Evaluation of Home Medical Care Pharmacists’ Services by Physicians, Nurses, Care Managers, and Home Helpers: A Mail Survey

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Research Article

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Abstract

Background: Home medical care has become a widely used and effective form of delivery for essential medical services. While it has been suggested that pharmacists can play an active role in home medical care, no study has been conducted that has accurately investigated the positive effects of pharmacists on home medical care or the influence pharmacists have on other medical professionals. The present study aimed to evaluate pharmaceutical care provided by home medical care pharmacists according to other medical professionals.

Methods: A mail survey was distributed, and 222 individuals responded. All participants had previously participated in the delivery of home medical care. A stratified analysis was used to compare responses between groups who had collaborated with pharmacists in home medical care and those who had not. Customer satisfaction analysis was conducted to identify areas for improvement in home medical care.

Results: Our results indicated the importance of pharmacists' participation in home medical care teams. Specifically, pharmacists' participation was associated with improving the management of medication storage by patients, providing explanations about how to take medicine, and reducing incidents or accidents related to taking medications. Further, the results indicated the need for pharmacists and other medical professionals to collaborate with each other.

Conclusions: These findings indicate the value of pharmacists' involvement in home medical care and the areas that can be improved. For example, pharmacists involved in home medical care could take a more active role in areas of medical care such as providing education on drug effects and the safe use of drugs.

Ethical Considerations: This study was approved by the Ethics Committee of the Showa University School of Pharmacy (approval no. 211) and conducted in accordance with Japanese ethical guidelines for epidemiological research and the Declaration of Helsinki. All respondents provided informed consent prior to participation.

Background

In Japan, the population is aging at a rapid and unprecedented pace. Of a total population of 126,496,000 in 2018, the population aged 65 years and over was 35,508,000 or 28.1%, representing the highest proportion of older people in the world.\(^1\) Older adults are increasingly affected by multiple chronic diseases and complex medication regimens are required to treat these conditions. Home medical care is an ideal care setting where patients can be interviewed in their own environment to gain the best understanding of their disease management goals as well as the limitations they face in the management of their medications.\(^2\)

Two-thirds of adults aged 65 years and over have two or more of the 15 conditions identified as chronic, and 37% have four or more.\(^3\) Multiple chronic diseases often require the involvement of several
Prescribed medications are an essential component of the care of older patients, and are valuable in the prevention, management, and cure of diseases. However, inappropriate medication use may lead to adverse effects and carry more risks than benefits. Several studies have shown that the use of potentially inappropriate medications in older patients correlates with an increased rate of adverse drug reactions, health care utilization, death, poor medication adherence, and a greater economic burden. The cost of potentially inappropriate medication is estimated to be high, and it represents an important topic for public health worldwide. Potentially inappropriate medication use among older home care patients is common and it is an important issue in developed countries with aging populations, including Japan, where the number of older home care patients is predicted to increase rapidly in the near future.

Patients frequently receive prescriptions for contraindicated medications or multiple medications for the same indication, but older adults are often unaware of these errors because they lack sufficient knowledge about their medications. It has previously been reported that individuals lacking knowledge or understanding about their medications are more likely not to consult a pharmacist. However, our previous study showed that consultation with a pharmacist appears to improve awareness among medication users and makes them more likely to use appropriate medication; individuals who consulted a pharmacist were also better able to identify side effects and take appropriate actions regarding the impact of their medications. A previous study in the United Kingdom further demonstrated the importance of the pharmacist in health management and examined participants’ use of their pharmacy. Therefore, active consultation with a pharmacist, who is a specialist in medication, may help to compensate for the patient’s lack of knowledge or understanding about their medications.

Home medical care, however, requires an individually targeted multidimensional team approach rather than the involvement of a single pharmacist. Previous research has examined collaborations between health care professionals in the community setting, including a study in which pharmacists and nurses collaborated to provide education on hypertension, which led to a decrease in systolic blood pressure among the participants. Furthermore, a study in Norway showed that home visits and collaboration between medical professionals including physicians, pharmacists, and nurses are important factors in the provision of reliable health-promoting risk assessments of older home patients to prevent morbidity. In a Japanese study, Takada et al. reported that the number of home visits by pharmacists was less than 10% of it by nurses exceeded 70%. Therefore, most nurses are engaged in medicine-related work, and about 60% of nurses feel that the care-related medicine is not enough. These findings indicate that cooperation between providers of home medical care is required, including the participation of pharmacists, in order to provide effective home medical care.

It therefore appears that the collaboration of pharmacists with other medical professionals is indispensable to facilitating effective home medical care. Although it has been suggested that pharmacists can play an active role in home medical care, no study has yet been conducted that has
accurately investigated the positive effects of pharmacists on home medical care and identified the influence pharmacists have on other medical professionals. Therefore, in the present study, we examined the opinions of medical professionals, such as physicians, nurses, care managers, and home helpers, toward pharmacists with the aim of evaluating the pharmaceutical care provided by home medical care pharmacists to identify strategies to improve the delivery of effective home medical care.

Methods

Study Design

A voluntary mail survey was distributed to respondents via the websites of the Kanto-Shinetsu Regional Bureau of Health and Welfare (https://kouseikyoku.mhlw.go.jp/kantoshinetsu/index.html) for doctors and the Welfare and Medical Service Network System (https://www.wam.go.jp/content/wamnet/pcpub/top/) for nurses, care managers, and home helpers participating in home medical care. A total of 800 participants (200 participants per occupation) located in Tokyo, Kanagawa, Chiba, or Saitama were recruited from the website databases. All identifying information was kept confidential. The survey items are shown in Tables 1–3.

Table 1
Survey questions used to collect basic information

| Q1. Have you been involved with the pharmacist at home medical care? |
|---------------------------------------------------------------|
| Q2. Do you think that the pharmacists need to be involved in home medical care? |
| Q3. What did you consult with the pharmacist at home medical care? |
| What did you get from the pharmacist at home medical care? |
| e.g., intention of prescription, management of a medicine, how to explain about a medicine, side effect, drug information, unused or leftover medicine, mental care for a patient and the family, patient's compliance, nothing, others. |
Table 2
Questions used to survey the consideration of overall home medical care that respondents are engaged in

| Q4. Have you had enough time for home medical care? |
|--------------------------------------------------|
| Q5. Have you confirmed the contents of prescriptions appropriately? |
| Q6. Have you managed the storing of patients’ medicine appropriately? |
| Q7. Have you explained the information of medicine to the patient appropriately? |
| Q8. Have you explained how to take medicine to the patient appropriately? |
| Q9. Have you coped with side effects of medicine appropriately? |
| Q10. Have you confirmed the drug interactions appropriately? |
| Q11. Have you comprehended the unused or leftover medicine appropriately? |
| Q12. Have you had enough mental care for patients and their families? |
| Q13. Have you had sufficient measures to ensure drug compliance? |
| Q14. Comprehensively, has home medical care involving you been done beneficially? |

Table 3
Questions used to survey the consideration of home medical care conducted as a medical profession team

| Q15. Do you think the team reduces incidents or accidents? |
|----------------------------------------------------------|
| Q16. Do you think it is necessary to hold drug study sessions by pharmacists? |
| Q17. Do you think it is necessary to collaborate with other medical professions? |
| Q18. Do you think the team reduces medical expenses by engaging in proper use of drug? |
| Q19. Do you think medical therapy is appropriately done by the conference with other medical profession? |
| Q20. Do you think the team increase the time to do your professional work? |
| Q21. Do you think the consultation system on medicine is enough? |
| Q22. Do you think sharing information with other medical profession is enough? |
| Q23. Comprehensively, has home medical care conducted on the team been done beneficially? |

Customer satisfaction analysis

Customer satisfaction (CS) analysis is a widely used method\(^{31-34}\) to identify factors that can lead to service improvements by analyzing the relationship between the degree of satisfaction in each element of home medical care and the degree of comprehensive satisfaction its entire site. To evaluate the satisfaction of respondents with various home medical care activities, a five-segment rating method was
used (0, strongly no; 1, no a little; 2, neither yes nor no; 3, yes a little; 4, strongly yes) to calculate the “satisfaction deviation score.” This value was defined as the degree of deviation of satisfaction, with higher degrees of satisfaction relating to greater deviation. To evaluate the importance of a given element in various home medical care activities, the correlated coefficient of the comprehensive satisfaction (Q14 and Q23) was calculated for each site and transformed into a deviation value, termed the “related deviation score” of importance degree. The deviation value of importance degree represented the degree of comprehensive influence. The vertical axis represented the “satisfaction deviation score” of satisfaction degree, and the horizontal axis represented the “related deviation score” of importance degree. All elements were converted into CS graphs (Figs. 3 and 4) divided into four quadrants, each of which was closely related to comprehensive satisfaction. The quadrant labeled “emphasis maintenance field” indicated a high degree of satisfaction closely related to comprehensive satisfaction, while “maintenance field” indicated a high degree of satisfaction but low relevance to comprehensive satisfaction. Conversely, the “improvement field” indicated an area of low of satisfaction and low relevance to comprehensive satisfaction, while “priority improvement field” indicated a low degree of satisfaction but high relevance to comprehensive satisfaction.

**Statistical Analysis**

All statistical analyses were performed using SPSS v.22 (IBM, Tokyo, Japan). Stratified analysis was used to compare responses from participants who had interacted with pharmacists in a home medical care setting to those who had not. The statistical significance of Q2 and Q3 was evaluated using Fisher’s exact test, while Q4–Q23 was evaluated using Student’s t-test or Welch’s t-test after homoscedasticity was determined by Levene’s test. Values of $P < 0.05$ were considered statistically significant.

**Results**

**Respondents’ characteristics**

In total, 222 individuals who had previously participated in the provision of home medical care responded to the survey, reflecting a response rate of 28%. Table 4 shows the distribution of sex, age, and occupation of the respondents.
Table 4
Respondents’ characteristics

| Sex   | n  | %  |
|-------|----|----|
| Male  | 76 | 34 |
| Female| 138| 62 |
| N.A.  | 9  | 4  |
| Total | 222| 100|

| Age   | n  | %  |
|-------|----|----|
| 20–29 | 5  | 2  |
| 30–39 | 27 | 12 |
| 40–49 | 91 | 41 |
| 50–59 | 65 | 29 |
| 60–69 | 24 | 11 |
| 70–   | 2  | 1  |
| N.A.  | 8  | 4  |
| Total | 222| 100|

| Occupation | n  | %  |
|------------|----|----|
| Physician  | 46 | 21 |
| Nurse      | 80 | 36 |
| Care manager | 31 | 14 |
| Home helper | 65 | 29 |
| Total      | 222| 100|

Necessity of pharmacist participation in home medical care (Q1–2)

Data relating to the opinions of other medical professionals regarding the necessity of pharmacists’ participation in home medical care are shown in Fig. 1. A total of 37 physicians (80.4%), 73 nurses (91.3%), 54 care managers (83.1%), 18 home helpers (58.0%), and 182 respondents overall (82.0%) had previously collaborated with pharmacists in the provision of home medical care (Fig. 1, Q1). Participants who had or had not previously collaborated with pharmacists in home medical care were designated as Group A and Group B, respectively. In addition, 41 physicians (89.1%), 78 nurses (98%), 60 care managers
(92.3%), 27 home helpers (87.1%), and 206 respondents overall (92.8%) indicated that pharmacists should be involved in home medical care (Fig. 1, Q2a).

As shown in Fig. 1, Q2b, the total number of respondents who stated that pharmacists should be involved in home medical care was 174 in Group A (95.6%) and 32 in Group B (80.0%), indicating that the percentage of total respondents who stated that pharmacists should be involved in home medical care was significantly higher in Group A than in Group B ($P < 0.01$). The number of physicians who indicated that pharmacists should be involved in home medical care was 33 in Group A (89.2%) and 8 in Group B (88.9%). Of note, the number of physicians who gave a response of “strongly yes” was 13 in Group A (35.1%) and none in Group B (0%), indicating that the percentage of physicians who provided this response was significantly higher in Group A than in Group B ($P < 0.01$). The number of care managers who indicated that pharmacists should be involved in home medical care was 53 in Group A (98.1%) and 7 in Group B (63.6%). The percentage of care managers who indicated that pharmacists should be involved in home medical care in Group A was significantly higher than that in Group B ($P < 0.01$). In contrast, the number of nurses who stated that pharmacists should be involved in home medical care was 71 in Group A (97.3%) and 7 in Group B (100.0%), with no significant difference between the groups. The number of home helpers who stated that pharmacists should be involved in home medical care was 17 in Group A (94.4%) and 10 in Group B (83.3%), again with no significant difference between the groups.

**Relationship between pharmacists and other medical professions in home medical care (Q3)**

The results for questions about the relationship between pharmacists and other medical professionals in home medical care are shown in Fig. 2. Respondents were asked about the nature of their consultations with pharmacists and what services they received from pharmacists. They selected from the following choices: “intention of prescription,” “management of a medicine,” “how to explain about a medicine,” “how to take a medicine,” “side effect,” “drug interaction,” “unused or leftover medicine,” “mental care for a patient and family,” “patient’s compliance,” “nothing,” or “others.” Participants could give multiple answers (Fig. 2, Q3). No difference was observed between the responses of physicians and home helpers. The percentage of nurses who consulted pharmacists on “side effect,” “drug interaction,” “unused or leftover medicine,” and “patient’s compliance” was significantly higher than that of nurses who received these services from pharmacists: 39 (53.4%) vs. 26 (35.6%) nurses answered “side effect” ($P < 0.05$), 41 (56.2%) vs. 22 (30.1%) answered “drug interaction” ($P < 0.01$), 53 (72.6%) vs. 34 (46.6%) answered “unused or leftover medicine” ($P < 0.01$), and 41 (56.2%) vs. 28 (38.4%) answered “patient’s compliance” ($P < 0.05$) as items about which they consulted with pharmacists and what services they received from pharmacists, respectively. The percentage of care managers who consulted on “drug interaction,” “unused or leftover medicine,” and “patient’s compliance” was significantly higher than that of care managers who received these services from pharmacists. In contrast, the percentage of care managers who consulted on “intention of prescription” was significantly lower than that of care managers who received this service from pharmacists. Furthermore, 20 (37.3%) vs. 9 (16.7%) care managers answered “drug interaction” ($P <
0.05), 40 (74.1%) vs. 23 (42.6%) answered “unused or leftover medicine” \((P < 0.01)\), 32 (59.3%) vs. 17 (31.5%) answered “patient’s compliance” \((P < 0.01)\), and 21 (38.9%) vs. 40 (74.1%) answered “intention of prescription” \((P < 0.01)\) regarding their consultations with pharmacists and what services they received from pharmacists, respectively.

**Overall home medical care engaged in by respondents (Q4–14)**

Figure 3 shows the results for the consideration of overall home medical care in which the respondents were engaged, using CS analysis. The average value of Q8 and Q9 for nurses in Group A was significantly higher than that in Group B \((P < 0.01)\). In addition, the average value of Q6 for home helpers in Group A was significantly higher than that in Group B \((P < 0.05)\). Involvement of pharmacists with physicians increased the “related deviation score” of Q6, Q12, and Q13 and caused a shift from the “improvement field” to the “priority improvement field.” In contrast, the “related deviation score” for Q5 was decreased, and caused a shift from the “emphasis maintenance field” to the “maintenance field.” Involvement of pharmacists with nurses increased the “related deviation score” for Q7 and caused a shift from the “improvement field” to the “priority improvement field,” increased the “satisfaction deviation score” and the “related deviation score” for Q8, and caused a shift from the “improvement field” to the “emphasis maintenance field.” In contrast, the “related deviation score” for Q6 was decreased and shifted from the “emphasis maintenance field” to the “maintenance field.” Involvement of pharmacists with care managers increased the “related deviation score” for Q6 and Q12 and caused a shift from the “maintenance field” to the “emphasis maintenance field.” In contrast, the “satisfaction deviation score” and the “related deviation score” for Q7 were decreased and shifted from the “emphasis maintenance field” to the “improvement field,” while the “related deviation score” for Q8 was decreased and shifted from the “emphasis maintenance field” to the “maintenance field” and the “related deviation score” for Q10 was decreased and shifted from the “priority improvement field” to the “improvement field.” Involvement of pharmacists with home helpers increased the “satisfaction deviation score” for Q6 and caused a shift from the “improvement field” to the “maintenance field,” increased the “satisfaction deviation score” and decreased the “related deviation score” for Q12 and shifted from the “priority improvement field” to the “maintenance field,” and increased the “satisfaction deviation score” and “related deviation score” for Q13 and shifted from the “priority improvement field” to the “emphasis maintenance field.” In contrast, the “satisfaction deviation score” for Q5 was decreased and shifted from the “maintenance field” to the “improvement field,” the “related deviation score” for Q9 was decreased and shifted from the “priority improvement field” to the “improvement field,” and the “satisfaction deviation score” for Q10 was decreased shifted from the “maintenance field” to the “improvement field.”

**Home medical care conducted by a medical profession team (Q15–23)**

Figure 4 shows the results for home medical care conducted by a medical profession team, using CS analysis. The average value for Q21, Q22, and Q23 for nurses in Group A was significantly higher than
that for nurses in Group B (Q22; \( P < 0.05 \), Q21 and Q23; \( P < 0.01 \)). In addition, the average value for Q20 and Q21 for care managers in Group A was significantly higher than that for Group B (\( P < 0.05 \)). The analysis showed that the involvement of pharmacists with physicians increased the “related deviation score” for Q17 and caused a shift from the “maintenance field” to the “emphasis maintenance field,” and increased the “related deviation score” for Q22, although the field did not change. In contrast, the “related deviation score” for Q16 and Q20 was decreased and shifted from the “priority improvement field” to the “improvement field.” Involvement of pharmacists with nurses increased the “satisfaction deviation” for Q21 and Q22, although the field did not change. In contrast, the “related deviation score” for Q16 and Q18 was decreased and shifted from the “emphasis maintenance field” to the “maintenance field.”

Involvement of pharmacists with care managers increased the “related deviation score” for Q22 and caused a shift from the “improvement field” to the “priority improvement field,” and increased the “satisfaction deviation” for Q21, although the field did not change. In contrast, the “related deviation score” for Q17, Q18, and Q19 was decreased and shifted from the “emphasis maintenance field” to the “maintenance field.” Involvement of pharmacists with home helpers increased the “related deviation score” for Q15 and caused a shift from the “maintenance field” to the “emphasis maintenance field,” increased the “related deviation score” for Q21, and shifted the “improvement field” to the “priority improvement field.” In contrast, the “related deviation score” for Q18 and Q19 was decreased, and shifted from the “emphasis maintenance field” to the “maintenance field.”

**Discussion**

The collaboration of a medical profession team in providing home medical care can improve the standard of care and facilitate reliable health-promoting risk assessments.\(^5\,29\) The active collaboration of pharmacists with other medical professionals can also lead to better medical care. Therefore, pharmacists need to understand what services they should provide and what other medical professionals require from them. Our findings indicate that medical professionals who have collaborated with pharmacists in home medical care (Group A) were more likely to consider pharmacists as indispensable in this collaboration (Fig. 1). Therefore, to facilitate effective consultation with other medical professionals, pharmacists should establish good relationships with their regular collaborators. Of note, 82.1% of respondents in Group B thought that pharmacists should be involved in home medical care but had not previously collaborated with pharmacists in this setting (Fig. 1, Q2b). However, although physicians and care managers in Group A were more likely to consider pharmacists as essential to home medical care, there was no difference for nurses and home helpers between the two groups. The data indicate that nurses already think that pharmacists should be involved in home medical care without regard to the previous their involvement, but home helpers may not have a similar understanding. Therefore, pharmacists should collaborate more actively with home helpers to ensure effective home medical care as part of a professional medical team.

To deliver effective medical care, medical professionals should have access to adequate information about the patient and should share it with other medical team members. Because the information
required by the various collaborators is dependent on their profession, the information required and provided should match as much as possible. Our results showed that physicians, nurses, and care managers selected “intention of prescription,” “side effect,” “drug interaction,” “unused or leftover medicine,” and “patient’s compliance” as information that they frequently requested from pharmacists. This finding indicated that physicians, nurses, and care managers regarded pharmacists as knowledgeable regarding information about patients after taking medicines as well as being informed about medicines. In addition, physicians frequently required information on “intention of prescription,” “drug interaction,” “unused or leftover medicine,” and “patient’s compliance,” indicating that pharmacists frequently support physicians in optimizing their prescribing practices. There was no difference between the groups with respect to requests to pharmacists by home helpers, and pharmacists provided information on “intention of prescription,” “management of a medicine,” and “how to take a medicine” to these collaborators. This finding suggested that pharmacists are aware of the value of providing this information to home helpers because of their close relationship with patients in home medical care settings. Conversely, the percentage of nurses who consulted pharmacists about “side effect,” “drug interaction,” “unused or leftover medicine,” and “patient’s compliance” was significantly higher than that of nurses who obtained these services from pharmacists. The percentage of care managers who consulted pharmacists on “drug interaction,” “unused or leftover medicine,” and “patient’s compliance” was also significantly higher than that of care managers who obtained these services from pharmacists. Pharmacists must give this information to care managers preferentially in home medical care to match the information required and provided with each other. The sharing of appropriate information about patients’ medical care is necessary to ensure an effective working relationship between collaborators; therefore, we suggest that consultation with a pharmacist is beneficial for other medical professionals in increasing the quality of home medical care.

Moreover, it is necessary for pharmacists not only to participate in home medical care, but also to demonstrate their value in the provision of this service. Our results indicate that nurses in Group A had a higher satisfaction rate for “how to take medicine to the patient appropriately” and “coping with side effects of medicine appropriately” compared with those in Group B (Fig. 3). In addition, the satisfaction level for “managing the storing of patient’s medicine appropriately” among home helpers in Group A was significantly higher than that in Group B. Thus, the involvement of pharmacists in home medical care has a positive influence on nurses and home helpers, but satisfaction among physicians and care managers requires further attention. Furthermore, we identified improvement areas by analyzing the relationship between the degree of satisfaction in each element and the degree of comprehensive satisfaction in the entire field of home medical care using CS analysis. The involvement of pharmacists with physicians changed the items “managing the storing of patient’s medicine appropriately,” “enough mental care for patients and their families,” and “sufficient measures to ensure drug compliance” to the “priority improvement field.” For physicians, this involvement can therefore improve not only the management of medication but also the provision of mental health care for patients and their families. The involvement of pharmacists with nurses changed “explaining how to take medicine to the patient appropriately” to the “emphasis maintenance field” and changed “explaining the information of medicine to the patient
appropriately” to the “priority improvement field.” For nurses, the explanation to patients about how to take medicine should be maintained, but consultation with pharmacists about how to explain medicine to patients should be improved. The involvement of pharmacists with care managers changed “managing the storing of patient’s medicine appropriately” and “enough mental care for patients and their families” to the “emphasis maintenance field.” Care managers should therefore maintain their involvement with pharmacists regarding the management of medicine and the mental care for patients and their families. The involvement of pharmacists with home helpers changed “sufficient measures to ensure drug compliance” to the “emphasis maintenance field.” Home helpers should thus maintain their involvement with pharmacists regarding the maintenance of drug compliance. Therefore, for pharmacists participating in home medical care, the management of medication storage by patients and the provision of information about how to take medicine could be improved. In addition, improvements in providing information about medicines to patients, furnishing sufficient mental care for patients and their families, and taking sufficient measures to ensure drug compliance are necessary to improve overall home medical care involving pharmacists. However, since the requirements for pharmacists to improve or maintain specific items depend on the type of medical profession, different approaches may be required to achieve this goal.

We also focused on areas for improvement by analyzing the relationship between the degree of satisfaction in each element and the degree of comprehensive satisfaction in the entire field of home medical care conducted by a team of medical professionals. The involvement of pharmacists with physicians changed the “necessary to collaborate with other medical professions” to the “emphasis maintenance field.” Physicians should therefore maintain their collaboration with other medical professionals in home medical care by involving pharmacists. The involvement of pharmacists with nurses increased the “satisfaction deviation” of the “consultation system on medicine” and the “sharing information with other medical professions,” although the field did not change. These findings indicate that the importance for nurses of conducting home medical care as part of a team should be addressed for improvement. The involvement of pharmacists with care managers changed the “sharing information with other medical professions” to the “priority improvement field” and increased the “satisfaction deviation” of the “consultation system on medicine,” although the field did not change. As for nurses, these items should also be addressed for improvement by care managers. The involvement of pharmacists with home helpers changed the “reduction of incidents or accidents by the team” to the “emphasis maintenance field,” and changed the “consultation system on medicine” to the “priority improvement field.” Home helpers should therefore not only maintain the reduction of incidents or accidents by the team, but also improve the consultation system on medicine with pharmacists.

Therefore, through the participation of pharmacists in home medical care as part of a medical profession team, the incidents or accidents were reduced and the necessity to collaborate with other medical professionals was improved. In addition, further improvements in the consultation system on medicine and the sharing of information with other medical professions are necessary to improve home medical care by teams involving pharmacists. Moreover, other medical professions are likely to be aware of the
importance of medication factors and the sharing of information, and how they can be improved by involving pharmacists.

Previously, it has been suggested that pharmacists play an active role in the delivery of home medical care. However, our results indicate that it may be important for pharmacists to participate in home medical care teams, and deficiencies in this area should be identified and improved continuously. In particular, our study is significant because for the first time it analyzed the results of medical professionals’ attitudes toward pharmacists in home medical care by dividing these medical professionals into two groups: those who had previously collaborated with pharmacists in home medical care and those who had not. It also showed that the need for pharmacists to participate in home medical care team has increased due to their involvement on the team, indicating that it is important for pharmacists to be actively involved in the functioning of the team. In addition, the effects of pharmacists engaging in home medical care were shown using CS analysis. Though the contents of contributions to each medical profession differ depending on the specialty of the target occupation, generally the involvement of pharmacists in home medical care resulted in improvements in the following areas: quality of the contents of prescriptions, management of appropriate storage of patients’ medicine, sufficient measurement to ensure drug compliance, reduction of incidents or accidents, sufficient consultation regarding medicine, and increased sharing information with other medical professionals. To more support this, pharmacists involved in home medical care could undertake a more active role in related areas of medical care, such as drug effects and safety, and could also publicize their role more widely. In recent years, the improvement of polypharmacy has become an important issue, which is attributed to problems related to the proper use of medicines. Our results demonstrate how pharmacists are involved in home medical care teams: they manage information about medicine and taking medicine, including patients’ compliance; they share information on the proper uses of medicines; and they are expected to contribute to the improvement of polypharmacy, which is a major problem in modern medical care. Further surveys are required to examine this topic.

Conclusion

Our study had several limitations. The self-reporting method is associated with various measurement errors that might not be associated with other reporting methods, such as phone surveys. However, bias exists for all questionnaire-bias social research investigations, regardless of how they are delivered.\(^{35}\) Therefore, the findings from the present study should be interpreted accordingly. Moreover, because this study relied on mail responses rather than on direct contact with respondents, the possibility of fraudulent responses cannot be eliminated.

We examined evaluations made by physicians, nurses, care managers, and home helpers who were on home medical care teams in Japan regarding the pharmaceutical services that were provided by home medical care pharmacists. Our results indicate the importance of ensuring that medical professional teams providing home medical care treatment are able to collaborate with pharmacists and that this collaboration may improve the quality of certain aspects of home medical care treatment.
Declarations

Ethics approval and consent to participate

This study was approved by the Ethics Committee of the Showa University School of Pharmacy (approval no. 211) and conducted in accordance with Japanese ethical guidelines for epidemiological research and the Declaration of Helsinki. All respondents provided informed consent prior to participation.

Consent for publication

Not applicable.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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This study was conducted through self-funding of the authors.

Authors' contributions

KS participated in research design, performed the analysis and interpretation of data, wrote the first draft of the manuscript and reviewed it. AS participated in research design, carried out the study, made revisions to the manuscript. MI, MN participated in the design of the study, carried out the study and reviewed the manuscript. NK and KK made revisions to the manuscript. All authors read and approved the final manuscript.

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Figures
Involvement of pharmacists with other medical professions and the necessity of pharmacists for home medical care, according to other medical professions (Q1–2). Q1 asked whether other medical professions had collaborated with pharmacists in home medical care. Q2 asked whether other medical professions consider it important that pharmacists are involved in home medical care. The percentage of
total respondents in each group is shown. **P < 0.01 indicates a statistically significant difference between Groups A and B.

**Figure 2**

Q3.

**Physician**

Information-sharing between pharmacists and other medical professions (Q3). *P < 0.05 and **P < 0.01 represent a statistically significant difference between what was asked by the medical profession and what the medical profession received.
Figure 3

Overall home medical care that respondents are engaged in (Q4–14). The average value for each question in Group A and Group B is shown on the left and the results of CS analysis are shown on the right. *P < 0.05 and **P < 0.01 represent a statistically significant difference between Groups A and B.
Figure 4

Home medical care conducted as a medical profession team (Q15–23). The average value for each question in Group A and Group B is shown on the left and the results of CS analysis are shown on the right. *P < 0.05 and **P < 0.01 represent a statistically significant difference between Groups A and B.