have you ever given someone the wrong medication?
 (1) Yes (2) No

Q18 (Those who answered "Yes" to Q17) Provide details of incorrect medication (multiple answers allowed)
 Forgot to give (all) Forgot to give (some) Gave too much Gave too little Gave wrong dosage (morning, noon, evening, etc.)
 Gave someone else's medicine Other ()

Q19 (For those who answered "experienced" in Q17) Who did you report to in case of the medication error? (Multiple answers allowed)
 Supervisor Facility nurse Facility manager Doctor Pharmacist Nurse No report Other ()

Figure 1 Questionnaire before the workshop

Occupation (Please check): Nurse, Caregiver, Consultant, Other ()
Please answer on a 7-point scale (from 1: not at all to 7: strongly agree).

1.	Entire workshop
Q1	Did the content of the workshop meet your needs? 1 2 3 4 5 6 7
Q2	Was the overall content of the workshop easy to understand? 1 2 3 4 5 6 7
Q3	Did you understand the lecture on how to take medicine (before and after meals)? 1 2 3 4 5 6 7
Q4	I understand "how to take medicine (volume of water for taking medicine)." 1 2 3 4 5 6 7
Q5	I understand "how to take medicine (other than water)." 1 2 3 4 5 6 7
Q6	I understand "how drugs work (in men and women)." 1 2 3 4 5 6 7
Q7	I understand "how drugs work (magnesium oxide and sennoside)." 1 2 3 4 5 6 7
Q8	Did you enjoy the workshop? 1 2 3 4 5 6 7
Q9	Was the training session acceptable? 1 2 3 4 5 6 7
Q10	Are you happy with your participation? 1 2 3 4 5 6 7
Q11	Would you like to participate again next time? 1 2 3 4 5 6 7
Q12	Do you think it will help you in your future work? 1 2 3 4 5 6 7
Q13	Has your anxiety about your daily work reduced? 1 2 3 4 5 6 7
Q14	Has your interest in learning more about medicine increased? 1 2 3 4 5 6 7
Q15	Would you like to continue to study about medication assistance? 1 2 3 4 5 6 7
Q16	Would you ask a pharmacist if you had a question? 1 2 3 4 5 6 7
Additional comment(s)	
If you have any comments or suggestions for improvement, please fill in the form below.	
2.	Pharmacist
Q17	Do you know any pharmacists by name? (Last name only is acceptable) ①Yes (_ persons) ②No
Q18	(If you answered "①Yes" in Q17) Please state the name of the pharmacist. _____
Q19	In the future, will you consult a pharmacist about your or your family member's medication? ①Yes ②No
Q20	What is your perception of pharmacists? ①Friendly ②Not friendly ③Neither
Q21	In the future, will you consult with a pharmacist regarding medications for facility residents? ① Yes ②No

Figure 2-(1) Questionnaire after the workshop

3.	Assistance with medication
Q22	In the future, in devising ways to assist with medication administration, will you consult with anyone? ①I will consult ②I will not consult
Q23	(If you answered "yes" to Q22) Who will you consult? Please select the top four occupations and fill in 1, 2, 3, and 4 in order of priority in parentheses. ①Doctor () ②Pharmacist () ③Nurse () ④Care support specialist () ⑤Care worker () ⑥ Social worker () ⑦Supervisor () ⑧Colleague () ⑨Other () ()
Q24	Will you confirm whether the device for medication assistance is correct or not? ①I check ②I do not check
Q25	(If you answered "yes" to Q24) Who will you check with? Please select the top four occupations and fill in 1, 2, 3, and 4 in order of priority in parentheses. ①Doctor () ②Pharmacist () ③Nurse () ④Care worker () ⑤Care worker () ⑥Social worker () ⑦Supervisor () ⑧Colleague () ⑨Other () () ⑩No confirming party
Q26	If a medication error occurs, to whom will you report? Please select the top four positions and fill in 1, 2, 3, and 4 in order of priority in parentheses ①Supervisor () ②Facility nurse () ③Facility manager () ④Doctor () ⑤Pharmacist () ⑥Nurse () ⑦No report ⑧Other () ()
4.	Learning Effects
Q27	Are you interested in the medications the user is taking? (1) I am very interested (2) I am interested (3) I am not very interested (4) I am not interested
Q28	(If you answered "①Very interested" or "②Interested" in Q27) What are you interested in? Please choose the top four and fill in 1, 2, 3, and 4 in parentheses in order of interest. ①Drug effects () ②Side effects () ③Combination with other medicines () ④ Combination with food and drink () ⑤Method of administration () ⑥Crushing tablet () ⑦Dissolution of medicine (water, etc.) () ⑧Purpose or necessity of administration () ⑨ Others ()
Q29	Do you think it is necessary for facility staff to have a better knowledge of medicines? ①Very much ②A little ③ Not very much ④Not at all
Q30	(For those who answered "very much" or "a little" to Q29) How will you improve your knowledge? ①In-house workshop②Outside workshop ③Books (book title:) ④Personal computer (5) Smart phone ⑥ Mobile phone ⑦Ask pharmacists ⑧Others ()
Q31	What would you like to see as the theme of the workshop? Please select your top four preferences and fill in 1, 2, 3, and 4 in parentheses in order from most to least preferred. ①Drug effects () ②Side effects () ③Combination with other medicines () ④ Combination with food and drink () ⑤Dosage method () ⑥Crushing tablet () ⑦ Dissolution of medicine (water, etc.) () ⑧Purpose or necessity of taking () ⑨Others () (Contents:)

Figure 2-(2) Questionnaire after the workshop

and after meals, volume of water during administration, use of other fluids in administration, sex difference in the effect of medicines, and differences between magnesium oxide and sennoside. Furthermore, questions on the awareness of the training sessions assessed participants' perception of relevance, attitude towards knowledge acquisition on medications, future plans on further training in medication assistance, and work-related anxiety. Responses to these questions were assessed on a 7-point scale, ranging from 1 (Strongly disagree) to 7 (Strongly agree).

Additionally, we investigated the incidence of medicine-related and non-medicine-related medical accidents before and after the training programs. The average of medical accidents for each month of the 3 months prior to the pharmacist training was set at 100%. The percentage of the number of medical accidents in each month of the 3 months after the pharmacist training to the average of the 3 months before the training was calculated. The average of the percentages for each month during the 3 months following the pharmacist training was used as the post-training rate of medical accidents.

2. Statistical analysis

In analyzing survey findings, we used the two-sided Wilcoxon's signed rank test. Student's t-test was used to compare the incidence of medical accidents before and after training. $p < 0.05$ indicated statistical significance.

3. Ethical considerations of research

The purpose of this study was to educate care workers and address their work-related problems. On December 22, 2014, the Ethical Guidelines for Medical Research Involving Human Subjects was promulgated. At the time of this study (February 2011), the scope of indications that were valid was "Epidemiological studies aimed at the elucidation of the origin and disease state of human diseases and the establishment of methods of prevention and treatment are targeted, and all parties involved in these studies are required to observe them". According to the Yubari Medical Centre Ethics Committee, this study was outside the scope of the ethical guidelines. However, to ensure the anonymity of respondents based on ethical considerations regarding recruitment of participants, participation was voluntary and questionnaires were

completed anonymously.

3. Results

1. Characteristics of Respondents

Seven participants (25%), five (7%), seven (25%), seven (25%), and two (7%) participants were aged 20–29, 30–39, 40–49, 50–59, and above 60 years, respectively. The participants included eight (29%) men and 20 (71%) women. The participants' levels of qualification comprised home helper level 3 (2 participants, 7%), nursing care staff first-level training, (7 participants, 25%), nursing care worker practical training (1 participant, 4%), nursing care worker (18 participants, 64%), nursing care assistance specialist (8 participants, 29%), and other questions, such as nurses and dietitians (9 participants, 2%). Since some participants had multiple qualifications, an overlap in responses were observed. Regarding the number of working years, one (4%), two (7%), two (7%), 18 (64%), and five (18%) participants had worked for < 1 year, 1 year to < 3 years, 3 years to < 5 years, 5 years to < 10 years, and ≥ 10 years, respectively (Table 1).

Table 1 Characteristics of survey respondents (n = 28)

		Frequency (Percentage)
Age (years)	≤ 19	0 (0%)
	20–29	7 (25%)
	30–39	5 (18%)
	40–49	7 (25%)
	50–59	7 (25%)
	≥ 60 years	2 (7%)
Qualifications (Duplicated by multiple answers)	Care worker	18 (64%)
	Care assistance specialist (Care manager)	8 (29%)
	Training for beginners of care workers	7 (25%)
	Home Helper Grade 3	2 (7%)
	Practical training for certified care workers	1 (4%)
	Other (nurses, dietitians)	9 (32%)
Years of experience (years)	<1	1 (4%)
	1–<3	2 (7%)
	3–<5	2 (7%)
	5–<10	18 (64%)
	≥ 10	5 (18%)

2. Questionnaire Findings

2.1. Experience with medication assistance and interest in medicines

In total, 93% of participants had had an experience of medication assistance. All participants indicated an interest in the medicines taken by residents. Additionally, all participants agreed that further knowledge about medicine was needed. However, most participants (84%) indicated that they barely or do not engage in opportunities to improve their knowledge on medicines.

2.2. Medication assistance

Respondents different tasks in medication assistance. Twenty-six (12.1%) respondents applied ointment, 25 (11.7%) respondents administered medicines, 25 (11.7%) respondents applied poultice, 25 (11.7%) respondents assisted application of eye

drops, 24 (11.2%) respondents confirmed dosing, 21 (9.8%) respondents inserted suppository, 17 (7.9%) respondents sorted administration, 17 (7.9%) respondents assisted enema application, 12 (5.6%) respondents assisted ear drop application, 12 (5.6%) respondents assisted administration of inhalants, 9 (4.2%) respondents assisted administration of nasal sprays, and one respondent (0.5%) assisted self-injection (Table 2).

To improve medication assistance, 19 (16.0%) respondents wrapped medicines in oblates, 17 (14.3%) respondents dissolved powder in water and other fluids, 17 (17.3%) respondents mixed medicines with meals, 16 (13.4%) respondents patients crushed tablets, 16 (13.4%) respondents kept medication records, 14 (11.8%) respondents sorted medicines by day or time, 12 (10.1%) respondents split tablets, and eight (6.7%) respondents took tablets out of their covers (Table 3).

Table 2 Details of medication assistance

Items	Frequency (Percentages)
Application of ointment	26 (12.1%)
Give someone medicine	25 (11.7%)
Poultice application	25 (11.7%)
Assistance with eye drops	25 (11.7%)
Confirmation of dosing	24 (11.2%)
Insertion of suppository	21 (9.8%)
Sorting by dose	17 (7.9%)
Enema assistance	17 (7.9%)
Assistance with ear drops	12 (5.6%)
Assistance with inhalants	12 (5.6%)
Nasal spray assistance	9 (4.2%)
Assistance with self-injection	1 (0.5%)

The percentage shows the proportion of the total number of activities.

Table 3 Ingenuity of medication assistance

Items	Frequency (Percentage)
Wrap the medicine in an oblate	19 (16.0%)
Dissolve powdered medicine in water, etc.	17 (14.3%)
Mix medicine into one's diet	17 (14.3%)
Crush a tablet	16 (13.4%)
Keep a medication record	16 (13.4%)
Sorting medicines by day of the week and hour	14 (11.8%)
Break a tablet	12 (10.1%)
To take a tablet out of a sheet	8 (6.7%)

The percentage shows the proportion of the total number of activities.

2.3. Change in intelligibility

The degree of understanding was investigated before and after the training on the appropriate use of medicines.

The changes in understanding on how medicines should be administered were investigated. Participants indicated a significant improvement in understanding on administration before and after meals, volume of water used in administration, and use of other fluids aside water (Figure 3).

Similarly, participants were assessed on their understanding of the effect of medicines. After the

training, participants had significantly improved in their degree of understanding on the role of sex differences in the effect of medicines and the differences between magnesium oxide and sennoside (Figure 4).

2.4. Awareness of training

The effect of the training provided by the pharmacist was investigated. Averagely, the participants strongly agreed the training would be useful in the future (6.48 ± 0.99). They agreed their interest in learning about medicine had increased (5.97 ± 1.32). They agreed they will continue to

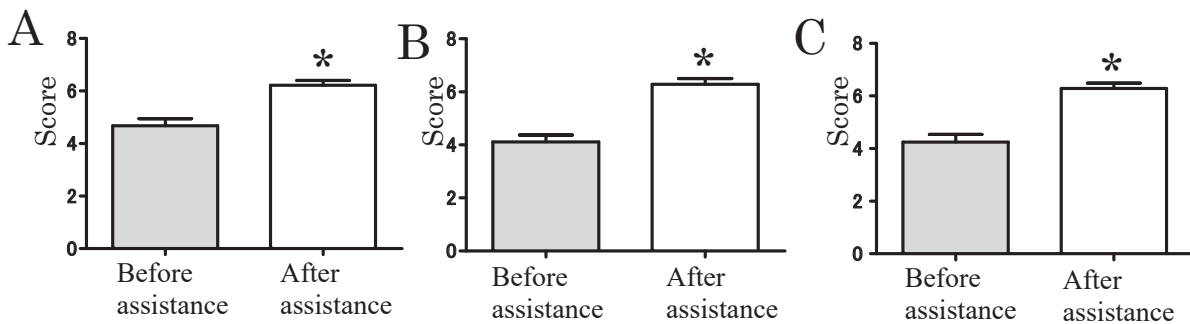


Figure 3 Changes in understanding of "how to take medicine" through educational assistance

A: Understand how to take medicine (before and after meals)
 B: Know how to take medicine (volume of water for taking medicine)
 C: Understand how to take medicine (other than water)
 Mean±S.E., n=28, * : $p < 0.05$ (Before assistance vs. After assistance)

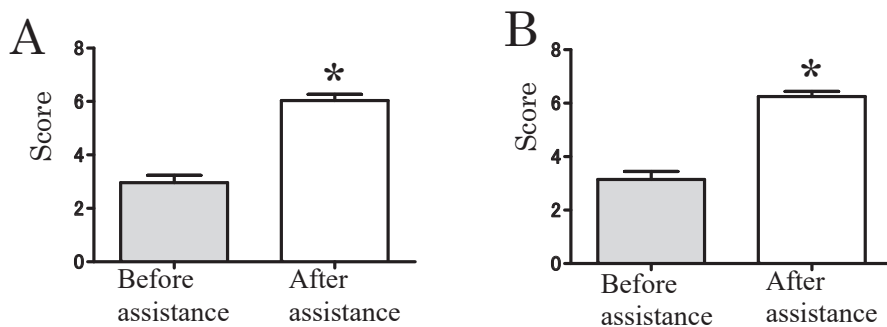


Figure 4 Changes in understanding of the difference in effects of medicine

A: Understand a drug may work differently for men and women
 B: Understand the difference between magnesium oxide and sennoside
 Mean±S.E., n=28, * : $p < 0.05$ (Before assistance vs. After assistance)

improve their knowledge on medication assistance (5.83 ± 1.31). Additionally, they agreed that anxiety levels at work had reduced (5.66 ± 1.40). Averagely, an evaluation of 5 out of 7 was obtained in all of these survey items (Table 4).

2.5. Incidence of medical accidents

The incidence of medicine-related and non-medicine-related accidents 3 months before the training was set to 100%. After the training, the incidence of both “medicine-related” and “non-medicine-related” medical accidents decreased significantly ($p < 0.05$) at 33.3% and 72.2%, respectively (Figure 5). Non-drug-related medical accidents decreased for falls while walking or sitting in a wheelchair. For drug-related medical accidents, errors associated with administration after breakfast, lunch, and dinner and errors associated with administration before and after

meals were reduced.

4. Discussion

Our study findings indicate that educational support by pharmacists in special nursing homes is useful and can contribute to the appropriate use of drugs and reduce medical accidents. Regarding the appropriate use of drugs, we investigated changes in care workers’ understanding of “how to take drugs” and “differences in the effects of drugs” and found significant improvement in their understanding. Additionally, 93% of the caregivers surveyed in this study helped patients in drug administration, and all of them thought they needed to learn more about drugs. This suggests that they had a high level of understanding of the content of the lecture.

Our study further suggests that training of care

Table 4 Participants’ perception of training

	Mean ± S.E.
Do you think it will be useful in the future?	6.48 ± 0.99
Has your interest in learning about medicine increased?	5.97 ± 1.32
Do you think you will continue to study for medication assistance?	5.83 ± 1.31
Did you get rid of anxiety in your daily work?	5.66 ± 1.40

Responses to above questions were assessed on a 7-point scale, ranging from 1 (Strongly disagree) to 7 (Strongly agree).

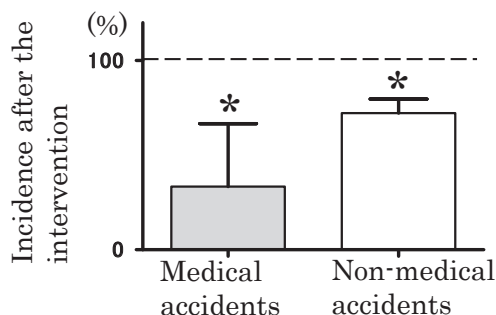


Figure 5 Incidence of medical accidents after educational assistance

The incidence of medicine-related and non-medicine-related accidents 3 months before the training was set at 100%. Mean±S.E., * : $p < 0.05$ (Before assistance vs. After assistance)

workers on medication assistance contributes to reduction in medical accidents. This finding strongly suggests the usefulness of cooperation between care workers and pharmacists. In the lecture, pre- and postprandial administration of drugs was discussed, suggesting that it may have been effective in reducing the incidence of drug-related medical accidents. Not only did the number of medication-related medical accidents decrease significantly, as expected, the number of non-medication-related medical accidents also decreased, despite the fact that no lectures were given. This observation seems to be unrelated to the effect of the training, but care workers' improved understanding of pharmaceuticals increased their awareness at work and caused behavior changes.

From the survey findings, all care workers felt the need to improve their knowledge of medicines and were interested in the medicines that the users were taking. Although they felt the need to deepen their knowledge of medicines, few opportunities to learn about medicine and medication assistance were available. Hisayoshi et al.¹³⁾ reported the need for nursing care staff and pharmacists to learn about and exchange information on pharmaceuticals to enable pharmacists obtain information on residents. Additionally, they indicated that such improved levels of understanding allow for appropriate prescription recommendations to physicians, while reducing the need for questions about medications among care staff. According to Uda and Maki^{15,16)}, several care workers consult fellow care workers with questions and concerns about medicines but rarely consult pharmacists, suggesting that the current level of cooperation between care workers and pharmacists is insufficient. Maki further stated that after focused group discussions between

pharmacists and facility care workers, care workers began to consult pharmacists on medication concerns¹⁷⁾. It is socially desirable that pharmacists with expert knowledge on pharmacokinetics are directly involved in the care of the aged population with comorbidities¹⁸⁾. Therefore, creation of opportunities for improved interactions between pharmacists and care workers is necessary.

Regarding the content of training provided by pharmacists, information on ingestion and medicine management are necessary. Okuno et al. discussed the need for pharmacists to provide drug information to care workers in addition to providing direct guidance to patients¹⁸⁾. However, Kasahara et al. argue that some expected duties of pharmacists-related have been taken up by nurses. Therefore, the incorporation of pharmacists in management guidance is not promoted¹⁹⁾. Pharmacists recognize that care staff have challenges with medication assistance and consider that active involvement is required for problem-solving. Additionally, Maki²⁰⁾ reported the need for pharmacists to actively participate not only in the supply of medicines but also in administration assistance by reviewing dosage. Therefore, cooperation among healthcare professionals is indispensable in ensuring the appropriate use of medicines among the elderly in nursing homes, and pharmacists should contribute to management from the pharmaceutical perspective.

Additionally, due to the understanding obtained from the educational assistance, all care workers had a high evaluation with an average score of ≥ 5 . By estimation, this evaluation will improve the motivation of the care workers to learn. Similarly, Tomizawa et al.²¹⁾ reported that training of care workers by pharmacists improves the degree of

understanding of medicines, increases motivation to learn about medicines, and encourages further learning and understanding.

Currently, the cooperation between care workers and pharmacists is insufficient. Training by pharmacists in nursing homes is useful and can contribute to the appropriate use of medicines and reduction in medical accidents. Therefore, positive cooperation between nursing staff and pharmacists will be necessary for ensuring the appropriate use of medical supplies among residents.

Conflict of Interest

None of authors has any conflict of interest to declare.

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