

BMJ Open Admissions for ambulatory care sensitive conditions on rural islands and their association with patient experience: a multicentred prospective cohort study

Makoto Kaneko ^{1,2}, Takuya Aoki ³, Masafumi Funato,⁴ Keita Yamashiro,⁵ Kaku Kuroda,⁶ Moe Kuroda,⁷ Yusuke Saishoji,⁸ Tatsuya Sakai,⁹ Syo Yonaha,¹⁰ Kazuhisa Motomura,⁵ Machiko Inoue^{1,2}

To cite: Kaneko M, Aoki T, Funato M, *et al.* Admissions for ambulatory care sensitive conditions on rural islands and their association with patient experience: a multicentred prospective cohort study. *BMJ Open* 2019;**9**:e030101. doi:10.1136/bmjopen-2019-030101

► Prepublication history for this paper is available online. To view these files, please visit the journal online (<http://dx.doi.org/10.1136/bmjopen-2019-030101>).

Received 27 February 2019
Revised 24 October 2019
Accepted 04 December 2019



© Author(s) (or their employer(s)) 2019. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ.

For numbered affiliations see end of article.

Correspondence to

Dr Makoto Kaneko;
makotok@hama-med.ac.jp

ABSTRACT

Objectives The rate of admissions for ambulatory care sensitive conditions (ACSCs) is a key outcome indicator for primary care, and patient experience (PX) is a crucial process indicator. Studies have reported higher rates of admission for ACSCs in rural areas than in urban areas. Whether there is an association between admissions for ACSCs and PX in rural areas has not been examined. This study aimed to document admissions for ACSCs on Japanese rural islands, and assess whether there was an association between the rate of admissions for ACSCs and PX.

Design Multicentred, prospective, cohort study

Setting This study was conducted on five rural islands in Okinawa, Japan.

Participants The study participants were all island inhabitants aged 65 years or older.

Primary outcome measures This study examined the association between ACSCs and PX assessed by a questionnaire, the Japanese Version of Primary Care Assessment Tool. ACSCs were classified using the International Classification of Diseases, Tenth Revision, and the rate of admissions for ACSCs in 1 year.

Results Of 1258 residents, 740 completed the questionnaire. This study documented 38 admissions for ACSCs (29 patients, males/females: 15/14, median age 81.9) that included congestive heart failure (11), pneumonia (7) and influenza (5). After adjusting for covariates and geographical clustering, admissions for ACSCs had a significant positive association with each patient's PX scores (OR per 1 SD increase=1.62, 95% CI 1.02–2.61).

Conclusions Physicians serving rural areas need to stress the importance of preventive interventions for heart failure, pneumonia and influenza to reduce the number of admissions for ACSCs. Contrary to previous studies, our findings might be explained by close patient–doctor relationships on the rural islands.

INTRODUCTION

Avoidable hospital admissions are associated with rising healthcare costs, the disruption of elective healthcare, and compromising a patient's quality of life.¹ Admissions for

Strengths and limitations of this study

- This is the first study to examine the association between patient experience (PX) and admissions for ambulatory care sensitive conditions (ACSCs) on rural islands.
- This is the first study to describe ACSCs in Japan's primary care settings.
- The Japanese version of the Primary Care Assessment Tool used in previous studies to assess PX in primary care was used as an indicator of PX.
- The severities of illnesses were not examined.

ambulatory care sensitive conditions (ACSCs) are potentially avoidable through the prevention, control and management of diseases in outpatient settings.² The rate of hospital admissions for ACSCs provides a key to assessing the quality of the primary care being delivered.^{3 4} For example, countries such as the UK, Australia, USA and Spain use rates of admission for ACSCs as an outcome indicator for the quality of their primary healthcare.^{5–10} On the other hand, patient experience (PX)—an important process indicator for the quality of primary care¹¹—encompasses the full range of patients' interactions with the healthcare system including the care they receive from health insurance providers, doctors, nurses and staff in healthcare facilities.¹² PX, together with clinical effectiveness and patient safety, is one of the three pillars of quality in healthcare.¹³

Outcome and process indicators need to be analysed conjointly. Several studies have indicated that PX in primary care settings such as those related to continuity of care is associated with lower rates of admissions for ACSCs.^{14–16} Quality of primary care is also a

problem in rural areas,¹⁷ and many studies have revealed higher rates of admissions for ACSCs in rural areas than in urban areas.^{10 18–21} One of the reasons could be that patients tend to be admitted at low threshold to compensate lower access to healthcare in comparison with that in urban areas.^{22 23} However, whether other domains of PX such as coordination, comprehensiveness or community orientation can affect admissions for ACSCs to remain unclear.

The Japanese version of the Primary Care Assessment Tool (JPCAT) has good reliability/validity and is suitable for measuring PX in primary care settings.²⁴ Therefore, the authors employed the JPCAT in previous research that examined the relationship between PX and hospitalisations/emergency department (ED) visits on rural islands.²⁵ It is composed of six domains that represent primary care attributes: first contact, longitudinality, coordination, comprehensiveness (services available), comprehensiveness (services provided) and community orientation.²⁴

The purpose of this study was to document admissions for ACSCs on rural Japanese islands, and confirm whether or not there was an association between the rate of admissions for ACSCs and PX. The study's findings will be used to inform the delivery of primary healthcare in these areas and reduce the number of hospital admissions for ACSCs.

METHODS

Design and setting

We conducted a multicentred prospective cohort study on five rural islands in Okinawa Prefecture, Japan. We reported an association between ED visits/hospitalisations and PX on these islands in a previous study, using the same dataset used in this study.²⁵ The geographical locations of the five islands are also documented in our previous study.²⁵

Health care system in Japan

Two main characteristics of the Japanese healthcare system are universal health coverage and free-access system.²⁶ All residents of Japan are enrolled in a health insurance programme.²⁶ Regarding the payment system in Japanese primary care, all medical institutions paid by fee-for-service in outpatient setting.²⁶ Pay-for-performance or capitation system is not employed in Japan. Therefore, a physician in a private clinic receives income based on fee-for-service system. However, a physician in a hospital or a public clinic is salaried by their institution. Usually, the salary of a physician in a private clinic is higher than that in a hospital or public clinic.²⁶

Primary care in Okinawa Prefecture, Japan

Okinawa Prefecture is composed of 54 islands, 39 of which are inhabited.²⁷ This represents the second largest number of inhabited islands in Japan.²⁸ Of the 39 inhabited islands, 18 have solo practice clinics,²⁹ and of these,

Okinawa Prefecture has 16 prefectural clinics on 15 islands (each island has one clinic, except for Iriomote Island, which has two).³⁰ Of these 15 islands, 5 local governments cooperated in conducting this study's survey.

Prefectural hospitals have a training programme for solo primary care physicians (PCPs) on these islands.²⁹ Since they have no surgical facilities or hospitals with beds, patients with advanced care needs are referred to off-island secondary facilities.²⁹ A medical helicopter service is used to transport patients with emergency illnesses to the main island of Okinawa. Details of the training programme are described in our previous study.²⁵

Patient and public involvement

This research was conducted without patient involvement because we regarded PX and admissions for ACSCs as patient-centred outcomes. Patients were not invited to comment on the study design, and they were not consulted in the development of relevant patient outcomes or asked to interpret the results. They were not asked to contribute to the writing or editing of this document for readability or accuracy.

Participants

With the exception of those who were unable to respond to the questionnaire due to cognitive impairment or mental disorders, all residents of the five islands whose local governments cooperated in our survey aged 65 years or older were included in our study. Detailed characteristics of the participants from these islands (740 people) are provided in our previous study.²⁵ The proportion of the populations aged 65 years or older was 19.5% to 27.7% (mean: 23.0),³¹ and distance to a hospital was 42.9–350.2 km (mean: 108.3). The study was conducted from 1 October 2016 to 30 September 2017, and the PX survey was conducted during October and November 2016. As of 1 October 2016, approximately 1257 people (600 males, 657 females) were aged 65 years or older.³² We delivered a questionnaire to town offices on each island. Town offices on four islands received JPY 200 per completed response, while the town office on one island did not require remuneration.

Measures

Admissions for ACSCs

The study's primary outcome was documenting the number of patients who were admitted to hospitals for ACSCs at least once during 1 year. We used the National Health Service (NHS) outcome framework to define ACSCs,³³ because there is no definition of ACSCs for Japanese clinical settings, and a previous study of ACSCs in Japan also used this framework.³⁴ This framework is based on the International Classification of Diseases, Tenth Revision for 11 chronic conditions such as diabetes and asthma, and 10 acute conditions such as influenza and pneumonia.³³ We prospectively coded these conditions and counted the number of admissions for ACSCs using the electronic medical record system. Because there

is only one primary care clinic in each island, almost all patients need to receive triage by a PCP. Therefore, we were able to grasp the information on referrals and admissions in the included islands. We ascertained the actual number of admissions using response letters from referral facilities and/or information from patient records.

PXs in primary care

We used the JPCAT²⁴ for data collection. The Primary Care Assessment Tool (PCAT) developed by the Johns Hopkins Primary Care Center has been adapted for use in many studies in different countries to measure the quality of primary care using PX. The JPCAT used in this study is based on the PCAT-AE.³⁵ The JPCAT scoring system is structured as follows: each response is measured on a 5-point Likert scale, reduced by a factor of one, and multiplied by 25.

The score for each of the domains is computed as the mean value for all converted scale scores in that domain. Therefore, the domain scores range from 0 to 100 points, with higher scores indicating better performance. Previous research has shown that the JPCAT has good reliability and validity.²⁴ It has been associated with the adoption of breast cancer screening,³⁶ advanced care planning discussions³⁷ and the bypassing of primary care.³⁸ The total score is the mean of six domain scores: first contact, longitudinality, coordination, comprehensiveness in terms of services available, comprehensiveness in terms of services provided and community orientation. The total score reflects an overall measure of the quality of core primary care principles.

Covariates

Covariates were selected based on a literature review undertaken to identify factors that may confound the association between PX and ED visits/admissions. We included covariates for age, sex, number of comorbidities, years of education, household income, self-rated health and prior regular visits to a primary care clinic on each island. All covariates were evaluated as categorical variables through a self-administered questionnaire.

Statistical analysis

According to the sample size formula demonstrated in a previous study, events per variable values ≥ 10 were necessary for logistic regression analysis.³⁹ We estimated a minimum sample size of 667 because the maximum number of variables in this study was eight. We used R V.3.4.2 (R Foundation for Statistical Computing; <https://www.r-project.org>) for statistical analyses.

RESULTS

This study's response rate was 58.8%, and we analysed 740 (345 males, 395 females) responses. Table 1 summarises respondents' characteristics: 23% were ≥ 85 , and 71.8% visited a primary care clinic regularly. We also found

that 30% of respondents had two or more comorbidities. In terms of education, 59.5% of respondents had no high school education, and 64.5% of respondents had an annual household income under JPY 200 million (\approx <US\$18 000).

Table 2 lists the means and SD of the JPCAT scores. Of a possible 100 points, the average JPCAT score was 67.8 points. The highest scoring domain was first contact (84.5), while the lowest scoring domain was comprehensiveness in terms of services provided (39.7). In 1 year, there were 38 ACSC admissions (29 patients, males/females: 15/14, median age 81.9). Frequent admission diagnoses for ACSCs included pneumonia (17), congestive heart failure (14) and asthma attacks (6). The rate of admissions for ACSCs was 51.4 per year per 1000 respondents (38 admissions for ACSCs per year and 740 respondents). We also counted 24 admissions for ACSCs among 518 non-respondents during the study period through the electronic medical record system. Therefore, the rate of admissions for ACSCs among all residents aged 65 years or older was 49.3 per year per 1000 residents. The details of these admissions are displayed in table 3.

Table 4 presents the results of the mixed effect model analyses of the association between PX with primary care and admissions for ACSCs. After adjusting for possible confounders and clustering within clinics, a higher total JPCAT score was significantly associated with admissions for ACSCs: (OR per 1 SD increase=1.62, 95% CI 1.02–2.61). In terms of each PX domain, longitudinality (1.87, 1.06–3.27) and coordination (3.19, 1.56–6.48) were associated with admissions for ACSCs.

DISCUSSION

This study revealed that on rural islands in Japan, a better PX is associated with admission for ACSCs. Frequent reasons for admissions were congestive heart failure, pneumonia and influenza. After adjusting for age, sex, number of chronic health problems, years of education, household income, self-rated health and prior regular visits to a primary care clinic on each island, the total JPCAT, longitudinality and coordination scores were associated with hospital admissions for ACSCs.

In this study, the rate of admissions for ACSCs was 49.3 per year per 1000 residents. Living in a rural area is associated with admissions for ACSCs.^{1 40 41} For instance, in Australia, the rate in major cities and very remote area were 30.2 and 70.6 per year per 1000 residents.⁴² Since there is no study to compare admissions for ACSCs in rural area with urban area in Japan, to investigate the difference of rate of admissions for ACSCs between rural and urban area is an important step for revealing ACSCs in Japan. Also, other patient factors such as age, socio-economic status and provider factors such as practice size or system of out-of-hours care can affect rate of admissions for ACSCs.¹ In this study, these factors were uniform among the clinics. To compare ACSCs in rural with urban areas overall Japan, these factors need to be considered.

Table 1 Participants' characteristics

	All participants (n=740)	Patients with admissions for ACSCs (n=29)	Patients with no admissions for ACSCs (n=711)
Characteristic	Number (%)		
Sex			
Male	339 (45.8)	14 (48.2)	325 (46.1)
Female	395 (53.4)	15 (51.7)	380 (53.9)
	Missing values: 6 (0.8)	Missing values: 0	Missing values: 6 (0.8)
Age (years)			
65–74	296 (40.0)	7 (25.0)	287 (40.4)
75–84	264 (35.7)	9 (32.1)	255 (35.9)
85–94	159 (21.5)	10 (35.7)	149 (21.0)
95–	11 (1.5)	2 (7.1)	9 (1.3)
	Missing values: 10 (1.4)	Missing values: 1 (3.0)	Missing values: 11 (1.5)
Regular prior visit to a doctor on an island			
Yes	531 (71.8)	25 (96.1)	506 (77.1)
No	150 (20.3)	1 (3.9)	149 (22.8)
	Missing values: 59 (7.8)	Missing values: 3 (10.3)	Missing values: 56 (7.9)
Number of comorbidities*			
0	73 (9.9)	0	73 (11.2)
1	196 (26.5)	7 (28.0)	189 (29.0)
2	181 (24.5)	5 (20.0)	176 (27.0)
≥3	227 (30.7)	13 (52.0)	214 (32.8)
	Missing values: 63 (8.5)	Missing values: 4 (13.8)	Missing values: 59 (8.3)
Education			
Less than high school	440 (59.5)	23 (88.5)	417 (65.0)
High school	181 (24.5)	2 (7.7)	179 (27.9)
Junior college	24 (3.2)	1 (3.9)	23 (3.6)
More than or equal to college	23 (3.1)	0	23 (3.6)
	Missing values: 72 (9.7)	Missing values: 3 (10.3)	Missing values: 69 (9.7)
Annual household income (million JPY)			
<200 (≒US\$18000)	477 (64.5)	20 (87.0)	457 (73.2)
200–499	131 (17.7)	2 (8.7)	129 (20.7)
≥500	39 (5.2)	1 (4.3)	38 (6.1)
	Missing values: 93 (12.6)	Missing values: 6 (20.7)	Missing values: 87 (12.2)
Self-rated health			
Very good	31 (4.1)	0	31 (4.8)
Good	83 (11.2)	1 (3.9)	82 (12.3)
Neutral	338 (45.7)	12 (46.2)	326 (65.8)
Poor	218 (29.5)	11 (42.3)	207 (31.0)
Very poor	23 (3.1)	2 (7.7)	21 (3.2)
	Missing values: 47 (6.4)	Missing values: 3 (10.3)	Missing values: 44 (6.2)

*Simple counts of the following chronic conditions: hypertension, diabetes, dyslipidemia, stroke, cardiac diseases, chronic respiratory diseases, digestive diseases, kidney diseases, urologic diseases, arthritis, rheumatism, mental disorders, endocrine diseases, and malignancy. ACSCs, ambulatory care sensitive conditions.

Regarding the types of ACSCs, the most frequent reasons for admission for ACSCs in this study were similar to those in other countries.^{43 44} Based on the NHS Outcomes Framework, congestive heart failure, status asthmaticus, chronic

obstructive pulmonary disease and ischaemic heart disease are classified as chronic ACSCs in the study (19 cases in this study).³³ Pneumonia, influenza, cellulitis, acute bronchitis, urinary tract infections and infectious gastroenteritis/

Table 2 Distribution of the JPCAT

JPCAT scores mean (SD)	Total (n=740)	Admissions for ACSCs (n=29)	Non-admissions for ACSCs (n=711)
Total score	67.8 (15.6)	73.7 (9.6)	67.5 (15.7)
First contact	84.5 (17.2)	83.0 (20.8)	84.5 (17.1)
Longitudinality	76.7 (19.8)	86.3 (13.6)	76.3 (19.9)
Coordination	73.4 (25.3)	91.7 (12.1)	73.2 (25.4)
Comprehensiveness (service available)	65.4 (24.6)	70.2 (19.4)	65.2 (24.7)
Comprehensiveness (service provided)	39.7 (28.7)	44.6 (22.2)	39.5 (28.9)
Community orientation	65.9 (21.7)	68.5 (24.3)	65.8 (21.6)

ACSCs, ambulatory care sensitive conditions; JPCAT, Japanese version of the Primary Care Assessment Tool.

colitis are classified as acute ACSCs (19 cases).³³ In previous studies conducted in rural settings, the proportions of chronic ACSCs among older adults were higher than those of acute ACSCs.^{42–45} Although our sample size was small, PCPs on rural islands may need to cope with acute as well as chronic ACSCs. Pneumonia and influenza are also classified as preventable ACSCs.⁴⁶ Promoting pneumococcal and influenza vaccinations could be helpful in reducing vaccine preventable ACSCs admissions on the islands.

Better PX on these rural islands was related to a higher rate of admissions for ACSCs. The results of the study are contrary to previous studies.^{14 15 47 48} We presume that whereas PX can affect healthcare seeking behaviour such as skipping PCPs by patients,³⁸ in remote islands where there is only one medical institution, PX might affect PCPs' decision-making regarding the referral. The reason is that PCPs might conduct overtriage to avoid undermining close doctor–patient relationship^{25 49} especially for patients who might have better experiences until the referral. In our previous study in the same setting, better

Table 3 ICD-10 codes and numbers of admissions for ACSCs: 38 admissions during 1 year

	ICD-10 code	Number (%)
1	I50 Congestive heart failure	11 (28.9)
2	J14, J15.9, J16.8, J18.8 Pneumonia	7 (18.4)
3	J10 Influenza	5 (13.2)
4	J46 Status asthmaticus	4 (10.5)
5	N39 Urinary tract infection	2 (5.3)
5	J20 Acute bronchitis	2 (5.3)
5	J44 Chronic obstructive pulmonary disease with acute lower respiratory infection	2 (5.3)
5	L03 Cellulitis and acute lymphangitis	2 (5.3)
5	I25 Ischaemic heart diseases	2 (5.3)
10	A09 Infectious gastroenteritis and colitis	1 (2.6)

ACSCs, ambulatory care sensitive conditions; ICD-10, the International Classification of Diseases, Tenth Revision.

Table 4 Factors associated with admissions for ACSCs (n=740)

Scale	Adjusted OR per 1 SD increase (95% CI)	P value
JPCAT		
Total score	1.62 (1.02–2.61)	0.040
First contact	0.90 (0.64–1.30)	0.593
Longitudinality	1.87 (1.06–3.27)	0.030
Coordination	3.19 (1.56–6.48)	0.001
Comprehensiveness (service available)	1.19 (.97–1.85)	0.441
Comprehensiveness (service provided)	1.18 (0.79–1.76)	0.416
Community orientation	1.27 (0.81–2.00)	0.279

ACSCs, ambulatory care sensitive conditions; JPCAT, Japanese version of Primary Care Assessment Tool.

PX assessed by the JPCAT was associated with higher rate of hospitalisations and ED visits.²⁵ Compared with the findings in our previous study,²⁵ which examined the association between ED visits/total hospitalisations and PX, this study demonstrated a stronger correlation: an adjusted OR per 1 SD increase (95% CI) in admissions for ACSCs and PX versus total hospitalisations²⁵ and PX: 1.62 (1.02–2.61); 1.39 (1.03–1.86). The difference in strength between the above two associations reinforces the hypothesis regarding the overtriage.

Since admissions for ACSCs were likely to be influenced by the exacerbation of chronic conditions relative to total hospitalisations, existing patient–doctor relationships could explain this study's results. Moreover, the domain of coordination included a patient's previous referral experience. Since patients with chronic conditions were likely to be referred more frequently, the results may be explained by previous referrals to the main island. In addition, PCPs might have low referral thresholds, because they regard PX in terms of their coordination with specialists on the main island as important. Also, the American College of Physicians pointed out that close patient–doctor relationships could cause overtesting.⁵⁰ In terms of first contact, generally, better access is associated with lower rates of admissions for ACSCs.⁴⁸ However, in this study, the association between access and admission for ACSCs was not statistically significant. Because access in the JPCAT is mainly evaluated by out-of-hours service availability,²⁴ this finding can be explained by a similar out-of-hours system among included islands. The pursuit of the Triple Aim (experience/health/cost) is an exercise in balance,⁵¹ and awareness of/monitoring their overtriage for admissions for ACSCs is necessary for PCPs in close patient–doctor relationships on rural islands. To reduce admissions for ACSCs from rural islands, PCPs also need to discuss the appropriateness of referrals with specialists in hospitals. In addition, although the authors did not involve patients/inhabitants when the study was planned, we would need to have a discussion with the

inhabitants to reduce ACSCs in the area and plan further research based on the results in this study.

Study strengths

This is the first study to examine the association between PX and ACSCs on rural islands. Consistent with methods used in previous primary care studies, we employed the JPCAT as an indicator of PX.

Study limitations

This study has several limitations. First, there is a concern with regard to the response rate of 58.8%, which may be insufficient. If patients with lower PX did not respond to the survey, sampling bias could influence the relationship between PX and admissions for ACSCs. In the case of PX surveys, however, there is little evidence that a low response rate leads to selective non-response bias.⁵² Also, the rate of admissions for ACSCs among non-responders were 46.3 per year per 1000 residents (24 admissions among 517 non-responders). Because the rate was close to the rate of responders, the sampling bias may not affect the results. Second, several residents (eg, patients on dialysis) may have moved from the islands during the study period due to difficulties associated with regular visits to medical facilities on the main island of Okinawa. However, the net migration rate of these islands was 0.65% during the period of study.⁵³ Therefore, inhabitants' migrations may not have affected our results. Third, although we used the UK's definition of ACSCs, this concept is influenced by healthcare systems in each country. Further research is needed to examine the validity of the definition of ACSCs in the Japanese primary care setting.³⁴ Fourth, though data related to the reasons for referral and the severity of illnesses are essential for assessing the association between admissions for ACSCs and PX, we could not gather this information. Moreover, although a premature mortality rate and length of stay in a hospital are more relevant outcomes for patients,^{22 54 55} we could not collect the information on them due to lack of the data in the primary care clinic-based database. As a next step, an assessment of the severity/appropriateness of referrals, a premature mortality rate and length of stay may be required. Finally, this study did not include inhabitants who were unable to respond to the survey because of dementia or other mental disorders.

CONCLUSION

To reduce admissions for ACSCs, rural physicians need to stress the importance of preventive interventions for heart failure, pneumonia and influenza. Higher PX was associated with higher admissions for ACSCs on the rural islands. These findings might be explained by PCPs' overtriage to avoid undermining close doctor-patient relationships. Awareness of/monitoring their overtriage for admissions for ACSCs is necessary for PCPs in close patient-doctor relationship.

Author affiliations

¹Department of Family and Community Medicine, Hamamatsu University School of Medicine, Hamamatsu, Japan

²Shizuoka Family Medicine Program, Kikugawa, Japan

³Department of Healthcare Epidemiology, School of Public Health, Graduate School of Medicine, Kyoto University, Kyoto, Japan

⁴Bureau of International Health Cooperation, National Center for Global Health and Medicine, Shinjuku-ku, Japan

⁵Department of Family Medicine, Okinawa Prefectural Chubu Hospital, Uruma, Japan

⁶US Naval Hospital Okinawa, Okinawa, Japan

⁷Zamami Clinic, Shimajiri-gun, Japan

⁸Department of General Internal Medicine, National Hospital Organisation Nagasaki Medical Center, Omura, Japan

⁹Department of Family Medicine, Okinawa Prefectural Yaeyama Hospital, Ishigaki, Japan

¹⁰Department of Family Medicine, Okinawa Miyako Hospital, Miyakojima, Japan

Acknowledgements The authors thank the members of the Okinawan Remote Islands-Practice Based Research Network: Makoto Ozaki, MD; Eitaro Jiroku, MD; Toshiki Sakugawa, MD; Kazutaka Yoshida, MD; Genki Kinjyo, MD; Tadahiro Yonaha, MD; Takamitsu Miyake, MD; Shoko Murata, MD; Taiki Asato, MD; Yoshifumi Sugiyama, MD; Sho Koki, MD; Koji Yamakoshi, MD; Masaki Ishihara, MD; and Ryo Adaniya, MD. The authors also thank all town offices and all residents on the five islands. The authors would like to thank Editage (www.editage.jp) for English language editing. Finally, I would like to express my gratitude to my wife and children for their warm support.

Contributors MK designed the study and participated in the implementation, data collection, data analysis and writing of the manuscript. MK also serves as the guarantor. MF, KY, KK, MK, YS, TS, SY, KM and MI contributed to the design of the study and critically reviewed the manuscript. TA analysed the data and drafted the manuscript. All authors had full access to the data and take responsibility for its integrity and the accuracy of the analyses.

Funding This study was supported by the Byoutaiseiri Institute. The study's sponsor had no role in the study design, data collection, analysis, interpretation, writing of the report or the decision to submit this article for publication.

Competing interests None declared.

Patient consent for publication Not required.

Ethics approval This study was approved by the Research Ethics Committee of Okinawa Chubu Hospital, Japan (approval number 52, 2015), as well as the research ethics committees of Okinawa Hokubu Hospital, Okinawa Prefectural Nanbu Medical Center and Children's Medical Center, Okinawa Miyako Hospital and Okinawa Yaeyama Hospital. We considered respondents' completion of the questionnaire as consent for the study, and followed them for 1 year.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement No data are available.

Open access This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited, appropriate credit is given, any changes made indicated, and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>.

ORCID iDs

Makoto Kaneko <http://orcid.org/0000-0002-4581-8274>

Takuya Aoki <http://orcid.org/0000-0002-8232-2155>

REFERENCES

- 1 Purdy S. *Avoiding hospital admissions: what does the research evidence say?* London: The King's Fund, 2010: 1–28. <http://www.kingsfund.org.uk/sites/files/kf/Avoiding-Hospital-Admissions-Sarah-Purdy-December2010.pdf>
- 2 Billings J, Zeitel L, Lukomnik J, *et al*. Impact of socioeconomic status on hospital use in New York City. *Health Aff* 1993;12:162–73.
- 3 Caminal J, Starfield B, Sánchez E, *et al*. The role of primary care in preventing ambulatory care sensitive conditions. *Eur J Public Health* 2004;14:246–51.
- 4 OECD, EU. *Strengthening primary care system, in health at a glance: Europe 2016: state of health in the EU cycle*. Paris: OECD Publishing, 2016: 37–53. <https://www.oecd-ilibrary.org/social-issues-migration->

- health/health-at-a-glance-europe-2016/strengthening-primary-care-systems_health_glance_eur-2016-5-en
- 5 Bottle A, Millett C, Xie Y, *et al.* Quality of primary care and hospital admissions for diabetes mellitus in England. *J Amb Care Manage* 2008;31:226–38.
 - 6 Magán P, Alberquilla Ángel, Otero Ángel, *et al.* Hospitalizations for ambulatory care sensitive conditions and quality of primary care. *Med Care* 2011;49:17–23.
 - 7 Agency for Healthcare Research and Quality. Prevention quality indicators overview, 2015. Available: https://qualityindicators.ahrq.gov/Modules/pqi_resources.aspx [Accessed 17 Feb 2019].
 - 8 Ansari Z, Carson N, Serraglio A, *et al.* The Victorian ambulatory care sensitive conditions study: reducing demand on hospital services in Victoria. *Aust Health Rev* 2002;25:71–7.
 - 9 Ansari Z, Barbetti T, Carson NJ, *et al.* The Victorian ambulatory care sensitive conditions study: rural and urban perspectives. *Soz Praventivmed* 2003;48:33–43.
 - 10 Ansari Z, Haider SI, Ansari H, *et al.* Patient characteristics associated with hospitalisations for ambulatory care sensitive conditions in Victoria, Australia. *BMC Health Serv Res* 2012;12:475.
 - 11 Saultz JW, Lochner J. Interpersonal continuity of care and care outcomes: a critical review. *Ann Fam Med* 2005;3:159–66.
 - 12 Agency for Healthcare Research and Quality. What is patient experience? 2017. Available: <https://ahrq.gov/cahps/about-cahps/patient-experience/index.html> [Accessed 17 Feb 2019].
 - 13 Institute of Medicine (US) Committee on Quality of Health Care in America. Crossing the quality chasm: a new health system for the 21st century, 2001. Available: <https://www.ncbi.nlm.nih.gov/pubmed/25057539> [Accessed 17 Feb 2019].
 - 14 Gill JM, Mainous AG. The role of provider continuity in preventing hospitalizations. *Arch Fam Med* 1998;7:352–7.
 - 15 Mainous AG, Gill JM. The importance of continuity of care in the likelihood of future hospitalization: is site of care equivalent to a primary clinician? *Am J Public Health* 1998;88:1539–41.
 - 16 Barker I, Steventon A, Deeny SR. Association between continuity of care in general practice and hospital admissions for ambulatory care sensitive conditions: cross sectional study of routinely collected, person level data. *BMJ* 2017;356.
 - 17 DeFries GH, Ricketts TC. Primary health care in rural areas: an agenda for research. *Health Serv Res* 1989;23:931–74.
 - 18 Silver MP, Babitz ME, Magill MK. Ambulatory care sensitive hospitalization rates in the aged Medicare population in Utah, 1990 to 1994: a rural-urban comparison. *J Rural Health* 1997;13:285–94.
 - 19 Ricketts TC, Randolph R, Howard HA, *et al.* Hospitalization rates as indicators of access to primary care. *Health Place* 2001;7:27–38.
 - 20 Purdy S, Griffin T, Salisbury C, *et al.* Emergency admissions for coronary heart disease: a cross-sectional study of general practice, population and hospital factors in England. *Public Health* 2011;125:46–54.
 - 21 Shi L, Samuels ME, Pease M, *et al.* Patient characteristics associated with hospitalizations for ambulatory care sensitive conditions in South Carolina. *South Med J* 1999;92:989–98.
 - 22 Lavoie JG, Ward A, Wong ST, *et al.* Hospitalization for mental health related ambulatory care sensitive conditions: what are the trends for first nations in British Columbia? *Int J Equity Health* 2018;17.
 - 23 Lavoie JG, Forget EL, Prakash T, *et al.* Have investments in on-reserve health services and initiatives promoting community control improved first nations' health in Manitoba? *Soc Sci Med* 2010;71:717–24.
 - 24 Aoki T, Inoue M, Nakayama T. Development and validation of the Japanese version of primary care assessment tool. *Fam Pract* 2016;33:112–7.
 - 25 Kaneko M, Aoki T, Mori H, *et al.* Associations of patient experience in primary care with hospitalizations and emergency department visits on isolated islands: a prospective cohort study. *J Rural Heal* 2019;35:498–505.
 - 26 Kato D, Ryu H, Matsumoto T, *et al.* Building primary care in Japan: literature review. *J Gen Fam Med* 2019;20:170–9.
 - 27 Okinawa Prefecture. Okinawa remote islands: population, 2017. Available: <http://www.pref.okinawa.jp/site/kikaku/chiikiritto/ritoshinko/documents/ixtousousaisinn> [Accessed 17 Feb 2019].
 - 28 Okinawa Prefecture. Number of inhabited Islands. Okinawa Prefecture, 1998. Available: www.pref.okinawa.jp/toukeika/100/2001/01/in003.xls [Accessed 17 Feb 2019].
 - 29 Motomura K. Reflective practice and situated learning in remote medicine. *An Off J Japan Prim Care Assoc* 2012;35:165–7.
 - 30 Okinawa Prefecture. Okinawa remote islands: living environment, 2017. Available: <https://www.pref.okinawa.jp/site/kikaku/chiikiritto/ritoshinko/documents/eyonn.pdf> [Accessed 16 Feb 2019].
 - 31 e-stat, Portal Site of Official Statistics of Japan. Regional statistics database. Available: <https://www.e-stat.go.jp/SG1/chiiki/CommunityProfileTopDispatchAction.do?code=2> [Accessed 16 Feb 2019].
 - 32 Okinawa Prefecture. Age composition of population, 2016. Available: <http://www.pref.okinawa.jp/site/kikaku/shichoson/2422.html> [Accessed 17 Feb 2019].
 - 33 Clinical Indicators Team, Health and Social Care Information Centre. Nhs outcomes framework, 2016. Available: <https://indicators.hscic.gov.uk/webview/> [Accessed 17 Feb 2019].
 - 34 Sasabuchi Y, Matsui H, Yasunaga H, *et al.* Increase in avoidable hospital admissions after the great East Japan earthquake. *J Epidemiol Community Health* 2017;71:248–52.
 - 35 Shi L, Starfield B, Xu J. Validating the adult primary care assessment tool. *J Fam Pract* 2001;50:161–75.
 - 36 Aoki T, Inoue M. Primary care patient experience and cancer screening uptake among women: an exploratory cross-sectional study in a Japanese population. *Asia Pac Fam Med* 2017;16:3.
 - 37 Aoki T, Miyashita J, Yamamoto Y, *et al.* Patient experience of primary care and advance care planning: a multicentre cross-sectional study in Japan. *Fam Pract* 2017;34:206–12.
 - 38 Aoki T, Yamamoto Y, Ikenoue T, *et al.* Effect of patient experience on bypassing a primary care gatekeeper: a multicenter prospective cohort study in Japan. *J Gen Intern Med* 2018;33:722–8.
 - 39 Peduzzi P, Concato J, Kemper E, *et al.* A simulation study of the number of events per variable in logistic regression analysis. *J Clin Epidemiol* 1996;49:1373–9.
 - 40 Spoon M, Greer N, Su J, *et al.* Rural vs. urban ambulatory health care: a systematic review, 2011.
 - 41 Schreiber S, Zielinski T. The meaning of ambulatory care sensitive admissions: urban and rural perspectives. *J Rural Heal* 1997;13:276–84.
 - 42 Australian Institute of Health and Welfare. Australian hospital statistics 2007–08, hospital performance indicators, 2008. Available: <https://www.aihw.gov.au/getmedia/701f784b-61f5-4e40-aa90-3adfeb2ba0a8/hse-71-10776-c04.pdf.aspx> [Accessed 17 Feb 2019].
 - 43 Bardsley M, Blunt I, Davies S, *et al.* Is secondary preventive care improving? observational study of 10-year trends in emergency admissions for conditions amenable to ambulatory care. *BMJ Open* 2013;3:e002007–12.
 - 44 World Health Organization. Ambulatory care sensitive conditions in Germany, 2015. Available: http://www.euro.who.int/__data/assets/pdf_file/0004/295573/ASCS-Germany-2015-rev1.pdf?ua=1 [Accessed 17 Feb 2019].
 - 45 Zhang W, Mueller KJ, Chen L-W, *et al.* The role of rural health clinics in hospitalization due to ambulatory care sensitive conditions: a study in Nebraska. *J Rural Heal* 2006;22:220–3.
 - 46 National Health Service. The NHS outcomes framework 2013/14 technical appendix, 2013. Available: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/213057/121109-Technical-Appendix.pdf [Accessed 17 Feb 2019].
 - 47 Weiss LJ, Blustein J. Faithful patients: the effect of long-term physician-patient relationships on the costs and use of health care by older Americans. *Am J Public Health* 1996;86:1742–7.
 - 48 Gibson OR, Segal L, McDermott RA. A systematic review of evidence on the association between hospitalisation for chronic disease related ambulatory care sensitive conditions and primary health care resourcing. *BMC Health Serv Res* 2013;13:336.
 - 49 Pohontsch NJ, Hansen H, Schäfer I, *et al.* General practitioners' perception of being a doctor in urban vs. rural regions in Germany - A focus group study. *Fam Pract* 2018;35:209–15.
 - 50 Snyder L, American College of Physicians Ethics, Professionalism, and Human Rights Committee. American College of physicians ethics manual: sixth edition. *Ann Intern Med* 2012;156:73–104.
 - 51 Berwick DM, Nolan TW, Whittington J. The triple AIM: care, health, and cost. *Health Aff* 2008;27:759–69.
 - 52 Roland M, Elliott M, Lyratzopoulos G, *et al.* Reliability of patient responses in pay for performance schemes: analysis of national general practitioner patient survey data in England. *BMJ* 2009;339.
 - 53 Okinawa Prefecture. Population movement report, 2017. Available: https://www.pref.okinawa.jp/toukeika/estimates/estimates_suikei.html [Accessed 16 Feb 2019].
 - 54 Lavoie JG, Wong ST, Ibrahim N, *et al.* Underutilized and undertheorized: the use of hospitalization for ambulatory care sensitive conditions for assessing the extent to which primary healthcare services are meeting needs in British Columbia first nation communities. *BMC Health Serv Res* 2019;19:50.
 - 55 Banham D, Chen T, Karnon J, *et al.* Sociodemographic variations in the amount, duration and cost of potentially preventable hospitalisation for chronic conditions among Aboriginal and non-Aboriginal Australians: a period prevalence study of linked public hospital data. *BMJ Open* 2017;7:e017331.