

## Research Article

# Impact of Primary Care Physicians on Hospital Mortality, Readmission Rate, and Length of Stay in Japanese Healthcare System

**Yasuhiro Osugi**

Fujita Health University, Toyoake, Japan

**Gautam A Deshpande**

Center for Clinical Epidemiology, St. Luke's Life Science Institute, Tokyo, Japan

**Osamu Takahashi**

Center for Clinical Epidemiology, St. Luke's Life Science Institute, Tokyo, Japan

**Hiroko Arioka**

Division of General Internal Medicine, Department of Medicine, St. Luke's International Hospital, Tokyo, Japan

**Teruo Ino**

Toyota Regional Medical Center, Toyota, Japan

**Kanichi Asai**

Fujita Health University, Toyoake, Japan

**Daiki Kobayashi**

Division of General Internal Medicine, Department of Medicine, St. Luke's International Hospital, Tokyo, Japan

## ABSTRACT

**Purpose:** The Japanese healthcare system offers an open-access model allowing patients to visit healthcare institutes or providers of their choice. We investigated the impact of using a primary care physician (PCP) on outcomes related to hospital admissions.

**Methods:** All patients admitted to the internal medicine ward of the St. Luke's International Hospital, Tokyo between 2009 and 2015 were included. Patient data including demographics, medical history, date of admission and discharge, and presence of a PCP, were collected. Outcomes including hospital mortality, rate of ambulance transportation, readmission rate, and hospital length of stay (LoS) were analyzed.

**Results:** Of 11,243 patients, 625 (5.6%) used a PCP. By bivariate analysis, those with a PCP were older and had higher Charlson index scores but had fewer episodes of requiring ambulance transport and after-hours admissions. Multivariable regression analysis demonstrated that the

ambulance transport (odds ratio [OR], 0.47; 95% confidence interval [CI], 0.30–0.74) and after-hours admission (OR, 0.76; 95% CI, 0.64–0.90) rates were significantly lower among patients using a PCP than among those without a PCP; however, neither hospital mortality (OR, 0.94; 95% CI, 0.68–1.31) nor LoS ( $\beta$  coefficient,  $-0.42$ ; 95% CI,  $-2.25$ – $2.17$ ) were significantly different. Those using a PCP had a significantly higher readmission rate (OR, 2.18; 95% CI, 1.76–2.69); however, among the readmitted patients, outcomes were not different between the two groups.

**Conclusion:** Patients using a PCP less frequently utilized hospitalization-related high-cost services such as ambulance use and after-hours hospital services but had a higher readmission rate. No differences in mortality or length of stay were found.

**Keywords:** Primary care; Japan; Readmission rate; Mortality

## Introduction

The impact of primary care physicians (PCPs) on healthcare outcomes has been well established by previous studies conducted across the globe. For instance, individuals using a PCP had lower mortality in the United States.<sup>1</sup> While one study conducted in the United States reported that visiting a PCP prevented readmission,<sup>2</sup> another study in The Netherlands showed using a PCP reduced hospital length of stay (LOS).<sup>3</sup> In addition to patient outcomes, using a PCP was reported to be cost-saving.<sup>1</sup> Similar to the case in other countries, there are numerous PCPs in Japan; however, their impact has not been evaluated in detail thus far.

One of the reasons for the globally outstanding longevity of Japanese people<sup>4</sup> is the unique Japanese medical insurance system that not only covers all Japanese citizens but also allows access to all facilities in Japan based on their preference.<sup>5-7</sup> Thus, some patients prefer to consult a PCP for health maintenance, whereas others prefer to consult large hospitals to directly see a specialist. In addition, it is said that the quality of care may be different between specialists and PCPs. In fact, previous study supported that patients' care by specialists may improve their outcomes.<sup>8</sup> As a result, many patients prefer to visit specialists or large hospitals, although Ministry of Health, Labour and Welfare of Japan applied first-visit fee for those who visit them

directly.<sup>9</sup> This unique medical insurance system may distinguish the impact of PCPs in Japan from that in other countries.

Besides its unique insurance system, residency training for PCPs in Japan is also different from that in other countries. Prior to the establishment of the Japan Primary Care Association in 2010 to provide formal training programs for PCPs, PCPs were retired specialists who practiced at large hospitals before retirement and who lacked formal primary care training.<sup>10,11</sup> As a result, previous studies demonstrated that specialists care may improve short and long-term outcomes and be favorable.<sup>8,12</sup> These historical reasons and the distinct structure of primary care services may also affect the impact of PCPs on patient outcomes in Japan.

The aim of this study was to evaluate the impact of PCPs on patient outcomes related to hospital admission in Japan.

## Methods

### Study population

This retrospective, open cohort study included all adult patients who were admitted to the internal medicine ward of St. Luke's International Hospital between September 2009 and June 2015. This hospital is a 520 bed, tertiary-level, community teaching hospital in urban Tokyo, Japan. Patient data including demographics, primary diagnosis, vital signs, laboratory measures, medical history including comorbid presence of obstructive lung disease, date of admission and discharge, and presence of a PCP on record were obtained from electronic medical records. In addition, the Charlson comorbidity index score,<sup>13</sup> an important risk factor considered to affect hospital mortality and readmission, was determined.

Patients with planned admissions, mostly for elective procedures, were excluded. For patients who were admitted to the hospital multiple times during the study period, information from the two most recent admissions were included in the final analysis.

The St Luke's International Hospital Ethics Committee institutional review board approved this study.

### Primary care physicians

The use of a PCP was confirmed by patient self-reporting, based on the questionnaire administered at admission as part of the hospital intake protocol. Those who reported using a PCP prior to admission were categorized into the PCP group.

Patients who were admitted to the hospital twice and reported using a PCP at the subsequent admission were categorized in the PCP group for the second admission but were included in the non-PCP group for the first admission. Those in the non-PCP group were considered as either those who were followed up at a hospital-based clinic or those without regular follow-up at any healthcare institution.

### Outcome measures

Outcomes of interest at admission included episodes of ambulance transport defined as those reported by emergency medical technicians and necessity for after-hours admission defined as admission between 5 p.m. and 8 a.m. Longitudinal outcomes included hospital mortality, LoS and unplanned readmission rate within 30 days.

### Statistical analysis

Data at first admission were characterized using descriptive statistics. Chi-square test was used to analyze categorical measures and Student's *t* test was used for continuous measures. Following bivariate analyses, logistic regression was used to compare hospital mortality, episodes requiring ambulance transport and after-hours admissions among those with and without a PCP after adjusting for age, sex, body mass index (BMI) and Charlson comorbidity index score. Linear regression was used to assess LOs after adjusting for the same clinical variables. For patients surviving after discharge, the effect of using a PCP on readmission was analyzed using logistic regression, after adjusting for age, sex, BMI, Charlson comorbidity index score, and history of asthma.<sup>14</sup> The same approach was used for outcome analyses at subsequent admissions. Sensitivity analyses were performed for analyses about second admission by contrasting having PCPs before and after first admission.

All statistical analyses were performed using SPSS® 19.0J statistical software (IBM Japan, Tokyo, Japan).

## Results

A total of 11,243 patients (pooled mean age, 66.4 ± 17.9 years; male, 57.4%) were admitted to the hospital during the study period, and 625 (5.6%; male, 57.6%) reported that they used a PCP at first admission. Table 1 shows patient characteristics based on self-reporting for PCP use. Patients who use a PCP were older (72.8 ± 13.7 vs. 66.0 ± 18.1 years; *p* < 0.01) and had a higher Charlson comorbidity index score (4.4 ± 3.2 vs. 2.7 ± 2.7; *p* < 0.01) but required significantly fewer episodes of ambulance

**Table 1:** Patient characteristics at first admission according to the presence of a primary care physician on record.

	With PCP (n=625)	Without PCP (n=10,618)	Total (n=11,243)	<i>p</i> value
Male, (%)	346 (57.6)	6113 (55.4)	6,459 (57.4)	0.28
Mean age, year, (SD)	72.8 (13.7)	66.0 (18.1)	66.4 (17.9)	<0.01
Mean BMI, kg/m <sup>2</sup> , (SD)	22.3 (4.0)	22.6 (4.5)	22.6 (4.4)	0.07
Mean Charlson index, (SD)	4.4 (3.2)	2.7 (2.7)	2.8 (2.8)	<0.01
History of asthma, (%)	89 (14.2)	1,269 (12.0)	1,358 (12.1)	0.86
Ambulance transport, (%)	20 (3.2)	737 (6.9)	757 (6.7)	<0.01
After-hours admission, (%)	295 (47.2)	5,952 (56.1)	6,247 (55.6)	<0.01
Hospital mortality, (%)	48 (7.7)	630 (5.9)	678 (6.0)	0.08
Mean length of stay, day, (SD)	17.5 (44.2)	14.8 (26.0)	15.0 (27.3)	0.14

BMI: Body Mass Index; PCP: Primary Care Physician; SD: Standard Deviation

transport (20 [3.2%] vs. 737 [6.9%];  $p < 0.01$ ) and after-hours admissions (295 [47.2%] vs. 5,952 [56.1%];  $p < 0.01$ ).

As shown in Table 2, multivariable regression analysis revealed a significantly decreased probability for requiring ambulance transport (odds ratio [OR], 0.47; 95% confidence interval [CI], 0.30–0.74) and after-hours admission (OR, 0.76, 95% CI, 0.64–0.90) among patients using a PCP. No significant differences in risk were identified for hospital mortality (OR, 0.94; 95% CI, 0.68–1.31) and LoS ( $\beta$  coefficient,  $-0.42$ , 95% CI,  $-2.25$ – $2.17$ ) between the two groups.

Table 3 shows the characteristics of patients on subsequent admission, at which time 833 (7.9%) patients reported that they had a PCP. Subanalysis of this group revealed that those with a PCP had a significantly higher readmission rate than did those without a PCP (158 [19.0%] vs. 624 [6.4%];  $p < 0.01$ ). Multivariable logistic regression confirmed that patients with a

PCP had a significantly higher rate of readmission (OR, 2.18; 95% CI; 1.76–2.69; Table 4). Among those readmitted to the hospital, there were no differences in outcomes between those with and without a PCP (Table 5). Sensitivity analyses showed similar results.

## Discussion

Our study demonstrated that using a PCP in Japan was associated with both favorable and adverse patient outcomes, which was contradictory to findings from studies conducted in other countries that showed positive associations. In fact, having a PCP reduced after-hour admission and ambulance transport rates, while increasing the readmission rate. Several reasons for that can be considered. One major potential reason for this discrepancy is the difference in healthcare structure between Japan and other countries.

The roles of Japanese PCPs and those in other countries

**Table 2:** Multivariable regression analysis of patients during first admission.

	Outcome			
	Hospital death Odds ratio (95% CI)	Ambulance transfer Odds ratio (95% CI)	After-hours admission Odds ratio (95% CI)	Length of stay $\beta$ coefficient (95% CI)
Primary care physician	0.94 (0.68–1.31)	0.47 (0.30–0.74)	0.76 (0.64–0.90)	$-0.42$ ( $-2.25$ – $2.17$ )
Age, year	1.02 (1.01–1.02)	1.02 (1.01–1.02)	1.00 (1.00–1.01)	0.13 (0.10–0.16)
Male	1.09 (0.90–1.32)	1.28 (1.08–1.52)	1.05 (0.96–1.14)	1.07 ( $-0.27$ – $2.16$ )
Body mass index, kg/m <sup>2</sup>	0.90 (0.87–0.92)	0.99 (0.97–1.01)	0.99 (0.98–0.99)	$-0.37$ ( $-0.49$ – $0.24$ )
Charlson index	1.25 (1.21–1.28)	0.93 (0.90–0.97)	0.94 (0.93–0.96)	1.04 (0.84–1.24)

CI: Confidence Interval

**Table 3:** Patient characteristics at subsequent admission based on the presence of a primary care physician on record.

	With PCP (n=833)	Without PCP (n=9,719)	Total (n=10,552)	<i>p</i> value
Hospital readmission within 30 days, (%)	158 (19.0)	624 (6.4)	782 (7.4)	<0.01
Male, (%)	459 (55.1)	5,617 (57.8)	6,076 (57.6)	0.13
Mean age, year, (SD)	73.2 (14.1)	65.2 (18.2)	65.9 (18.0)	<0.01
Mean BMI, kg/m <sup>2</sup> , (SD)	22.7 (4.4)	22.7 (4.4)	22.7 (4.4)	0.92
Mean Charlson index, (SD)	4.1 (3.0)	2.5 (2.6)	2.6 (2.7)	<0.01
History of asthma, (%)	133 (16.0)	1,164 (12.0)	1,297 (12.3)	<0.01

PCP: Primary Care Physician; BMI: Body Mass Index

**Table 4:** Multivariable logistic regression analysis of patients who were admitted within 30 days following initial admission.

	Odds ratio	95% CI	<i>p</i> value
Primary care physician	2.18	1.76–2.69	<0.01
Age, year	1.02	1.01–1.02	<0.01
Male	0.80	0.67–0.94	<0.01
Charlson index	1.28	1.25–1.31	<0.01
History of asthma	1.24	0.99–1.54	0.06
Length of stay at previous admission, day	1.00	0.99–1.01	0.15

CI: Confidence Interval

**Table 5:** Multivariable regression analysis of patients who were readmitted within 30 days following initial admission.

	Outcome			
	Hospital death Odds ratio (95% CI)	Ambulance transport Odds ratio (95% CI)	After-hours admission Odds ratio (95% CI)	Length of stay $\beta$ coefficient (95% CI)
Primary care physician	1.20 (0.76–1.90)	0.97 (0.60–1.56)	0.78 (0.54–1.13)	–2.34 (–8.24–3.56)
Age, year	0.99 (0.98–1.01)	1.02 (1.01–1.04)	1.00 (0.99–1.01)	0.20 (0.04–0.35)
Male	1.30 (0.87–1.94)	1.05 (0.70–1.57)	0.90 (0.66–1.22)	0.46 (–4.44–5.37)
Body mass index, kg/m <sup>2</sup>	0.93 (0.88–0.97)	1.01 (0.96–1.06)	0.97 (0.93–1.00)	–0.62 (–1.18–0.06)
Charlson index	1.22 (1.15–1.29)	0.96 (0.89–1.03)	0.99 (0.95–1.04)	–0.05 (–0.78–0.68)

may be different. Patients who visit to PCPs may have not only physical problems, but also mental problems. In fact, previous study reported that depressive patients who visited to Japanese PCPs tend to have more somatic complains than those to American PCPs.<sup>15</sup> In addition, Japanese PCPs may have more specialized knowledges and skills, because most of them became PCPs after retiring specialists. Although Japanese PCPs have these characteristics, studies about patients' care by PCPs in Japan are limited. In contrast, PCPs in the United States may have more general skills. In the United States, 40.5% of the adult population reported having a PCP.<sup>16</sup> Typically defined as a family practitioner, general internist, and in some cases an obstetrician-gynecologist focusing on women's health issues, the role of a PCP is often expansive. For example, approximately 30% of patients followed by PCPs had mental health issues,<sup>17</sup> and the absence of a PCP was associated with longer LoS, higher mortality, and poorer outcomes in the United States.<sup>1–3</sup> However, in the United States healthcare system, poor access to primary care is also correlated with suboptimal access to healthcare of all types and is further complicated by a host of social and economic barriers that preclude optimal population-level health, including low health literacy, poverty and consequent lack of adequate insurance coverage, geographic and social isolation, and low educational status.<sup>18</sup>

The Japanese primary healthcare system stands in stark contrast to that of the United States in a number of ways. The specialty of most Japanese PCPs is internal medicine (88.3%) and 9.7% of PCPs are surgeons.<sup>19</sup> Despite the widespread availability of specialists in a vast array of disciplines, primary care as a distinct discipline remains exceedingly rare in Japan. As the open-access healthcare system in Japan precludes the need for gatekeepers, the practice of primary care has long been relegated to prehospital triage medicine by community providers who are trained specialists with very limited exposure to preventive, community-based, and primary care training. As such, patients with a certain depth or complexity of organ dysfunction that may be beyond the purview of the relatively narrow training of a PCP are readily referred to appropriate specialty clinics, either within the community or at large hospital organizations. Thus, as expected, only 5.6% of the subjects in

the present study had a PCP. In response to the growing need for primary care for rural as well as rapidly aging populations, the Ministry of Health, Labour and Welfare of Japan will introduce the first formal training standards for primary care in 2017.<sup>20</sup> Nonetheless, the model of holistic and longitudinal general care of a single individual by a single provider does not exist in the current Japanese healthcare infrastructure.

Despite relatively less primary healthcare provision, Japan continues to enjoy very low social and economic barriers to secondary and tertiary healthcare. Literacy rates are amongst the highest in the world and, despite growing income gaps, a stunning 99% of the population receives health insurance.<sup>21</sup> In addition, without any training caps on residency and fellowship spaces for specialty-training, secondary healthcare has remained extensive. Healthcare costs, set by national standards at the government level, have remained low. As such, and for a variety of sociocultural prerogatives in addition to increased availability and access, Japanese patients were previously reported to visit healthcare providers at rates 2–3 times greater than that observed in the United States.<sup>22</sup>

Our study has several limitations. First, our study included patients who admitted to single center which is large academic hospital. Because they may have severer diseases than those in general population, our results may not be applied to general population. In addition, those who didn't have PCPs in our study may either be healthier patients who didn't require follow-up or those who required specialized care by specialists. Therefore, we cannot compare effects of PCPs and specialists simply with our data, although we adjusted covariates in analyses.

## Conclusion

Patients who reported to have a PCP had less frequent utilization of high-cost services related to hospitalization such as ambulance use and after-hours hospital services but a had higher readmission rate. No differences in mortality or LoS stay were found.

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## ADDRESS FOR CORRESPONDENCE:

Daiki Kobayashi, M.D., MPH, MBA, Division of General Internal Medicine, Department of Medicine, St. Luke's International Hospital, Tokyo, Japan, Tel: +81-3-3541-5151; E-mail: yosugi77@fujita-hu.ac.jp

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