**ORIGINAL ARTICLE**

# Do pharmacists have the most potential for patient safety in Japan? Learning from a 2010 nationwide survey

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## ABSTRACT

**Background:** Unlike in many other countries, patient safety (PS) in Japan has been promoted under the social insurance medical fee schedule, with the implementation of preferential medical fee paid to medical institutions as incentives. Meanwhile, many hospitals do not assign a full-time physician as PS manager at PS division due to the shortage of physicians.
**Objective:** The Health Ministry in Japan has been promoting PS by utilizing the preferential patient safety countermeasure fee (PPSCF) since 2006. This study aims to address the potential of pharmacists for PS at hospitals implementing the PPSCF.
**Methods:** A nationwide questionnaire survey targeting 2,674 hospitals with the PPSCF was performed from 2010 to 2011. Of the 669 hospitals that responded, 627 hospitals were eligible for analysis, including 178 hospitals implementing PPSCF 1 with 400 beds or more (group A), 286 hospitals implementing PPSCF 1 with 399 beds or fewer (group B), and 163 hospitals implementing PPSCF 2 (group C).
**Results:** Although the mean values of PS activities for nurses were the highest among physicians, nurses, and pharmacists, the values per person recalculated for pharmacists were the highest, and the ranges of the values per person for pharmacists were narrowest across the three professional groups. For example, the number per person of incident reports filed in group A was 2.37 $\pm$ 0.30 for pharmacists, 1.14 $\pm$ 0.11 for physicians, and 2.09 $\pm$ 0.31 for nurses ($p$ = .002). For pharmacists, those values were 2.37 $\pm$ 0.30 in group A, 2.43 $\pm$ 0.14 in group B and 2.35 $\pm$ 0.19 in group C ($p$ = .802).
**Conclusions:** Across health professionals, pharmacists may have the most potential for PS under the social insurance medical fee schedule in Japan.

**Key Words:** Universal health insurance in Japan, Social insurance medical fee schedule, Pharmacists' potentiality for patient safety, Shortage of health professionals, Preferential patient safety countermeasure fee, Pharmacy practice

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# 1. INTRODUCTION

Japan's universal health care system, implemented in 1961, has a free-access policy and low out-of-pocket medical costs, which enabled Japan to attain top status for its overall health system in the World Health Report 2000. Since then, its health status has barely changed, aside from a focus on excessive expenditures. For example, Japan's average life expectancy at birth is still the highest with 83.7 years, and the country has the lowest infant mortality rate, with 2.0 per 1,000 live births, according to the World Health Statistics 2017 report.[1]

Health care has been provided under the social insurance medical fee schedule, according to the Medical Care Act, and has sustained the above three features of Japan's health care system. The fee schedule is revised every two years based on the result of the Central Social Insurance Medical Council in response to the Minister of Health, Labour, and Welfare. The same price is determined for medical care at any medical institution in Japan, according to the schedule.[2]

Meanwhile, concern about patient safety (PS) has been increasing worldwide after the publication of the first Institute of Medicine (IOM) issue in November 1999.[3] Curiously, in Japan, health professionals acknowledged that the incorrect surgeries performed at Yokohama City University Hospital (YCUH) on January 11, 1999, increased the attention given to PS activity at hospitals.[4,5]

Subsequently, on February 11, 1999, a 58-year-old female with rheumatoid arthritis died after surgery because she received disinfectant intravenously at Tokyo Metropolitan Hiroo Hospital. In this case, the nurse in charge mistakenly substituted a syringe full of Chlorhexidine gluconate for another syringe with anti-coagulant.[6]

Since the 1999 landmark YCUH case, the Ministry of Health, Labour, and Welfare (MHLW) mandated that approved hospitals with advanced technology, including all 80 university hospitals and two national medical centers in 2000, 1) prepare a guideline for PS, 2) establish a reporting system within the hospital, 3) create a PS committee, and 4) hold a training seminar on PS for hospital staff.

Then, on October 1, 2002, the MHLW mandated that all hospitals and clinics with beds implement the four above-stated countermeasures to secure PS. Starting in April 2006, a preferential patient safety countermeasure fee (PPSCF) of 500 Japanese Yen (US $4.5) was paid to hospitals that met the requirements of the revision of the Medical Care Act. The PPSCF was incorporated into patients' hospitalization costs upon admission. Thus, the MHLW has implemented the preferential medical fee under the social insurance medical fee schedule to advance important health care policies such as PS and infection control.

Since the YCUH landmark case, the Japanese people have become increasingly concerned about PS, and the central government has implemented one countermeasure after another to improve this area. Nurses are generally involved in PS, whereas physicians are involved in many serious adverse events, such as the two above cases at public large-scale hospitals. Physicians, then, are less interested in PS than nurses are[7, 8] and cannot be assigned to the PS division due to the shortage of physicians.[9]

Furthermore, although our research group has been conducting two nationwide surveys under the social insurance medical fee schedule and several novel findings on the Japanese-style PS system that have been published,[9–13] only just 17 hospitals out of 627 participating hospitals assigned physicians at PS division according to the result of 2010 survey and 43 hospitals assigned pharmacists.[9]

In Japan, physicians take a leading part in health care, and nurses play a leading role in PS. Pharmacists, however, have not been a focus or, until recently, played an original or important role in many incidents related to drugs. Until now, little is known about the extent to which pharmacists contribute to PS and how to spend the pharmacy practice time involved.

As the current PPSCF system has not changed in more than seven years since the 2010 revision, the data regarding a nationwide survey performed by the authors in 2010 to 2011 have profound significance for the public. To date, only one part of the novel findings had been published.[9] This study aims to explore the suitability of the pharmacist for PS and the duration of pharmacy practice time involved.

# 2. METHODS

## 2.1 Subjects of this study

As of October 31, 2010, 2,674 of the 8,670 domestic hospitals in Japan could add the PPSCF. We sent the questionnaire to the 2,674 hospitals implementing the PPSCF. Our cross-sectional survey was conducted between December 2010 and May 2011. As PS performance is more active at larger hospitals,[14] of the 669 responding hospitals, the data from 42 hospitals did not include the necessary variables for this study. Therefore, they were excluded. We divided 627 participating hospitals eligible for analysis into three groups, according to PPSCF implementation and number of beds; hospitals with invalid data and/or data that could not be used in this study were excluded.

### 2.2 PPSCF

The PPSCF allotment changed from 500 JY in 2006 to 850 JY (PPSCF 1) and 350 JY (PPSCF 2) in 2010.

Hospitals implementing PPSCF 1 must have at least one assigned full-time PS manager onsite, whereas hospitals implementing PPSCF 2 must have at least one assigned part-time PS manager at the hospital. In both cases, the PS manager must be a qualified health professional who has completed an appropriate training course requiring more than 40 hours, regardless of their working arrangements, according to the definition provided by the MHLW. Additionally, the full-time PS manager at a hospital with PPSCF 1 is assigned to address only PS, whereas the part-time PS manager at a hospital with PPSCF 2 can engage in other work of up to 20 hours per week. In 2006, the authors performed a nationwide survey of certified clinical training hospitals officially designated by the MHLW and reported the following results: 1) PS promotion required full-time staff focused on PS,[10, 11] 2) PS activity was performed quickly at hospitals with well-balanced medical practice payments,[10, 12] and 3) Many hospitals had invested considerable amounts of money in PS.[10, 13]

### 2.3 Questionnaire items and variables

This study's questionnaire was created based on the questionnaire developed for the nationwide survey conducted in 2006.[10] Additionally, the 2006 survey examined certified clinical training hospitals, whereas the 2010 survey investigated hospitals allowed to implement the PPSCF in terms of whether they met the requirements.

This study questionnaire collected basic information on the participating hospitals (including the number of beds), evaluated PS activities and examined PS management regarding pharmaceuticals.

The results regarding basic information on participating hospitals and PS activities were reported in detail.[9] Variables regarding basic information included the number of beds; number of pharmacists, physicians and nurses; and variables regarding PS activities, including the number of PS managers, the working hours (person-time) that health professionals dedicated to PS activities per week, the number and duration (min) of seminars held within six months, the number of participants, the one-year participation rate of health professionals (October 2009 to September 2010), and the number of incident reports filed by health professionals within a six-month period.

According to the Medical Care Act, the Health ministry mandated hospitals to prepare a drug safety management system within their facilities. One of the requirements is to provide pharmacy practice based on a standard operating procedure that includes the following items: implementation and purchase of pharmaceuticals, drug management, administration direction for dispensing drugs for patients, medication teaching for patients, dealing with drug information and collaboration with other institution (hospitals, clinics and out-of-hospital pharmacies).

With regard to pharmacy practice, little is known about the actual situation of it. Our research group initially consisted of three physicians (a principal investigator and two co-investigators); then, our research staff grew to include nine health care professionals, including one statistician and one nurse, who were hired as collaborative researchers to join the original members.

After the research group heard from pharmacists and discussed together on the basis of the Medical Care Act, we decided that pharmacy practice includes 1) medication teaching and history-taking, 2) brought-in drugs review on admission, 3) inquiry on prescriptions, 4) inquiry from an out-of-hospital pharmacy, 5) drug information services, 6) mixing of anti-cancer drugs, 7) mixing of intravenous hyperalimentation (IVH) and 8) dispensing, prescribing, managing, etc. in pharmacy practice.

### 2.4 Statistical analysis

We used the software package IBM SPSS Statistics (version 22.0 for Microsoft Windows, USA) for the statistical analysis. The data are presented as the means and standard errors with 95% confidence intervals. The variables included the number of health care professionals and values converted to per patients (fixed number of beds). For the assignment of PS managers, the total number of staff and working hours were used as variables. Among PS activities, the variables included the number of participants, the number of times that PS seminars were attended by health care staff and the number of incident reports by health care staff. The variables also included continuous variables (0%-100%) to indicate the proportion of eight services to pharmacy practice. Differences in means were determined by ANOVA (Tukey test) among the three hospital groups and the three types of health care professionals. A level of significance of $p < .05$ was used.

## 3. RESULTS

### 3.1 Basic information on participating hospitals as social insurance medical institutions

The 627 participating hospitals (response rate: 23.4%) included 178 hospitals implementing the PPSCF 1 with 400 beds or more (group A), 286 hospitals implementing PPSCF 1 with fewer than 399 beds (group B), and 163 hospitals implementing PPSCF 2 (group C). The mean numbers (± standard errors) of beds were 626 ± 16 in group A, 247 ± 5 in group B, and 174 ± 8 in group C.

According to Table 1, in each hospital group, the nurses group was the largest, and the pharmacists group was smallest among the three professional groups. The largest number of health care professionals per 100 beds was 24.8 ± 1.2 for pharmacists, 174.4 ± 12.5 for physicians, and 488.1 ± 16.0 for nurses in group A; the smallest was 4.9 ± 0.3, 16.5 ± 1.4 and 92.6 ± 4.9 for pharmacists, physicians, and nurses, respectively, in group C ($p < .001$ for each health professional).

When values were converted to per 100 beds, there were no differences for pharmacists across three hospital groups, and there was no difference for nurses between groups A and B.

### 3.2 Assignment of health professionals and working hours for the PS division

Table 2 shows the assignment of health professionals and working hours for PS. In the assignment of health professionals and working hours in the PS division, most hospitals in group A (96.6%) and group B (89.9%) assigned nurses as full-time PS managers; however, few hospitals in group C (10.4%) did so.

Table 2 also indicates that nurses were the health professionals who worked most frequently as PS managers, regardless of their hospital group. With regard to pharmacists' working hours among hospital groups, the highest was 2.78 ± 0.58 in group A, and the lowest was 1.08 ± 0.21 in group B. When the values were converted to per 100 beds, there was no significance ($p = .084$).

**Table 1.** Mean number ± standard error with (95% confidence interval) of health care professionals by hospital groups

| Hospital group | Pharmacists | Physicians | Nurses | *p*-value ANOVA* |
|---|---|---|---|---|
| Group A (178) | 24.8 ±1.2 (22.5-27.1) | 174.4 ±12.5 (149.6-199.1) | 488.1 ±16.0 (456.6-519.7) | < .001 |
| (PPSCF 1 with 400 beds or more) | 3.88 ±0.12 (3.65-4.11)$^{x,z}$ | 25.40 ±1.26 (22.92-27.88) | 78.09 ±1.44 (75.24-80.94)$^{x}$ | < .001 |
| Group B (286) | 9.0 ±0.5 (8.0-10.1) | 32.0 ±1.5 (29.0-34.9)$^{y}$ | 170.2 ±5.0 (160.3-180.0) | < .001 |
| (PPSCF 1 with less than 399 beds) | 3.82 ±0.23 (3.36-4.28)$^{a,x,y}$ | 12.71 ±0.45 (11.82-13.60)$^{a}$ | 75.47 ±4.94 (65.73-85.20)$^{x}$ | < .001 |
| Group C (163) | 4.9 ±0.3 (4.3-5.6) | 16.5 ±1.4 (13.7-19.3)$^{y}$ | 92.6 ±4.9 (83.0-102.2) | < .001 |
| (PPSCF 2) | 3.19 ±0.18 (2.84-3.54)$^{y,z}$ | 9.45 ±0.44 (8.57-10.32) | 55.83 ±1.76 (52.35-59.31) | < .001 |
| *p*-value | < .001 | < .001 | < .001 | - |
| ANOVA** | .050 | < .001 | < .001 | |

*Note*. Values in lower columns indicate the values per 100 beds; ANOVA* and ANOVA** are performed by using Tukey test; *: comparison among the three professionals; **: comparison among the three hospital groups; a: There is no significant difference between pharmacists and physicians; x: There is no significant difference between groups A and B; y: There is no significant difference between groups B and C; z: There is no significant difference between groups A and C

**Table 2.** Assignment situation of PS managers and working hours at PS division by groups and health professionals

| Patient safety managers | Number of staff | Pharmacists | Physicians | Nurses | *p*-value ANOVA* |
|---|---|---|---|---|---|
| Group A (178) | 0 | 162 | 169 | 6 | - |
| (PPSCF 1 with 400 | 1~ | 16 | 9 | 172 | |
| beds or more) | working | 2.78 ±0.58 (1.63-3.93)$^{a,z}$ | 9.02 ±3.01 (3.08-14.95)$^{a,b}$ | 21.09 ±5.64 (9.96-32.21)$^{b,x,z}$ | .002 |
| | hours | 0.43 ±0.09 (0.25-0.60)$^{a,z}$ | 1.29 ±0.38 (0.54-2.04)$^{a,x,z}$ | 3.38 ±0.86 (1.68-5.07)$^{x,z}$ | < .001 |
| Group B (286) | 0 | 267 | 283 | 29 | - |
| (PPSCF 1 with less | 1~ | 19 | 3 | 257 | |
| than 399 beds) | working | 1.08 ±0.21 (0.66-1.50)$^{a,c,y}$ | 1.81 ±0.34 (1.14-2.47)$^{a,b,y}$ | 17.25 ±10.03 (-2.48-36.99)$^{b,c,x,y}$ | .084 |
| | hours | 0.58 ±0.14 (0.31-0.85)$^{a,c,y}$ | 0.79 ±0.13 (0.53-1.05)$^{a,b,x,y}$ | 6.76 ±3.31 (0.25-13.28)$^{b,c,x,y}$ | .035 |
| | 0 | 155 | 158 | 146 | - |
| Group C (163) | 1~ | 8 | 5 | 17 | |
| (PPSCF 2) | working | 1.56 ±0.41 (0.76-2.36)$^{a,y,z}$ | 2.53 ±0.75 (1.06-4.00)$^{a,y}$ | 8.64 ±1.52 (5.63-11.64)$^{y,z}$ | < .001 |
| | hours | 0.99 ±0.27 (0.46-1.52)$^{a,y,z}$ | 1.66 ±0.45 (0.76-2.55)$^{a,y,z}$ | 5.66 ±1.01 (3.67-7.64)$^{y,z}$ | < .001 |
| *p*-value | | .005 | .002 | .627 | |
| ANOVA** | | .084 | .105 | .658 | |

*Note*. Values indicate mean ±standard errors with (95% confidence interval). Values of working hours in lower rows indicate the values per 100 beds; ANOVA* and ANOVA** are performed by using Tukey test; *: comparison among the three professionals; **: comparison among the three hospital groups; Working hours include full-time and part-time health professionals' working hours; a: There is no significant difference between pharmacists and physicians; b: There is no significant difference between physicians and nurses. c: There is no significant difference between pharmacists and nurses; x: There is no significant difference between groups A and B; y: There is no significant difference between groups B and C; z: There is no significant difference between groups A and C

### 3.3 PS activities

Figures 1 and 2 show the characteristics of PS activities by health care professionals.

With regard to in-hospital seminars on PS for hospital staff, although participation numbers per capita must be above 2.0, the numbers of physicians per capita did not reach 2.0 in groups A and B. When the values were recalculated per capita for each health professional group, there was no significant difference across the three hospital groups (pharmacists: $p$ = .802; physicians: $p$ = .138; and nurses: $p$ = .713); in particular, the values per capita for pharmacists were nearly identical (2.37 ± 0.30 in group A, 2.43 ± 0.14 in group B, and 2.35 ± 0.19 in group C; $p$ = .802).

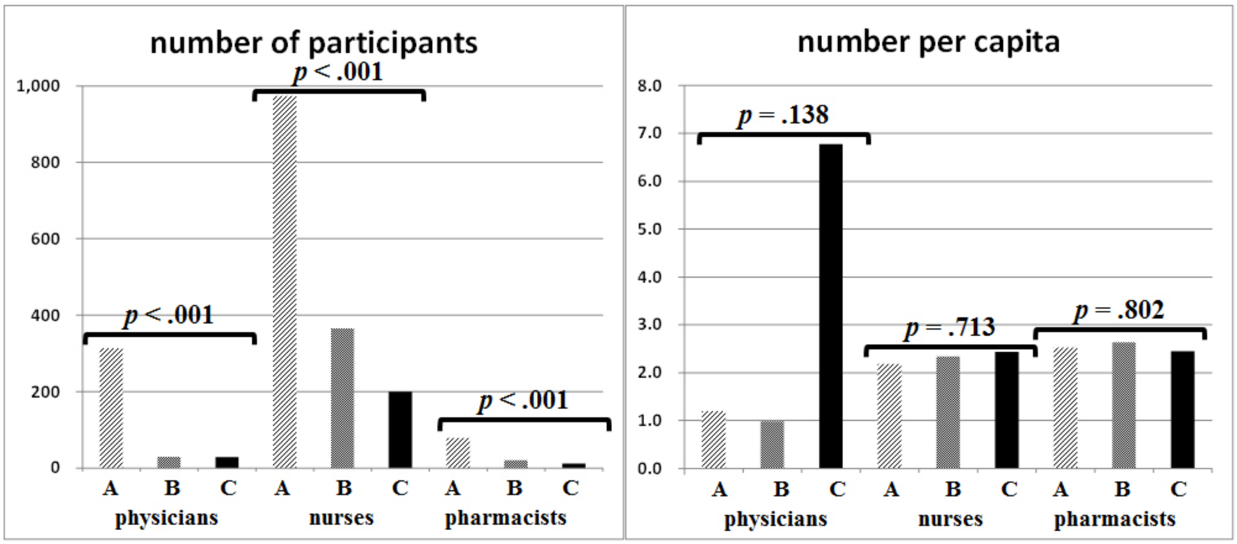


**Figure 1.** Participation situation of PS seminars

*A, B and C indicate groups A, B and C. When the values per capita are recalculated, there is no differences among three groups A, B and C. When the values per capita are recalculated, there is no differences among three groups A, B and C. The values per capita for pharmacists were nearly identical (2.37 ± 0.30 in group A, 2.43 ±0.14 in group B, and 2.35 ± 0.19 in group C; p = .802)*

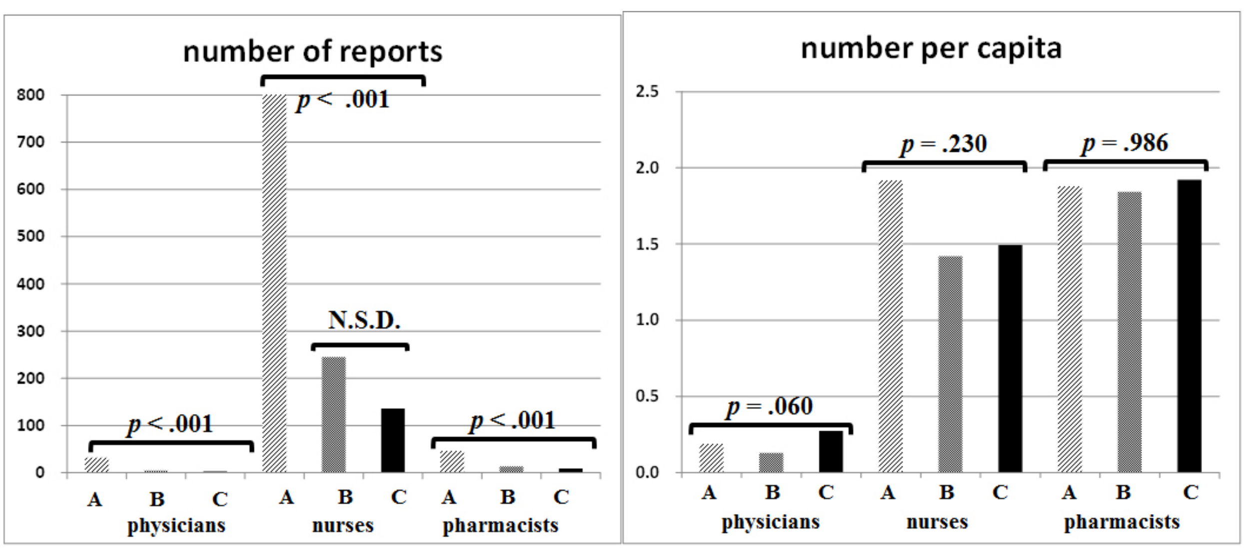


**Figure 2.** Incident reporting situation

*A, B and C indicate groups A, B and C; N.S.D. indicates non statistical difference; When the values per capita are recalculated, there is no differences among three groups A, B and C; The values per capita for pharmacists were nearly identical (1.79 ± 0.37 in group A, 1.84 ± 0.24 in group B, and 1.91 ± 0.45 in group C; p = .986)*

The mean number of incident reports filed by pharmacists, physicians and nurses for the six-month period was highest in group A and lowest in group C, and there were statistically significant differences across the three hospital groups ($p$ < .001). When the values were recalculated per capita for each health professional group, there was no significant difference across the three hospital groups (pharmacists: $p$ = .986; physicians: $p$ = .230; and nurses: $p$ = .060); in particular, the values per capita for pharmacists were nearly identical (1.79 ± 0.37 in group A, 1.84 ± 0.24 in group B, and 1.91 ± 0.45 in group C; $p$ = .986).

### 3.4 Proportion to pharmacy practices by services

Figure 3 shows the proportion of pharmacy practice by services. Pharmacists spent the most time from the eight services on dispensing, prescribing, managing, etc., and the proportion of these tasks was approximately 40% in each hospital group (group A: 38.68%, group B: 39.61%, group C: 40.02%; $p$ = .864). Medication teaching and history taking ranked second and was approximately 20% in each hospital group (group A: 20.53%, group B: 20.64, group C: 19.28%; $p$ = .610).

Of the services with statistical significance among the three hospital groups ($p$ < .001), the proportions of mixing of anti-cancer drugs were 9.32% ± 0.53% in group A, 5.94% ± 0.40% in group B, and 2.05% ± 0.37% in group C ($p$ < .001). Similarly, regarding the proportion of mixing of IVH, although there was a significant difference among the three groups, there was actually a significant difference between groups A and C ($p$ = .027).

Regarding the brought-in drugs review on admission and drug information services, there were significant differences between groups A and B in the former service ($p$ = .018) and between groups A and C ($p$ = .015) in the latter service, even though there were significant differences among three groups ($p$ = .024 and .021).

With regard to statistically significant services, the proportion of in-hospital inquiry of doubtful points on prescription to all pharmacy practice was 2.94% ± 0.21% in group A and 4.96% ± 0.40% in group C ($p$ < .001); there was no significance between groups B and C ($p$ = .274).

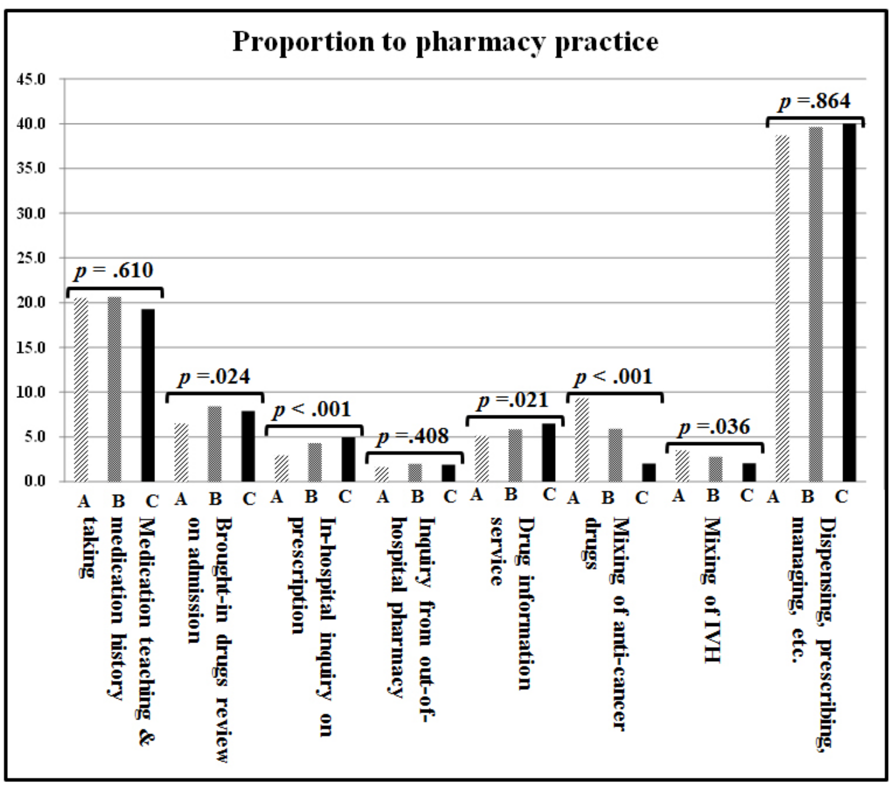


**Figure 3.** Proportion to pharmacy practice
*A, B and C indicate groups A, B and C*

## 4. Discussion

This is the first report in Japan on the pharmacist's aptitude for PS and how time is spent regarding pharmacy practice at hospitals implementing the PPSCF under the social insurance medical fee schedule in Japan.

With regard to the number of pharmacists, physicians and nurses in the targeted hospitals, there were significant differences in the values, including values recalculated to per 100 beds among three health care professional groups. The numbers of health care professionals are regulated by the Medical

Care Act, and the ratio of pharmacists, physicians and nurses to inpatients (fixed number of beds) has to be less than 70:1, 16:1 and 3:1 in general-type hospitals, respectively.

Although the table in this study does not show it, the mean numbers of pharmacists to inpatients (fixed number of beds) were 30.9 in group A, 36.3 in group B, and 43.6 in group C, and they met the requirement of there being fewer than 70. Likewise, the ratios of physicians to inpatients were 6.1 in group A, 10.7 in group B, and 15.0 in group C, and they were less than 16. Furthermore, the ratios of nurses to inpatients were 1.4 in group A, 1.6 in group B, and 2.1 in group C, and they were less than 3.

These results demonstrate that each hospital was observing the health care regulations, as hospitals have been audited annually on the basis of the Medical Care Act by their prefectural health center and/or regional Bureau of Health and Welfare, which is a branch of the MHLW. Although some are critical that Japan has a shortage of health care professionals,[16] hospitals have been legally providing appropriate health care. However, the number of pharmacists is determined from the viewpoint of not "pharmacy practice" but the number of prescriptions.

Nurses have played an important role in securing PS at Japanese hospitals by being assigned as PS managers.

Figures 1 indicates the mean values per capita of pharmacists joining PS seminars (2.35-2.64: $p$ = .802). With regard to in-hospital seminars on PS for hospital staff, the MHLW mandates that all hospital staff attend seminars on PS at least twice per year. Although the participation numbers per capita must be above 2.0, the numbers of physicians per capita did not reach 2.0 in groups A and B. Nevertheless, the 95% confidence interval of the value in group C was -2.52-15.57, with wide variance. Additionally, the number of incident reports per capita for pharmacists was 1.79-1.91: $p$ = .986, regardless of their hospital groups. Thus, it might be that pharmacists' qualification in PS was better and more consistent than those of physicians and nurses.

The other survey was conducted by us in 2011-2012 to evaluate PS culture by using the Hospital Survey on Patient Safety Culture (HSOPSC), which was developed by the Agency for Healthcare Research and Quality; we targeted 37 hospitals with 16,670 personnel (valid data), including 1,160 physicians, 9,308 nurses and 459 pharmacists. Percent Positive Responses were higher among pharmacists than they were among doctors and nurses. These results suggested that pharmacists might be more highly concerned with PS in Japan.[14]

According to our original article, by using Lag time, which is the difference between the date of an incidence and the date on which it is reported, we could establish that Lag time for physicians was longer than that for nurses at Kyoto University Hospital in Japan. Likewise, Lag time for physicians was longer than that for non-MDs at Brigham and Women's Hospital in the United States.[7,8]

Therefore, pharmacists were likely to be more suitable for PS than the two other health professionals and to observe the rules regarding health care.

Meanwhile, in recent years, the role of pharmacists has changed and has become increasingly important as people's concern about PS has increased. However, little is known about how pharmacists spend time in pharmacy practice under the social insurance medical fee schedule in Japan. Although pharmacy practice categorization depends on each country's health care system, in the United States, pharmacy practice generally includes four work activities: medication dispensing, consultation, business management and drug use management.[16]

The services on which pharmacists spent the most time of the eight services was dispensing, prescribing, managing, etc., and the proportion of time was approximately 40% in each hospital group ($p$ = .864). Next , were medication teaching and history-taking; the proportions of time spent were approximately 20% in each hospital group ($p$ = .610). When the two services were merged, the proportion of the time accounted for approximately 60%.

Dispensing, prescribing, managing, etc. is a fundamental service of the pharmacy department and medication teaching, and history-taking is the most important practice among the eight services.[17] Pharmacists' admission medication histories are known to reduce adverse drug events.[18]

With regard to the three remaining services, although there were statistical significances across the three groups, there was a significant difference between groups A and B in the brought-in drugs review on admission ($p$ = .018) and between groups A and C in the drug information service ($p$ = .015).

When considering the brought-in drugs review on admission, after the adverse event due to excessive administration of RTX (Methotrexate tablets) that occurred at Kyoto University Hospital,[15] every hospital has paid attention to brought-in drugs review on admission because of the many cases similar to one that occurred due to the incorrect administration of RTX.[19] After the serious case in Kyoto, the Japanese Society of Hospital Pharmacists suggested that pharmacy department directors of domestic hospitals pay attention to brought-in drugs review on admission, as of January 13, 2005.[20] Hence, this survey implemented this aspect.

Similarly, for mixing of anti-cancer drugs, the proportion of this service for pharmacy was 9.32% in group A, 5.94% in group B, and 2.05% in group C, possibly because the hospitals in group A were large-scale and included some university hospitals, those in group B were relatively large-scale, and those in group C were generally small-scale. Although the MHLW assigned a designated cancer hospital for each prefecture and several regional designated cancer hospitals in secondary medical care regions in the prefecture, according to the Cancer Control Act of 2001, large-scale hospitals such as those in groups A and B had to be assigned as designated cancer hospitals. In contrast, for in the in-hospital inquiry on prescriptions, the proportion of this service in group C was 4.96%, which was the highest among the three groups ($p < .001$).

Among the eight services considered, "medication teaching and history taking" and "dispensing, prescribing, managing, etc." seem to be performed regardless of hospital scale. Meanwhile, "mixing of anti-cancer drugs and IVH" were performed at large-scale hospitals from the viewpoint of safety.

**Limitations**

Our study has several limitations. First, this study should have included hospitals without the PPSCF as a control. Nevertheless, as the number of hospitals without PPSCF was approximately 6,000 out of 8,670 domestic hospitals and we could not target them financially when performing the survey at that time.

Second, this 2010 survey's response rate was 23.4% (627/2,674) and lower than that of the 2006 survey (40.0%: 418/1,039). Many hospitals did not respond to our survey, thus raising the possibility of selection bias. It is said to be non-response rate bias reflecting the survey's quality. This 2010 survey, however, does not follow this principle.

In the 2006 survey, 418 hospitals responded out of the targeted 1,039 clinical training hospitals, and 627 hospitals out of 2,674 targeted hospitals in the 2010 survey. The number of beds of hospitals in the 2006 survey was 415. Meanwhile, the number of beds in this survey was $626 \pm 16$ in group A, $247 \pm 5$ in group B, and $174 \pm 8$ in group C. Furthermore, the ratio of certified clinical training hospitals to total hospitals was 60.1% (107/178) in group A, 55.2% (158/286) in group B, and 28.8% (47/163) in group C. In summary, the ratio of clinical training hospitals with larger-number of beds was higher in the second survey. In this survey, many small-scale hospitals were included in the 627 participating hospitals, and in particular, in group C. As a result, the response rate is very low.

Third, questions on the level of PS performance were answered by PS managers. Therefore, even if activities to improve PS systems were conducted by other departments, not all activities in a hospital might be reflected in our survey.

Fourth, a ward-based pharmaceutical service was introduced as a preferential medical fee in 2012 FY; since then, the role of the pharmacist in the hospital wards has expanded. Pharmacists have a number of responsibilities on the ward, including filling prescriptions, monitoring patients' drug histories, avoiding drug interactions, providing drug information to medical staff, and recommending drug regimens. Pharmacists now also perform a pharmaceutical service for outpatients receiving chemotherapy.

Furthermore, as the central government mandated approved hospitals with advanced technology to assign at least one pharmacist to the PS division in 2017 and implemented a preferential hospital ward pharmacy practice fee in 2016, a further survey should be performed immediately.

## 5. Conclusions

The hospitals that implement PPSCF comply with the requirements of the Medical Care Act, regardless of their scale. As pharmacists steadily and effectively performed PS activities and pharmacy practice, regardless of hospital size, pharmacists might be the most suitable for PS activities.

The PPSCF encouraged hospitals to perform actions for PS by providing incentives under the social insurance medical fee schedule in Japan. These data regarding pharmacists and pharmacy practice could be useful for hospitals without the PPSCF that seek to establish a PS system.

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## Conflicts of Interest Disclosure

The authors declare they have no conflicts of interest.

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