Patient Survey on Polypharmacy in the Clinic and Its Impact on Health Professionals' Management of Polypharmacy: a Before-after Study

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Abstract

**Background:** Patient awareness surveys on polypharmacy have been reported previously, but no previous study has examined the effects of sending feedback to health professionals on reducing medication use. Our study aimed to conduct a patient survey to examine factors contributing to polypharmacy, feedback the results to health professionals, and analyze the resulting changes in the number of polypharmacy patients and prescribed medications.

**Methods:** Study 1: In July 2016, we conducted a questionnaire survey among adult patients receiving medical care at Minamihama clinic. We examined polypharmacy and its contributing factors by performing logistic regression analysis. Study 2: We sent feedback of survey results to 12 health professionals. Performing a t-test and a chi-square test on medical fee receipts, we analyzed changes in the percentage of polypharmacy patients and the number of prescribed medications during one month before and after the feedback.

**Results:** In the questionnaire survey, significant differences were found in the following 3 items: age (odds ratio (OR)=3.14; 95% confidence interval (CI)=2.01-4.91), number of medical institutions (OR=2.34; 95%CI=1.50-3.64), and patients’ difficulty with asking their doctors to deprescribe their medications (OR=2.21; 95%CI=1.25-3.90). After the feedback, the percentage of polypharmacy patients decreased from 21.5% to 20.1% and the mean number of prescribed medications per patient decreased from 8.2 to 7.7 (p<0.001, respectively).

**Conclusions:** Providing feedback to health professionals on polypharmacy survey results may lead to a decrease in the number of polypharmacy patients. Factors contributing to polypharmacy included age (75 years or older), the number of medical institutions (2 or more institutions), and patients’ difficulty with asking their physicians to deprescribe their medications. Feedback to health professionals reduced the percentage of polypharmacy patients and the number of prescribed medications.

**Trial registration:** UMIN. Registered 21 June 2020 - Retrospectively registered, https://www.umin.ac.jp/ctr/index-j.htm

**Background**

Polypharmacy is a situation in which a patient takes multiple oral medications. It is known to increase the risk of adverse drug events and the hospitalization rate and cause a decline in adherence to treatment as well as a deterioration in quality of life (QOL) [1-3]. In addition, calculations have shown that in Japan, pharmaceuticals worth a total of 50 billion Japanese yen a year are destroyed and discarded without being used because of polypharmacy [4], which has contributed to increased medical costs. Thus, addressing polypharmacy is an urgent issue.

The reduction of medication use in polypharmacy patients is known to improve the quality of medical care [5]. Standard criteria currently used for the detection of inappropriate prescriptions among older
adults include the Beers Criteria [6] in the United States and the STOPP/START Criteria [7] in Europe. The guideline for safe drug therapy for older adults [8], which uses a modified version of the STOPP criteria, has developed into a standard, reflecting current drug treatment in Japan. Measures against polypharmacy have been taken accordingly.

Patient awareness surveys on polypharmacy have been reported previously [9,10], but no previous study has examined the effects of sending feedback to health professionals on reducing medication use. Our study aimed to conduct a patient awareness survey to examine the factors contributing to polypharmacy (Study 1) and elucidate changes in the percentage of polypharmacy patients and in the number of prescribed medications that result from sharing survey results as feedback to health professionals (Study 2).

**Methods**

**Study 1**

*Participants and Setting*

The study was conducted on patients aged 20 years or older who consulted Minamihama clinic, general outpatient department in July 2016 for regular drug prescriptions. Minamihama clinic is in a city that is approximately 20 minutes from Tokyo, with a population of roughly 600,000. The clinic is run by five doctors and provides primary care services, including outpatient consultations, dialysis, and home visits.

*Procedure*

In an awareness survey on polypharmacy, the participants answered a self-administered questionnaire during their regular visits at the clinic. The exclusion criteria were: patients who were under 20 years of age, institutionalized, or receiving care via specialized outpatient consultations, dialysis, or in-home visits. In addition, we considered questionnaires incomplete and excluded them if respondents had failed to answer one or more of their items.

*Questionnaire*

There were 7 questionnaire items (supplementary 1). The questions asked: the patient's age, gender, number of medical institutions regularly consulted, whether the patient felt a need for prescription drugs, whether they understood the reason for the prescriptions, whether deprescribing medications made them anxious, and whether the patient had difficulty with asking their physicians to deprescribe their medications. All questions, except those about age, gender, and the number of medical institutions regularly consulted, had two answer options, "yes" or "no." We determined the survey items based on focus group discussions and the Patients’ Attitudes Towards Deprescribing (PATD) questionnaire, which gauges how patients feel about their prescription drugs [2] (Y.H, K.S, Y.O, S.M, M.C, T.H). The questionnaire used in our study was developed for this study.
Analytic methods

We followed an observational study design, and we conducted it in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines. In Japan, taking 6 or more oral medications has been reported to increase the frequency of adverse drug events [11]. In our study, polypharmacy was defined as taking 6 or more oral medications. Therefore, patients taking 6 or more oral medications were assigned to a polypharmacy group, and those taking 5 or less oral medications were assigned to a non-polypharmacy group. The number of oral medications taken by each patient was confirmed by a researcher (YH) who used electronic health records. Factors contributing to polypharmacy were studied in both groups. We performed univariate and binomial logistic regression analyses, using a t-test and a chi-square test, to examine factors contributing to polypharmacy. The statistical power was set to 80%, the level of significance was set to 0.05, and a sample size of 134 people was necessary to demonstrate a significant difference.

All analyses were performed using the SPSS Statistics for Windows 26.0 software package (IBM, Armonk, USA).

Study 2

Participants and Setting

The study was conducted among patients aged 20 years or older who regularly visited the Minamihama clinic during one month prior to and one month after we sent feedback to health professionals in August 2016. There were no staff changes during the above-mentioned periods.

Intervention

We provided feedback to 12 healthcare professionals (5 doctors, 4 nurses, 2 pharmacists, and 1 social worker) working at the clinic. For 15 minutes, we disclosed the results of the questionnaire survey from Study 1.

Immediately after providing the results, we presented the 12 health professionals with 3 questions. We asked them: were the survey results useful for understanding the current state of polypharmacy patients, would there be changes in the medical care they provided now that they knew the survey results; and were the survey results unexpected (Table 1). We instructed those who responded that the results were unexpected to further assess the expectations for part of the survey from Study 1; namely, the results from the questions, "Do you feel that the prescribed medications were necessary? Do you understand the reasons why the medications were prescribed? Would you be worried if your medications were deprescribed? Is it difficult to ask your doctor to deprescribe your medications?" The health professionals' answer options were: "more than expected," "as expected," or "less than expected." (Table 1).

Outcome and Measures
As primary outcomes, the number of polypharmacy patients and the number of prescribed medications were measured in adult patients who visited Minamihama clinic regularly during a one-month period before and after we gave feedback (April and October 2016). To determine the number of prescribed medications, medical receipt data was surveyed, and participants taking 6 or more oral medications were considered polypharmacy patients.

**Analytic methods**

We followed a before-after comparative study design. We surveyed the percentage of polypharmacy patients and the number of oral medications before and after feedback, and we performed analyses using a t-test and a chi-square test. The statistical power was set to 80%, the level of significance was set to 0.05, and a sample size of 113 individuals was necessary in each measurement in order to demonstrate significant differences.

All analyses were performed using the SPSS Statistics for Windows 26.0 software package (IBM, Armonk, USA). With the α error estimated at 0.05 and β error at 0.2 (with the power of detection at 0.8), the minimum sample size necessary to compare the difference between the pre-intervention and post-intervention group data was 150 participants for this study.

**Results**

**Study 1**

The number of patients who had medical care consultations was 574, the number of survey respondents was 469 (81.7%), among them 407 individuals (70.9%) provided valid responses. We compared the polypharmacy group, which was composed of 138 participants (33.9%), with the non-polypharmacy group, which was composed of 269 participants (66.1%; Fig. 1). For age and the number of medical institutions visited on a regular basis for medical care, the cutoff values were set based on the receiver operating characteristic (ROC) curve; the cutoff value for age was 75 years (area under the curve (AUC) = 0.690; 95% confidence interval (CI)=0.64-0.74, p<0.001), and the cutoff value for the number of medical institutions visited on a regular basis was 2 (AUC= 0.640; 95% CI=0.58-0.70, p<0.001). Univariate analysis showed that the percentages of the following items were significantly higher in the polypharmacy group than in the non-polypharmacy group: age 75 years or older, 2 or more medical institutions visited on a regular basis, and "patients' difficulty with telling physicians about their wish to reduce their medication use" (Table 2). In the multivariate analysis using a binomial logistic regression analysis, according to the best-subset selection procedure, the following 7 items were entered: age, gender, number of medical institutions visited on a regular basis, the questions "Do you feel that the prescribed medications were necessary," "Do you understand the reasons why the medications were prescribed to you," "Would you be worried if your medications were deprescribed," and "Is it difficult to ask your doctor to deprescribe your medications." The following 3 items were extracted as factors contributing to polypharmacy: age (75 years or older; odds ratio (OR)=3.14; 95% CI=2.01-4.91), number of medical institutions visited on a
regular basis (2 or more institutions; OR=2.34; 95%CI=1.50-3.64) and difficulty with asking their doctors to deprescribe their medications (OR=2.21; 95%CI=1.25-3.90; Table 3).

Study 2

In total, 814 patients visited the clinic before and 791 after we gave our feedback to the health professionals. The patients who visited the clinic both before and after our feedback accounted for 592 individuals. Among them, patients who fell under the category of polypharmacy before feedback accounted for 175 individuals (29.8%). Those who did so after feedback accounted for 159 individuals (26.8%). Therefore, the proportion had decreased significantly after feedback (p<0.001; Table 4). In addition, the number of prescribed medications per patient was 8.2 before the intervention, and it significantly decreased to 7.7 after the intervention (p<0.001; Table 4).

From the interview results with the 12 health professionals (5 doctors, 4 nurses, 2 pharmacists, and 1 social worker), all respondents answered "Yes" (12 answered "Yes," and no one answered "No") to the following questions: "Are the survey results useful for understanding the current state of polypharmacy patients," "Will the medical care you provide change now that you know the survey results," and "Were the survey results unexpected" (Table 5). Regarding the percentage of polypharmacy and the question of whether the patients understood the reasons why the medications were prescribed, the majority of the health professionals answered that the findings were more than they had expected (58.3% and 91.6%, respectively). As for the items "Do you feel that the prescribed medications were necessary," "Would you be worried if those medications were deprescribed," and "Is it difficult to ask your doctor to deprescribe your medications," the majority answered that the findings were as expected (50.0%, 58.3%, and 58.3%, respectively; Table 5).

Discussion

Study 1 showed that the following three items were contributing factors to polypharmacy: age (75 years or older), the number of medical institutions visited on a regular basis for medical care (2 different locations or more), and patients’ difficulty with asking their doctors to deprescribe their medications. The finding that age is a risk factor for polypharmacy was consistent with previous reports [11]. In Japan, the number of patients with multimorbidities have increased as population aging has advanced [12]. Reports from previous studies conducted in the United States and Europe have shown that the percentage of polypharmacy is high in older adults because of coexisting chronic diseases [13-17]. Previous reports have shown that the risk of polypharmacy is higher when the number of prescribing physicians is large [18]. In Japan, the health insurance system has enabled free access to medical institutions [19]. As a result, most patients visit multiple medical institutions [20] and receive prescriptions from several physicians. There is a lack of cooperation between medical institutions, which are unaware of each other’s prescriptions. This situation promotes "prescription cascades" in which similar drugs are prescribed more than once [21], and the number of prescribed medications increases. There have been no previous reports on the difficulty that patients have with asking their doctors to deprescribe their
medications; it is a newly identified risk factor for polypharmacy. Asking to deprescribe medications can impact the relationship between the patient and the physician in some cases [22], which may have been the reason why it presented a challenge for some respondents. Health professionals need to actively confirm polypharmacy patients’ intentions. They should ask them whether they wish their physician to deprescribe their medications. Thereafter, health professionals need to work on deprescribing the medications that the patients wish to reduce.

Study 2 showed that when feedback on the risk factors for polypharmacy was sent to health professionals, the proportion accounting for the polypharmacy group decreased, and the number of prescribed medications declined. Previous reports have shown that the promotion of changes in consciousness (aimed at improving the quality of medical care) through sending feedback to health professionals has led to an improvement in the quality of medical care [23]. In the questionnaire survey results on the feedback submitted to healthcare professionals in our study, all respondents answered that a survey of the current situation regarding polypharmacy was useful, and 94% answered that after hearing the results of the survey, they would implement changes in the medical care they provide. In addition, all respondents answered that the results of the questionnaire survey conducted in Study 1 were unexpected, suggesting that changes in awareness and attitude toward the current situation of polypharmacy may have occurred before and after feedback. Conducting a fact-finding survey of polypharmacy and submitting the results as feedback promotes changes in consciousness and behavior among health professionals [23] and may reduce the percentage of polypharmacy. Martin et al. [24] explained that following a method consisting of submitting a written opinion (from a pharmacist to a physician) regarding oral medications and giving patients pamphlets on polypharmacy, the number-needed-to-treat (NNT) was 3.22 for reducing medication by one drug. In our study, the NNT was 71. Therefore, the intervention conducted in our study was not as efficient as those in previous studies. However, the method we undertook is inexpensive, can be performed in any type of medical institution, and based on written opinions, is easier to do than the interventions mentioned in previous studies [24]. Thus, our method can be expected to yield beneficial effects when carried out consistently in routine medical care.

Instead of relying on physicians alone, intervention through multi-sectoral collaboration involving nurses, pharmacists, and social workers is important to eliminating polypharmacy. Physicians can assess the prescriptions; nurses can ask patients about their oral medications and submit reports to the treating physicians; pharmacists can intervene by answering questions (regarding drug prescriptions), and social workers can monitor the condition of polypharmacy patients receiving nursing care and submit reports to the treating physicians.

Our study has several limitations. The study was conducted in a single clinic, and it remains unverified that the data can be used in other facilities with a different medical care setting. To check its validity, an additional study will need to be conducted at multiple facilities. The second limitation of our research is that it was designed as a pre- and post-intervention study. The change in the percentage of polypharmacy may have been due to confounding factors beyond our provision of feedback on the questionnaire survey.
results to the healthcare professionals. The third limitation is that there was no way to confirm long-term behavior modification among the health professionals regarding polypharmacy. A follow-up study needs to be conducted to determine the period within which the residual effects of a single intervention can be expected and whether repeating the intervention could serve as a "booster" for decreasing polypharmacy.

**Conclusion**

Factors contributing to polypharmacy included age (57 years or older), the number of medical institutions visited on a regular basis (2 or more institutions), and patients' difficulty with asking their doctors to deprescribe their medications, which, importantly, was previously unreported. Moreover, sending health professionals feedback on the factors contributing to polypharmacy led to changes in awareness among health professionals. It may also lead to a decrease in the percentage of polypharmacy patients and in the number of prescribed medications.

**Abbreviations**

AUC: area under the curve

NNT: number-needed-to-treat

PATD: Patients' Attitudes Towards Deprescribing

QOL: quality of life

ROC: receiver operating characteristic

STROBE: Strengthening the Reporting of Observational Studies in Epidemiology

**Declarations**

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Not applicable

**Authors’ contributions**

YH, KS, YO, and SM contributed in the conception of the hypothesis and designed the study. YH, SM, MC, HT produce the experimental material, collected the data. YH, KS, and YO performed a statistical analysis of the data. DY, AI, TT, NK, UT, and IM reviewed the data and contributed in the data analysis and manuscript writing. YH and KS were a major contributor in writing the manuscript. All authors read and approved the final manuscript.

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Availability of data and materials

Not applicable

Ethics approvals and consent to participate

This study was approved by the Ethics Committee of Chiba University School of Medicine (Chiba, Japan). A detailed explanation of the study was given to all participants, who confirmed that they fully understood the information before voluntarily giving informed consent to participate. They signed the informed consent form.

Consent for publication

Not applicable

Competing interests

The authors declare that they have no competing interests

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**Tables**
Table 1: Interview with survey results feedback

1. Are the survey results useful for understanding the current state of polypharmacy patients?
2. Will the medical care you provide change now that you know the survey results?
3. Were the survey results unexpected?

| Percentage of polypharmacy patients |
|-------------------------------------|
| Felt prescriptions were necessary   |
| Understanding the reason for the prescription |
| Anxiety about reducing medicine     |
| Difficulty talking about reducing medicine |

Question 1, 2, 3: Answer Yes or No.

Question (1), (2), (3), (4), (5): Answer "more than expected," "as expected," or "less than expected."

Table 2: Factors Influencing Polypharmacy (Simple Correlations)

|                               | Polypharmacy group (n = 138) | Non polypharmacy group (n = 269) | p-value |
|-------------------------------|------------------------------|----------------------------------|---------|
| Age ≥ 75, n (%)               | 76 (55.1)                    | 72 (26.8)                        | <0.001  |
| Male, n (%)                   | 70 (50.7)                    | 150 (55.8)                       | 0.334   |
| Number of family doctors ≥ 2, n (%) | 81 (58.7)                      | 92 (34.2)                        | <0.001  |
| Feeling prescriptions were necessary, n (%) | 111 (80.5)                     | 195 (72.1)                       | 0.079   |
| Understanding reason for prescriptions, n (%) | 125 (90.6)                     | 252 (93.7)                       | 0.257   |
| Anxiety about reducing medicine, n (%) | 66 (47.8)                      | 165 (39.0)                       | 0.089   |
| Difficulty talking about reducing medicine, n (%) | 34 (24.6)                      | 33 (12.3)                        | 0.001   |

Univariate analyses showed significant differences between the polypharmacy group and the non-polypharmacy group in terms of the following 3 items: age, medical institutions visited for medical care, and the difficulty that patients had with asking their doctors to deprescribe their medications.
Table 3: Factors Influencing Polypharmacy (Multiple Logistic Regression Analysis).

| Items                              | OR (95%CI)   | p-value |
|------------------------------------|--------------|---------|
| Age (75 or over)                   | 3.14 (2.01-4.91) | <0.001 |
| Number of family doctors (2 or more) | 2.34 (1.50-3.64) | <0.001 |
| Difficulty talking about reducing medicine | 2.21 (1.25-3.90) | 0.006 |

OR: odds ratio, 95%; CI: 95% confidence interval

In a multivariate analysis using binominal logistic regression analysis, significant differences were found in the following 3 items: age, medical institutions visited for medical care, and the difficulty that patients had with asking their doctors to deprescribe their medications.

Table 4. Outcomes: The number of oral medications and the number of polypharmacy patients

|                                      | Pre-intervention | Post-intervention | p value |
|--------------------------------------|------------------|-------------------|---------|
| Oral medication, number (SD)         | 8.2 (2.2)        | 7.7 (2.2)         | <0.001  |
| Polypharmacy patients, number        | 175              | 159               | <0.001  |

Among the 592 patients who visited the clinic both before and after intervention, comparison between data from before and after the intervention showed that the number of polypharmacy patients and the number of prescribed medications decreased significantly after the intervention.

Table 5. Results: Interview following survey results feedback
Results of the interviews with the 12 health professionals. Participants who answered Yes to the question "Were the survey results unexpected" were instructed to respond to questions (1) to (5) by choosing either "more than expected," "as expected," or "less than expected."

Figures
Figure 1. Outline of the study.

Outline of Study 1. The number of patients who had medical care consultations was 574, the number of survey respondents was 469 (81.7%), among them 407 individuals (70.9%) provided valid responses. We compared the polypharmacy group, which was composed of 138 participants (33.9%), with the non-polypharmacy group, which was composed of 269 participants.

Supplementary Files

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- Supplementary1.docx