

Health Service Research

# Gatekeeping function of primary care physicians under Japan's free-access system: a prospective open cohort study involving 14 isolated islands

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## Abstract

**Background.** Gatekeeping is important for strong primary care and cost containment. Under Japan's free-access system, patients can access any medical institution without referral, which makes it difficult to evaluate the gatekeeping function of primary care physicians (PCPs).

**Objectives.** To examine the gatekeeping function of PCPs in Japan, we compared the frequencies of visits to primary care clinics, referrals to advanced care and hospitalizations between 14 remote islands and a nationwide survey.

**Methods.** This study was a prospective, open cohort study involving 14 isolated islands (12 238 inhabitants) in Okinawa, Japan. Participants were all patients who visited the clinics on these islands in 1 year. Main outcome measures were the incidence of on-island clinic visits and referrals to off-island advanced care.

**Results.** There were 54 741 visits to the islands' clinics with 2045 referrals to off-island medical facilities, including 549 visits to emergency departments and 705 hospitalizations. The age- and sex-standardized incidences of healthcare use per 1000 inhabitants per month were: 360.0 (95% confidence interval: 359.9 to 360.1) visits to primary care clinics, 11.6 (11.0 to 12.2) referrals to off-island hospital-based outpatient clinics, 3.3 (2.8 to 5.2) visits to emergency departments and 4.2 (3.1 to 5.2) hospitalizations. Comparison with the nationwide survey revealed a lower incidence of visits to hospital-based outpatient clinics in this study, while more patients had visited PCPs.

**Conclusions.** The lower incidence of visits to secondary care facilities in this study might suggest that introduction of a gatekeeping system to Japan would reduce the incidence of referral to advanced care.

**Key words:** Access to care, emergency medicine/urgent care, international health, population health, primary care, rural health.

## Introduction

Gatekeeping by primary care physicians (PCPs) is an important component of strong primary care (1) and is associated with cost

containment (2). Therefore, building an efficient gatekeeping system is an important issue for policy makers and healthcare professionals (3). However, many countries (i.e. France and Belgium in Europe (1),

and the Republic of Korea (4) and Japan (5) in Asia) do not use a gatekeeping system whereby patients need referral from PCPs to access advanced care.

Japan has a free-access system under which patients can access any medical institution without referral. This lack of a gatekeeping system means that it is difficult to evaluate the gatekeeping function of PCPs (5,6). To overcome this problem, we surveyed healthcare seeking behaviour (e.g. frequency of referrals to advanced care) in a geographically isolated island where the PCP performed a gatekeeper role (7). Although the study design introducing a gatekeeping system to one part of a country and comparing gatekeeping areas with non-gatekeeping areas as the study by Hofman *et al.* (8) is the more valid way to verify the efficacy of gatekeeping system, we conducted our previous study (7) as a natural experiment with regard to feasibility. Our previous study highlighted the low frequencies of referrals to advanced care, emergency department visits and hospitalizations compared with an earlier nationwide study in Japan (7,9). However, our findings did not have sufficient generalizability as it was a single-centre study involving one physician (7). In addition, there was a discrepancy of a study period between our previous study (2013–2014) (7) and the nationwide survey used for comparison (2003) (9).

To obtain a clearer picture of the gatekeeping function of PCPs, we extended our study to include 14 remote islands and compared the incidences of visits to primary care clinics, referrals to advanced care, referrals to emergency departments and hospitalizations on these 14 islands with data from an updated nationwide survey conducted in 2013 (10). Moreover, we also evaluated the association between the gatekeeping function and geographical differences, such as distance, travel time and cost of travel to the advanced care hospital. The findings will inform development of a PCP gatekeeping system in Japan and other countries without a strict gatekeeping system.

## Methods

We conducted a prospective, open cohort study involving 14 isolated islands in Okinawa Prefecture, Japan (Supplementary Fig. S1).

### Study setting

#### Primary care in Japan

In Japan, a dividing line between primary care and secondary care is vague due to a free-access system (6). To spread the concept of 'primary care' for Japanese people and to promote clinical research and medical education in primary care, the Japan Primary Care Association (JPCA) was established in 2010 (11). As of October 31, 2017, there were 673 certified family physicians (11). The definition of primary care by the JPCA is 'Primary care is the provision of integrated, accessible health care services by clinicians who are accountable for addressing a large majority of personal health care needs, developing a sustained partnership with patients, and practicing in the context of family and community'. based on National Academy of Sciences, 1996 (12).

#### Primary care in Okinawa Prefecture

Okinawa Prefecture has 54 islands; of which, 36 are inhabited (13). Eighteen islands have solo-practice clinics (14). Of these, Okinawa Prefecture has 16 prefectural clinics on 15 islands (15) (each island has one clinic, except Iriomote island that has two clinics). Prefectural hospitals have a training program for solo PCPs on isolated islands (14). PCPs on these islands were trained in the program and are the

members of the Practice-based Research Network (16). They covered all health problems for all inhabitants, including children and pregnant women. However, they did not provide prenatal check-ups for pregnant women and a delivery. Therefore, they need to refer the patients who need such care. They are employed and paid by Okinawa Prefecture. Their clinics have 2–4 staff (one physician, one nurse and up to two clerks) but no beds. A PCP in each clinic works at 8:30–17:00 on weekday and provides 24-h emergency medical services on call, including after hours on weekday and holidays. The clinics have electrocardiogram, X-ray, ultrasound and microscope equipment, and simple blood tests are available. As there are no surgical facilities or hospitals with beds, patients with advanced-care needs are referred to off-island secondary facilities (14). A medical helicopter service is accessible to transport patients with emergent illness to the main island of Okinawa.

### Participants

We included 15 prefectural clinics that used an electronic medical system. One prefectural clinic was excluded because it did not use this system. All patients who visited the islands' clinics between 1 February 2016 and 31 January 2017 were included in the present study. In 2016, there were 12 238 inhabitants (male/female: 6610/5719); 26.1% of the islands' population was aged 65 years and over (Okinawa Prefecture 17.4% (17) versus Japan overall 26.6% (17)) and 16.1% was aged under 15 years (Okinawa Prefecture 17.4% (17) versus Japan overall 12.6% (17)).

### Main outcome measures

We prospectively counted the numbers of patient visits to the islands' clinics using the data of routine practice. We also collected the information about referrals to off-island medical facilities using the electronic database from the PCPs. In this study, we excluded referrals/emergency department visits/hospitalizations for non-inhabitants such as tourists because we aimed to describe the healthcare use of inhabitants of the 14 islands.

Although PCPs discriminated inhabitants from non-inhabitants by his/her address on a patient record in terms of the referred patients, we did not obtain the information on the address of those who visited clinics and were not referred for this study. The reason was that gathering information about the address would become too heavy burden on the PCPs. The frequencies of visits, referrals and hospitalizations were counted by event-based but not patient-based, which means in the case that a patient visited the clinic twice a year, the number of his/her visits was described as 2.

We examined the incidence of referrals by referrals to emergency departments and other medical facilities. We ascertained the actual numbers of visits to off-island facilities, emergency department visits and hospitalizations using response letters from referral facilities and/or information from patient records. We emailed monthly reminders to each PCP to complete the forms.

We compared the incidence rates for visits, referrals and hospitalizations with those reported in the updated nationwide study (10). The category 'visits to off-island medical facilities' in the present study included referrals to hospital-based outpatient clinics, secondary care clinics (e.g. orthopaedic clinics) and emergency departments. Japan has secondary care clinics that are not hospital-based (i.e. orthopaedists, ophthalmologists); therefore, we compared 'visits to hospital-based outpatient clinics' with 'hospital-based outpatient clinic visits' used in the updated nationwide study (10).

The composition and socioeconomic status of the population was important for comparisons of healthcare use with the updated nationwide study (10). However, that study did not present this information. Therefore, we used data for Japan overall from the Japanese Statistics Bureau (18) for those comparisons. We substituted data for socioeconomic status on the 14 islands from the Japanese Statistics Bureau (18), Okinawa Prefecture (15,17,19,20) and the Ministry of Health, Labour and Welfare in Japan (21). Socioeconomic data for 9 of the 14 islands were available. Data for four islands (Tsuken, Kudaka, Iriomote, and Kohama) were not available because those islands are part of large administrative districts and specific socioeconomic data are not published. Two islands, Aka and Zamami, comprise one district.

As factors such as the proportion of the population aged 65 years and over and socioeconomic status may be associated with healthcare use. However, we could not obtain the data about socioeconomic status from each patient directly. By using census data, therefore, we compared these factors between the present study (conducted in 2016–2017) and the 2013 nationwide survey (10). We found that 26.1% of the population of all 14 islands was aged 65 years and over (2016) versus 25.1% in Japan overall (2013) (18). Weighted average annual healthcare cost per capita for the islands (sum of healthcare cost times population in each island/total population in these islands) was 263 100 Yen (2015) (21) compared with 314 700 Yen (2015) for Japan (22). Regarding socioeconomic status, weighted average annual income for the islands was 2 397 918 Yen (2014) (19) compared with 3 085 000 Yen (2013) (18) for Japan. In 2010, the unemployment rate in the islands was 6.9% compared with 6.4% for Japan (18). The proportion of high school graduates in the islands (2010) was 33.7% compared with 35.5% for Japan (2010) (18). In addition, the proportion of university graduates in the islands (2010) was 8.2% compared with 11.5% in Japan (2010) (18). Weighted average annual healthcare cost per capita, weighted average annual income, unemployment rate, proportion of high school graduates and proportion of university graduates were calculated using data for the nine islands for which these data were available.

### Statistical analysis

We conducted descriptive analyses and employed ‘the ecology of medical care model’ by White *et al.* (23) to substantiate healthcare use per 1000 inhabitants over a 1-month period, based on the actual number of visits. We calculated 95% confidence intervals (CI) for event rates obeying a normal distribution. We used Spearman’s rank correlation coefficients to examine correlations between the incidence of visits to primary care clinics/visits to off-island medical facilities/emergency department visits/hospitalizations and travel distance/time/cost to the advanced care hospital.

### Results

Characteristics of each island are shown in Table 1. In total, there were 54 741 patient visits to the clinics over the 1-year study period (27 724 men and 27 017 women). Of these, 6728 (3651 men and 3077 women) were aged <15 years, 4941 (2443 men and 2498 women) were aged 15–39 years, 17 203 (10 334 men and 6869 women) were aged 40–64 years and 25 873 (11 295 men and 14 578 women) were aged ≥65 years. There were 2165 referrals to off-island medical facilities. Of these, we excluded 120 referrals for patients from outside the islands (e.g. tourists). The 2045 referrals used in the analyses (1119 men and 926 women) included 549 (288 men and

261 women) referrals to emergency departments and 705 (382 men and 323 women) hospitalizations. Of the analysed referrals, 1786 were referrals to hospital-based outpatient clinics and 259 were referrals to secondary care clinics such as an ophthalmology clinic. Whether these patients actually visited off-island medical facilities was confirmed by response letters and/or patient records.

We calculated the number of visits and referrals for 1 month per 1000 inhabitants. The results showed there were 372.8 (95% CI 369.6 to 375.9) visits to clinics on the islands. Of these visits, 13.9 (95% CI 13.3 to 14.5) were referred to off-island medical facilities, which included 3.7 (95% CI 3.4 to 4.1) referrals to emergency departments and 4.8 (95% CI 4.4 to 5.2) hospitalizations.

Table 2 shows the overall and category-specific incidence rates by age and sex. Comparisons between the age- and sex-standardized incidence of healthcare-seeking behaviour in the present study with the updated nationwide study targeting Japan (10) are shown in Table 3 and Fig. 1. The Japanese nationwide population as on 2013(26) was used as the population for standardization. A higher incidence of visits to the primary care clinics was observed in the present study than in the updated nationwide study (10). In contrast, the incidence of visits to hospital-based outpatient clinics in the present study was lower than that in the updated nationwide survey (10).

Figure 2 demonstrates the relationship between travel distance/time/cost to the advanced care hospital and age- and sex-standardized incidence of visits to primary care clinics/visits to off-island medical facilities/emergency department visits/hospitalizations. There were no statistically significant correlations. Spearman’s rank correlation coefficient between distance and visits to primary care clinics was 0.36 (95% CI –0.2 to 0.74), visits to off-island medical facilities was 0.33 (95% CI –0.25 to 0.373), emergency department visits was –0.29 (95% CI –0.7 to 0.29) and hospitalizations was 0.01 (95% CI –0.52 to 0.54). The coefficient between travel time and visits to primary care clinics was –0.04 (95% CI –0.56 to 0.5), visits to off-island medical facilities was –0.09 (95% CI –0.59 to 0.46), emergency department visits was –0.03 (95% CI –0.56 to 0.51) and hospitalizations was –0.14 (95% CI –0.62 to 0.43). Finally, the correlation between travel cost and visits to primary care clinics was 0.37 (95% CI –0.2 to 0.75), visits to off-island medical facilities was 0.3 (95% CI –0.28 to 0.72), emergency department visits was –0.3 (95% CI –0.71 to 0.28) and hospitalizations was 0.02 (95% CI –0.52 to 0.55).

### Discussion

On 14 isolated islands in Japan, the ecology of medical care with limited access to advanced care was described and compared with the updated nationwide study (10). Despite more visits to primary care clinics in this study compared with the nationwide survey (10), fewer patients were referred to advanced medical care. This suggests that introduction of gatekeeping by PCPs might reduce the incidence of referrals to advanced care in the Japanese primary care setting. Moreover, the incidence of healthcare use did not have statistically significant correlations with travel distance/time/cost. These results suggested PCPs played an important gatekeeper role in each island, regardless of travel distance/time/cost to the main island of Okinawa.

Fewer referrals to advanced care may be explained by the gatekeeping function of PCPs. However, needless to say, some known other factors affect decision making on the process of referral. According to the O’Donnell’s review (27), referral rates in past studies have wide variation (27) and the variation is explained by patient

**Table 1.** Basic characteristics of the 14 islands and overall Japan from census data 2010–2017

|   | Iheya | Izena | Tsukun | Aka   | Zamami | Aguni     | Tokashiki | Tonaki | Minamidaito | Kitadaito | Kudaka | Tarama | Iriomote | Kohama | Japan   |
|---|-------|-------|--------|-------|--------|-----------|-----------|--------|-------------|-----------|--------|--------|----------|--------|---------|
| Area (13) (km <sup>2</sup> )                      | 21.7  | 14.1  | 1.9    | 5.0   | 6.7    | 7.6       | 15.3      | 3.6    | 30.5        | 11.9      | 1.4    | 19.8   | 289.6    | 7.9    | 372     |
| Population (24)                                   | 1238  | 1517  | 391    | 306   | 564    | 759       | 730       | 430    | 1329        | 629       | 206    | 1194   | 2314     | 631    | 967.4   |
| Population aged ≥65 years (%) (24)                | 26.3  | 27.7  | 46.5   | 20.3  | 19.5   | 33.1      | 21.2      | 30.0   | 21.3        | 17.6      | 39.8   | 26.4   | 19.2     | 16.2   | 127.298 |
| Distance to hospital (km)                         | 57.4  | 47.4  | 18.0   | 43.8  | 42.9   | 69.9      | 39.9      | 68.0   | 350.2       | 368.9     | 17.5   | 68.6   | 54.6     | 21.9   | 000     |
| Transportation (20)                               | Ship  | Ship  | Ship   | Ship  | Ship   | Ship      | Ship      | Ship   | Ship        | Ship      | Ship   | Ship   | Ship     | Ship   | Ship    |
| SMR (25)  |       |       |        |       |        | Aeroplane |           |        | Aeroplane   | Aeroplane |        |        |          |        |         |
| Male  | 107.4 | 105.5 |        | 120.4 | 120.4  | 87.9      | 145.3     | 101.8  | 72.3        | 81.6      |        | 125.9  |          |        | 100     |
| Female  | 73.5  | 97.8  |        | 81.9  | 81.9   | 85.3      | 74.1      | 78.8   | 123.9       | 45.9      |        | 75.3   |          |        | 100     |
| Annual healthcare cost per capita (1000 Yen) (21) | 263.5 | 337.4 |        | 216.4 | 216.4  | 259.1     | 241.2     | 422.1  | 218.2       | 242.0     |        | 222.3  |          |        | 314.7   |
| Annual income per capita (1000 Yen) (19)          | 1509  | 2048  |        | 2196  | 2196   | 1908      | 2838      | 2324   | 3307        | 4147      |        | 2047   |          |        | (22)    |
| Proportion of high school graduates (%) (18)      | 32.6  | 39.0  |        | 40.1  | 40.1   | 27.1      | 34.2      | 32.3   | 38.3        | 38.1      |        | 26.6   |          |        | 32.3    |
| Proportion of university graduates (%) (18)       | 5.3   | 4.3   |        | 13.1  | 13.1   | 6.5       | 12.0      | 10.6   | 5.8         | 8.0       |        | 4.9    |          |        | 13.8    |
| Unemployment rate (%) (18)                        | 8.8   | 14.7  |        | 7.0   | 7.0    | 8.9       | 4.9       | 8.8    | 4.9         | 0.8       |        | 3.6    |          |        | 6.4     |

SMR, standardized mortality ratio; SMRs were based on the census data in 2010 and published in 2014.

**Table 2.** Healthcare-seeking behaviour for 1 month per 1000 inhabitants (2016–2017)

|             | Primary care clinic visits<br>(95% CI) | Referrals to off-island<br>medical facilities<br>(95% CI) | Referrals to emergency<br>departments<br>(95% CI) | Hospitalizations<br>(95% CI) |
|-------------|--|---|---|------------------------------|
| Overall     | 372.8<br>(369.6 to 375.9)              | 13.9<br>(13.3 to 14.5)                                    | 3.7<br>(3.4 to 4.1)                               | 4.8<br>(4.4 to 5.2)          |
| Age (years) |  |   |   |                              |
| <15         | 283.7<br>(277.0 to 290.5)              | 6.5<br>(5.4 to 7.5)                                       | 1.7<br>(1.2 to 2.3)                               | 2.1<br>(1.5 to 2.7)          |
| 15–39       | 142.7<br>(138.7 to 146.6)              | 5.3(4.6 to 6.1)   | 1.4<br>(1.0 to 1.8)                               | 1.5<br>(1.1 to 1.9)          |
| 40–64       | 311.5<br>(306.9 to 316.2)              | 10.1<br>(9.3 to 10.1)                                     | 2.1<br>(1.7 to 2.5)                               | 2.6<br>(2.2 to 3.1)          |
| ≥65         | 725.5<br>(716.6 to 734.3)              | 32.5<br>(30.7 to 34.4)                                    | 9.6<br>(8.6 to 10.6)                              | 12.8<br>(11.7 to 14.0)       |
| Sex         |  |   |   |                              |
| Men         | 344.7<br>(340.7 to 348.8)              | 13.9<br>(13.1 to 14.7)                                    | 3.6<br>(3.2 to 4.0)                               | 4.7<br>(4.3 to 5.2)          |
| Women       | 406.7<br>(401.8 to 411.5)              | 13.9<br>(13.0 to 14.8)                                    | 3.9<br>(3.5 to 4.4)                               | 4.9<br>(4.3 to 5.4)          |

CI, confidence interval.

**Table 3.** Comparison of healthcare use (age- and sex-standardized incidence/1000 inhabitants/month) between the present study observed in 2016–2017 and the updated nationwide study observed in 2013 (10)

|  | Fukui <i>et al.</i> 2013 (10)<br>Japan overall<br>(95% CI) | Present study<br>(95% CI)  |
|--|--|--|
| Visits to primary care<br>clinics <sup>a</sup> | 206<br>(194 to 218)  | 360.0<br>(359.9 to 360.1)  |
| Visits to<br>off-island medical facilities     | 60 <sup>b</sup><br>(54 to 68)                              | 13.1 <sup>c</sup><br>(12.6 to 13.7)<br>11.6 <sup>b</sup><br>(11.0 to 12.2)<br>1.8 <sup>d</sup><br>(0.4 to 3.3) |
| Visits to emergency<br>departments             | 4<br>(2 to 6)  | 3.3<br>(2.8 to 5.2)  |
| Hospitalizations                               | 6(4 to 9)  | 4.2<br>(3.1 to 5.2)  |

CI, confidence interval.

<sup>a</sup>The category 'Visits to a primary care office' used in Fukui *et al.*'s study was equivalent to 'Visits to primary care clinics' in the present study; therefore, we unified this to 'Visit to primary care clinics'.

<sup>b</sup>Data for people that visited hospital-based outpatient clinics.

<sup>c</sup>Data for people that visited hospital-based outpatient clinics, secondary care clinics (e.g. ophthalmological clinics) and emergency departments off-island.

<sup>d</sup>Data for people that visited secondary care clinics.

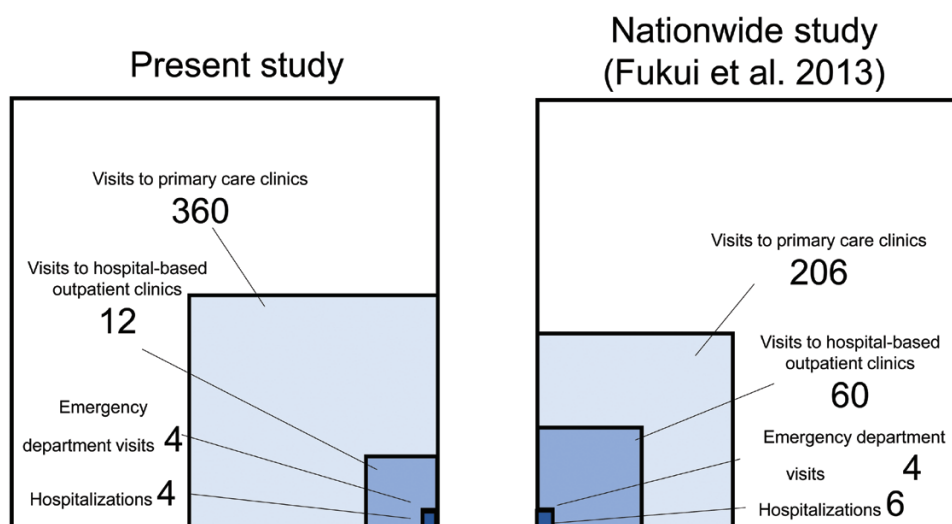
characteristics (age (28,29), sex (28,29) and social class (30)), practice characteristics (practice size (31) and location (32)), physician characteristics (interest or training in particular speciality (33)) and access to specialist care (34). These four factors have been demonstrated in Methods and Results sections. To generalize the results of the study, these factors should be considered. In this study, the weighted-average annual healthcare cost per capita areas was lower than that in overall Japan. This finding might mean gatekeeping by PCPs saved healthcare expenditure. Although some patients with severe renal failure might move out from study areas to the main

island of Okinawa due to lack of facilities for dialysis, the proportion of the cost of dialysis in all healthcare cost is about 4% in Japan (35). Thus, the cost for dialysis may not change our results.

Furthermore, it is needed to compare between in this study and in other countries with a gatekeeping system. The referral rate to specialist per 1000 consultations, 37.3 (2045 referrals in 54 741 visits) in this study was not so much different than that in Ireland (42), in the Netherlands (44.2) and the UK (47.2) (36). Also, the definition of primary care (12) is similar to that of other counties (37). Therefore, introduction of a gatekeeping system to Japan might reduce the number of referral to the same level of other countries with a gatekeeping system.

In our study, the incidences of visits to primary care clinics/visits to advanced medical facilities/emergency department visits/hospitalizations did not show statistically significant correlations with travel distance/time/cost to advanced medical care. In the study setting, patients potentially can skip PCPs. However, if patients skip PCPs, they need to travel a long distance by ship or aeroplane and pay money for the travel. Also, from our results, the incidence of referral in the islands near the main islands of Okinawa was not lower than that in the islands far from the main island. If patients skipped PCPs, closer the island was to main island, lower the incidence of referrals would have been. Thus, these results suggest that a gatekeeping function exists on the islands regardless of difficulty in access to advanced medical care. This may be attributed to an appropriate training scheme for developing rural PCPs and a support system for PCPs (including a phone/Internet consultation system) (14).

Macinco *et al.* (38) indicated that gatekeeping/first contact by PCPs is associated with less use of specialists and emergency rooms in their review. In the present study, it is likely that PCPs could reduce the number of referrals to advanced medical care, provided that well-established training in response to regional needs and an appropriate support system are available. Since physicians in these islands received the training for rural solo practitioner (14), the scope of practice and comprehensiveness of care might be broader than that of physicians in the main island of Japan. However, a system for certified general practitioners is now being constructed in Japan (39) and to foster physicians with the broad scope of practice and comprehensiveness might be important for Japanese health care.



**Figure 1.** Comparison of healthcare use between the present study observed in 2016–2017 and the updated nationwide study observed in 2013 (10)

We propose that Japanese healthcare providers and policy makers need to introduce the gatekeeping system to Japan with PCPs who can offer comprehensive care with broad scope of practice based on established training system.

Of course, it is difficult to change healthcare system from a free-access system to a gatekeeping system drastically only by one evidence from the present study. The other research in Japanese primary care setting, however, indicated that better patient satisfaction is associated with the reduction of patient's bypass of primary care (40). Therefore, improvement of primary-care quality may reduce referrals to specialists in overall Japan even under a free-access system. In Japan, a system for certified general practitioners had just started. However, 'the Japan Primary Care Association certified family physician' is its predecessor and 673 certified family physicians (41) have already engaged in practice. In the main island of Japan, especially in rural area, some of them play a central role as PCPs as well as in the study area. Thus, as a next step, we are going to examine the impact of practice by PCPs on regional health status and healthcare cost in the overall Japan to propose the importance of the gatekeeping system by PCPs to policy makers, medical associations and academia. Also, we will appeal to the JPCA to hold a symposium about gatekeeping system with citizen groups.

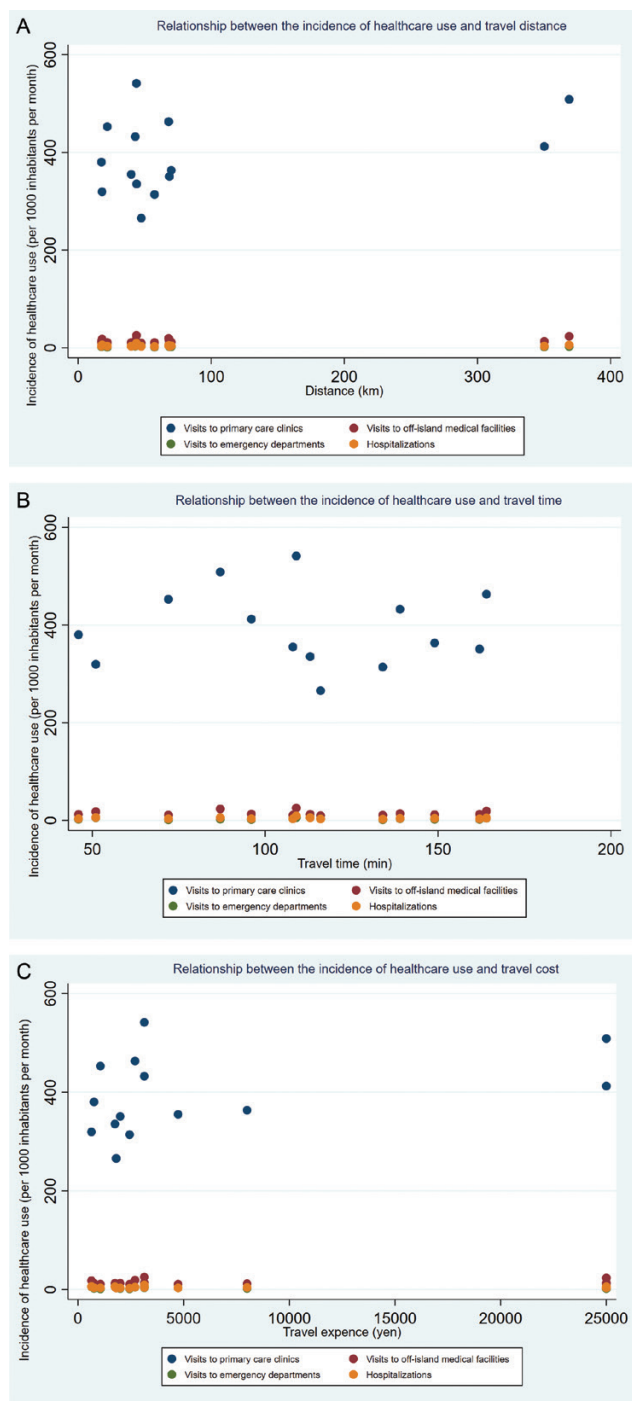
### Limitations of this study

First, although we were able to exclude non-inhabitants such as tourists from the number of referrals/visits to emergency departments/hospitalizations, the number of visitors to primary care clinics included these non-inhabitants. Therefore, we might have overestimated the number of visits to primary care clinics. However, as we wrote in the Results section, the proportion of the referrals about non-inhabitants was 5.5%: 120 referrals about non-inhabitants/2165 all referrals. Assuming that the proportion of referrals among non-inhabitants was the same as that among inhabitants, a crude incidence of visits to primary care clinics per 1000 inhabitants per month would be 352.2 (95% confidence interval 349.2–355.3) which was not so different from, 372.8, our results. Considering that the incidence of clinic visits in the nationwide survey was 206 per 1000 inhabitants/month, therefore, our conclusion that the incidence of clinic visits was higher than that in the nationwide survey would not change.

Second, several inhabitants (e.g. patients with terminal cancer or dialysis) might have moved off the islands because of difficulties associated with regular visits to medical facilities on the main island of Okinawa. Thus, the present study might have underestimated the number of visits and referrals.

Third, although the reason for referral, severity of illness and final diagnosis are important information to examine numbers of referrals and hospitalizations, we could not obtain the information. The reason is why the PCPs did not use a common code for reason for visit and diagnosis.

Fourth, the results of the present study should be interpreted carefully because we had difficulty in comparing the spectrum of diseases, the health status of inhabitants such as life style-related diseases/malignancy and the quality of care between this study and the updated nationwide study (10), given a lack of corresponding survey data for each island. In terms of quality of care, we considered that the clinics had a valid triage function as the incidences of hospitalizations and emergency department visits in our study were almost the same as those of the nationwide survey despite the higher incidence of visits to primary care clinics and the lower incidence of referrals in our study. In addition, as shown in Table 1, the standardized mortality ratios in the islands are close to 100 with some variation, which indicates that the patients with critical diseases may be referred to advanced care through a valid triage by PCPs; the standardized mortality ratios in the islands would have elevated if the quality of care with referrals were so poor. Also, the health status between these islands and overall Japan appeared to be not so much different to the extent that we changed our conclusions because of the standardized mortality ratios which were close to 100. In addition, introducing gatekeeping in German improved quality of care in regard to prevention such as check-ups and influenza vaccinations (8). Thus, in our study setting, gatekeeping may also be related to better health status. The studies in other countries reported that a gatekeeping system had controversial aspects (42) and a systematic review reported that there was no significant difference between a gatekeeping system and a free-access system in relation to morbidity and mortality (43). Even if health outcomes in a gatekeeping system are similar to those in a free-access system (42), the lower incidence of referral in our study may be worthwhile. Also, a gatekeeping system can reduce healthcare inequities such as a provision of decision making support to disadvantaged patients (43).



**Figure 2.** (A–C) Relationships between travel distance/time/cost to advanced care hospitals and the age- and sex-standardized incidence of visits to primary care clinics/visits to off-island medical facilities/emergency department visits/hospitalizations (2016–2017)

Finally, the present study and the updated nationwide study (10) used different methods; however, selection bias was minimized in both studies. The nationwide study (10) used a population-weighted random sample and achieved a high response rate (response rate 91% with 4548 participants), and our study targeted all residents on 14 islands.

## Conclusions

This study described the ecology of medical care in areas with limited access to advanced care in Japan, and compared the findings

with an updated nationwide study (10). Introduction of a gatekeeping system with established training for PCPs to Japan might reduce the incidence of referrals to advanced care. The present results provide a useful benchmark for PCPs and policy makers in Japan and the other countries without a strict gatekeeping system.

## Supplementary material

Supplementary material is available at *Family Practice* online.

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## Declaration

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**Ethical approval:** This study was approved by the Research Ethics Committee of Okinawa Chubu Hospital, Japan (approval number 52, 2015) and the research ethics committees of Okinawa Hokubu Hospital, Okinawa Prefectural Nambu Medical Center and Children's Medical Center, Okinawa Miyako Hospital and Okinawa Yaeyama Hospital. We did not receive individual informed consent from patients; however, we displayed posters in the waiting rooms of the clinics providing information about collecting and using data for this research and the protection of personal information.

**Conflict of interest:** MM received lecture and travel fees from the Centre for Family Medicine Development (CFMD) of the Japanese Health and Welfare Co-operative Federation. MM is an adviser for the CFMD Practice-based Research Network. MM is a program director for Jikei Clinical Research Program for Primary Care. MK is a member of the CFMD Practice-based Research Network. MK, RO, AS and HM were former trainees of the Jikei Clinical Research Program for Primary Care. There are no potential competing interests to be declared relevant to this work other than the above descriptions.

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