



BMJ Open Fragmentation of ambulatory care among older adults: an exhaustive database study in an ageing city in Japan

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ABSTRACT

Objectives Continuity of care is a core dimension of primary care, and better continuity is associated with better patient outcomes. Therefore, care fragmentation can be an indicator to assess the quality of primary care, especially in countries without formal gatekeeping system, such as Japan. Thus, this study aimed to describe care fragmentation among older adults in an ageing city in Japan.

Design Cross-sectional study.

Setting The most populated basic municipality in Japan.

Participants Older adults aged 75 years and older.

Interventions This study used a health claims database, including older adults who visited medical facilities at least four times a year in an urban city in Japan. The Fragmentation of Care Index (FCI) was used as an indicator of fragmentation. The FCI was developed from the Continuity of Care Index and is based on the total number of visits, different institutions visited and proportion of visits to each institution. We employed Tobit regression analysis to examine the association between the FCI and age, sex, type of insurance and most frequently visited facility.

Results The total number of participants was 413 600. The median age of the study population was 81 years, and 41.6% were men. The study population visited an average of 3.42 clinics/hospitals, and the maximum number of visited institutions was 20. The proportion of patients with FCI >0 was 85.0%, with a mean of 0.583. Multivariable analysis showed that patients receiving public assistance had a lower FCI compared with patients not receiving public assistance, with a coefficient of 0.137.

Conclusions To our knowledge, this is the first study to demonstrate care fragmentation in Japan. Over 80% of the participants visited two or more medical facilities, and their mean FCI was 0.583. The FCI could be a basic indicator for assessing the quality of primary care.

INTRODUCTION

Continuity of care is a core dimension of primary care.¹ The term means having a long-term relationship between primary care physicians and their patients in their practice that goes beyond any specific episode of illness or disease.¹ Continuity of care is associated with

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ This is the first study to describe the care fragmentation in Japan.
- ⇒ We targeted almost all residents aged ≥75 years in the most populated basic municipality in Japan.
- ⇒ Over 80% of the participants visited two or more medical facilities.
- ⇒ One-fourth of the participants had a Fragmentation of Care Index above 0.7, which is considered an indicator of care fragmentation.
- ⇒ The study did not consider the severity of the disease or the reason for encounter.

better processes of care and better patient outcomes, such as more preventive care,^{2 3} fewer emergency visits,⁴⁻⁶ decreased hospital admission^{7 8} and lower mortality.⁹ By contrast, ‘fragmented ambulatory care’, which is receiving ambulatory care from multiple providers,^{10 11} is related to more testing,¹² more procedures,¹³ more visits to the emergency department^{14 15} and more hospitalisations.^{15 16} It also can cause insufficient communication among providers.^{11 17} Moreover, population ageing will induce expanding fragmented care because a number of patients with multimorbidity will increase with ageing.¹⁸⁻²¹

Continuity of care is not only dependent on an individual doctor-patient relationship but also on the healthcare system. The reason is that continuity of care overlaps coordination of care.¹ Coordination of care means the ability of primary care physicians to coordinate the use of other levels of healthcare.¹ Gatekeeping system, one of the features of coordination, restricts access for patients to medical institutions without a referral from a primary care physician. In Japan, a country without formal gatekeeping, previous study reported that lower quality of primary care is associated with skipping primary care physicians and patients’ direct access to secondary

care.²² This implies the lower quality of primary care increases the degree of care fragmentation. Therefore, describing care fragmentation among older adults can be an indicator to assess the quality of primary care in countries without formal gatekeeping by primary care physicians, such as France and Belgium in Europe²³ and China,²⁴ Singapore,²⁵ the Republic of Korea²⁶ and Japan²⁷ in Asia.

Japan's population ageing rate (the proportion of people aged ≥ 65 years) is the highest worldwide in 2019,²⁸ and Japan will have the world's highest number of older adults in 2050.²⁸ Moreover, regarding the health-care system, the roles and responsibilities of primary care physicians are not well defined²⁷; for example, there are no formal gatekeeping system²⁷ and system of patient registration.²⁹ Therefore, the degree of fragmentation in ambulatory care must be high in Japan. In addition, assessing fragmentation in ambulatory care is necessary to assess quality of primary care, especially for the increasing number of older population. However, to the best of our knowledge, no study has been conducted to assess fragmentation in ambulatory care setting in Japan.

Thus, this study aimed to describe care fragmentation among older adults in Japan. The results will offer a benchmark of fragmentation of care to Japan and other countries with an ageing population and without a formal gatekeeping system.

METHODS

Design

This was a cross-sectional study using health claims database.

Setting and participants

We included older adults aged ≥ 75 years who visited medical facilities at least four times during 1 year between 1 April 2018 and 31 March 2019. We targeted people aged ≥ 75 years because the insurance plan is changed when people turn 75 years old in Japan.³⁰ Almost all people are covered by late-stage medical care system for the elderly.³⁰ Under 75 years, people use various insurance plans, and it is difficult to grasp the number of visits from each claims database. The participants were registered by the City of Yokohama, which is located next to Tokyo and has approximately 3.7 million population, the most populated basic municipality in Japan. We selected the city because an urban city has more institutions, and the degree of care fragmentation might be high. The population ageing rate (≥ 65 years) was 24.5% in 2018 (the rate in overall Japan was 28.1 in 2018). We counted all medical facilities that they visited, including those outside of the city.

Patient and public involvement

This study was conducted without patient involvement. Patients were not invited to comment on the study design, 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.

Source and study population

We used the Yokohama Original Medical Database (YoMDB).³¹ YoMDB consists of health insurance claims of residents of the City of Yokohama. In Japan, the medical fee of people aged ≥ 75 years is covered by late-stage medical care system for the elderly or public assistance.¹⁹ Public assistance in Japan includes livelihood, housing and healthcare services.³² Thus, this database includes 99.7% of residents aged 75–79 years and 98.6% of residents aged >80 years.³¹ People using the insurance need to pay 10%–30% of medical fee as out-of-pocket medical spending.³⁰ The percentage of out-of-pocket spending is mainly 10% among older adults aged ≥ 75 years.³⁰ Moreover, there is an upper limit on the spending.³⁰ In terms of public assistance, among people aged ≥ 75 years, the percentage of those receiving public assistance is 3.6%, and all of their medical fees are covered by public assistance.³⁰

In this study, we targeted the people with at least four ambulatory visits during a year. The reason is that the previous report indicated that the measure of fragmentation among older adults is reliable in people with at least four visits.¹⁶ We employed the number of residents on 30 September 2018. Because the number of residents is only available on 30 September and 31 March in every year, we acquired the number from the middle of the study period.

Data collection tools and procedures

We extracted age, sex, type of insurance (late-stage medical care system for the elderly or public assistance) and most frequently visited facility (MFVF) from the database. MFVF is determined by the types of facility (a clinic, hospital or advanced treatment hospital) which has the highest frequency of visits during the year.

Outcome variables

As an indicator of fragmentation, we employed the Fragmentation of Care Index (FCI).^{21 33} The FCI is developed from the Continuity of Care Index.³³ It is 'based on the total number of visits, different institutions visited, and proportion of visits to each institution'³³:

$$\begin{aligned} \text{FCI} &= 1 - \text{Continuity of Care Index} = 1 - \frac{\sum_{i=1}^s n_i^2 - n}{n(n-1)} \\ &= \frac{n^2 - \sum_{i=1}^s n_i^2}{n(n-1)}, \end{aligned}$$

where n is the total number of outpatient visits, n_i is the number of visits to institution i and s is the number of institutions visited.

The FCI ranges from 0 (all visits to the same institution) to 1 (each visit to a different institution).³³ The previous studies in the countries without formal gatekeeping system using the FCI have demonstrated that a mean FCI of 0.50 corresponds to moderate levels of care

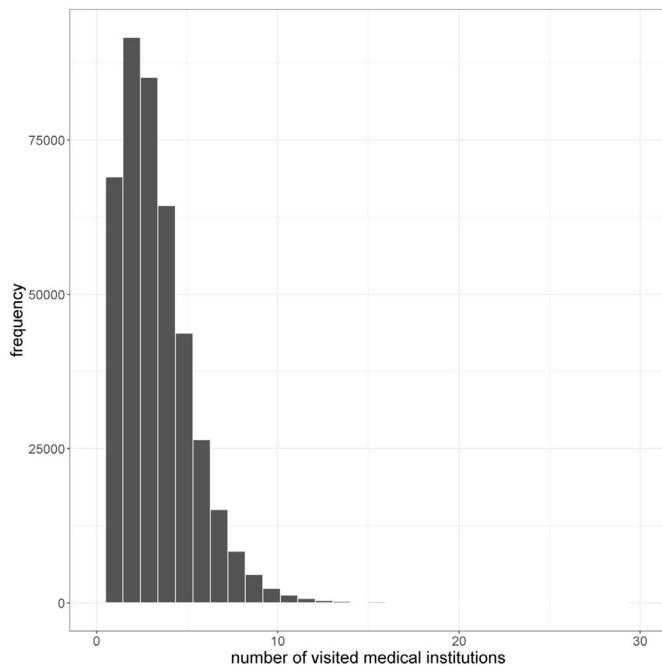


Figure 1 Frequency of the number of visited institutions.

fragmentation and a mean FCI of 0.70 corresponds to moderately high levels of care fragmentation.^{33 34}

Statistical analyses

Continuous variables are presented as mean and SD or median and IQR. Categorical variables are presented as numbers and percentages. FCIs were calculated for

each age group, sex, insurance type and types of MFVF (a clinic, hospital and advanced treatment hospital) from our study population. An advanced treatment hospital mainly indicates a university hospital in the study setting. Associations between the FCI and explanatory variables were evaluated using Tobit regression analysis,³³ where the left censored variables were 0. The coefficients indicate an increase or a decrease in the FCI per change of each variable. When MFVF was unidentified, we excluded the cases from the analysis. All analyses were performed using Stata V.15 and R V.4.1.2 (R Foundation for Statistical Computing, Vienna, Austria) using the R packages ‘censReg’ V.0.5-32 (Henningsen A., 2020),³⁵ with the level of significance set at $\alpha=0.05$.

RESULTS

The total number of participants was 413 600. The median age of the study population was 81 years, and 41.6% were men. The study population visited an average of 3.42 clinics/hospitals, and the maximum number of visited institutions was 20. **Figure 1** shows the frequency of visits of the study population to institutions. The mean FCI of all participants was 0.492 (SD 0.271) (**table 1**) and the median was 0.55 (IQR 0.33–0.7).

Approximately 15% of the patients had only one institution (FCI=0), and the mean of the remaining 85.0% of patients (FCI>0) was 0.583 (SD 0.185). Moreover, 26.1% of the patients had FCI≥0.7.

	N	%	FCI mean	FCI SD	P value
Total	413 600	100.0	0.492	0.271	
Sex					<0.001
Male	172 122	41.6	0.486	0.274	
Female	241 478	58.4	0.496	0.269	
Insurance					<0.001
Non-public assistance	399 357	96.6	0.496	0.270	
Public assistance	14 243	3.4	0.381	0.288	
Age group (years)					<0.001
75–79	166 083	40.2	0.496	0.271	
80–84	129 789	31.4	0.505	0.266	
85–89	77 427	18.7	0.489	0.271	
90–94	31 771	7.7	0.449	0.282	
95+	8 530	2.1	0.394	0.291	
MFVF					<0.001
Advanced treatment hospital	4 488	1.1	0.526	0.266	
Hospital	114 141	27.6	0.452	0.289	
Clinic	292 557	70.7	0.506	0.262	
Unidentified	2 414	0.6	0.505	0.313	

FCI, Fragmentation of Care Index; MFVF, most frequently visited facility.

Table 2 Characteristics of the participants with FCI >0

	N	%	FCI mean	FCI SD	P value
Total	349 067	100.0	0.583	0.185	
Sex					<0.001
Male	143 957	41.2	0.581	0.186	
Female	205 110	58.8	0.584	0.185	
Insurance					<0.001
Non-public assistance	339 018	97.1	0.584	0.185	
Public assistance	10 049	2.9	0.540	0.179	
Age group (years)					<0.001
75–79	140 456	40.2	0.586	0.184	
80–84	111 680	32.0	0.586	0.185	
85–89	65 393	18.7	0.579	0.186	
90–94	25 327	7.3	0.564	0.187	
95+	6 211	1.8	0.541	0.191	
MFVF					<0.001
Advanced treatment hospital	3 904	1.1	0.604	0.187	
Hospital	89 512	25.6	0.577	0.184	
Clinic	253 820	72.7	0.577	0.184	
Unidentified	1 831	0.5	0.666	0.148	

FCI, Fragmentation of Care Index; MFVF, most frequently visited facility.

For participants with FCI >0, the proportions and mean FCIs for each subgroup are described in [table 2](#).

The mean FCIs of males and females were almost the same. The youngest age groups, 75–79 and 80–84 years, had the highest FCI, and the older group had the lowest FCI. Patients receiving public assistance had a lower FCI compared with patients not receiving public assistance. The most common MFVF was a clinic (72.7%). The distribution of FCI among patients with FCI >0 showed a peak (3.4% of the study population) at FCI=0.53 ([figure 2](#)).

Among the 413 600 participants, the MFVF of 2414 participants were unidentified and Tobit regression analysis targeted 411 186. The analysis revealed that female sex (male as a reference), age, type of insurance (public assistance as a reference) and type of medical institution of MFVF (clinic as a reference) were associated with FCI. The coefficients of each variable were as follows: female sex, -0.00897 (-0.0109 to -0.000699 , $p<0.001$); age, -0.00325 (-0.00343 to -0.00306 , $p<0.001$); non-public assistance, 0.137 (0.132 to 0.142 , $p<0.001$); MFVF (hospital) -0.064 (-0.0662 to -0.0619 , $p<0.001$); and MFVF (advanced treatment hospital), 0.0155 (0.00616 to 0.0248 , $p<0.001$).

DISCUSSION

This study described the care fragmentation in Japan. The mean FCI was 0.492 among the 413 600 older adults aged ≥ 75 years. Over 80% of the participants visited two or more medical facilities (FCI >0), and their mean FCI was 0.583. Although 70% of the participants mainly

visited a clinic, 1.1% used an advanced treatment hospital as MFVF. Multivariable analysis revealed that non-public assistance had the largest effect on FCI among the included variables.

The key finding of our study is the high proportion of patients with FCI >0. In a previous study targeting the

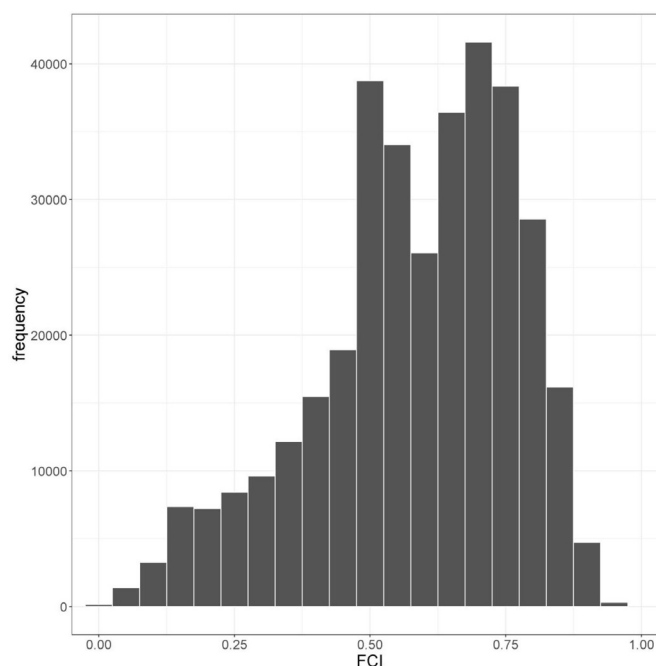


Figure 2 The distribution of the Fragmentation of Care Index (FCI) among patients with FCI >0.

general population in Hong Kong, the proportion was 27%, and the mean of FCI among the participant with FCI >0 was 0.528.³³ This can be explained by the Japanese healthcare system without gatekeeping.²⁷ Although the Japanese Ministry of Health, Labour and Welfare recommended individuals having their own 'primary care doctor',³⁶ the results demonstrated that the actual healthcare-seeking behaviour is fragmented. Because low-quality primary care is related to skipping primary care and direct access to secondary care,²² the quality of primary care could affect the care fragmentation. Moreover, since older population is associated with high FCI,^{21 33} the target of the study might affect the high FCI in this study. However, in the study, age was related to lower FCI among older adults aged ≥ 75 years. The promotion of home visit for frail people by the Japanese government³⁷ might affect the results. In such older population, fragmented care might be integrated into home care.³⁸

The effects of the other variables on the FCI differ from previous studies. For example, a previous study in Hong Kong reported that lower income was associated with higher FCI.³³ However, receiving public assistance was related to lower FCI in the study. This can be explained by the fact that people receiving public assistance need to report to the local government the name of the medical institution where they would like to visit. Moreover, female sex was associated with higher FCI in Hong Kong³² and was not significant in Singapore.²¹ Because the coefficients were relatively small, sex might not be an important factor for FCIs of 0.07 (Hong Kong, general population), 0.0017 (Singapore, specialist outpatient clinics in a regional hospital) and -0.00897 (Japan, this study).

Policy implication of this study

FCI can be an indicator to assess the quality of primary care, especially in countries without a formal gatekeeping system. Continuity of care is associated with decreasing overuse of medical procedures,¹³ improving receipt of preventive services³⁹ and lowering mortality rate.⁹ Reducing FCI may improve healthcare outcomes. In countries without formal gatekeeping system, to lower FCI, promoting primary care use by improving the quality of primary care is necessary.^{22 24} In addition, incentives to recruit and retain healthcare providers in primary care might be necessary. Moreover, because a fee-for-service payment system allows hospitals to attract patients to hospitals, setting incentives to refer a stable patient to primary care might be useful.

Study strengths

This study included almost all residents aged ≥ 75 years in the most populated basic municipality in Japan. Moreover, to the best of our knowledge, this is the first study to describe the FCI in Japan. These results provide a useful benchmark for an ageing world.

Study limitations

This study has some limitations. First, this study used a claims database, which can only differentiate institutions from departments in the same hospital. Thus, if a patient

visited several different departments in the same hospital, the number of institutions visited would be one. Therefore, we might have underestimated the care fragmentation. Nevertheless, the FCI was higher in this study than those in previous studies. This limitation did not change the conclusion. Second, the study did not consider the severity of the disease or the reason for encounter. In addition, the reason why people select care fragmentation in the healthcare system without a gatekeeper remains unclear. However, this was a descriptive study exploring care fragmentation in Japan. We plan to conduct a qualitative interview study targeting patients with low FCI and high FCI to explore the meaning of care fragmentation for patients. Third, since the study was conducted in an urban city with more institutions compared with a rural area, the FCI might be higher than that in a rural area. Thus, the results need to be carefully extrapolated to other areas. Medical care resources may influence the FCI.

CONCLUSIONS

This is the first study to reveal care fragmentation among older Japanese adults. Over 80% of the participants visited two or more medical facilities, and their mean FCI was 0.583. FCI could be a basic indicator to assess the quality of primary care, especially in countries without a formal gatekeeping system.

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Contributors MKa designed the study and served as a guarantor. MKa, SS, SN and TC analysed the data. MKa drafted the manuscript. MKa, SS, MKu, SN, TC and AG contributed to the design of the study and critically reviewed the manuscript. All authors had full access to the data and took responsibility for the integrity of the data and the accuracy of the analysis.

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Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics approval This study was approved by the Ethics Committee of Yokohama City University (approval number: B201200046). Informed consent was waived owing to the anonymous nature of the data.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement No data are available. Data sharing is not applicable because the database is available only for the officer of the Medical Policy Division, Medical Care Bureau, in the City of Yokohama. In this study, we could analyse the data because the officers are coauthors of the manuscript.

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REFERENCES

- 1 Kringos DS, Boerma GW, Hutchinson A, *et al.* The breadth of primary care: a systematic literature review of its core dimensions. *BMC Health Serv Res* 2010;10:65.
- 2 Menec VH, Sirski M, Attawar D. Does continuity of care matter in a universally insured population? *Health Serv Res* 2005;40:389–400.
- 3 Fenton JJ, Franks P, Reid RJ, *et al.* Continuity of care and cancer screening among health plan enrollees. *Med Care* 2008;46:58–62.
- 4 Gill JM, Mainous AG, Nsereko M. The effect of continuity of care on emergency department use. *Arch Fam Med* 2000;9:333–8.
- 5 Ionescu-Iltu R, McCusker J, Ciampi A, *et al.* Continuity of primary care and emergency department utilization among elderly people. *CMAJ* 2007;177:8.
- 6 Huntley A, Lasserson D, Wye L, *et al.* Which features of primary care affect unscheduled secondary care use? A systematic review. *BMJ Open* 2014;4:e004746.
- 7 Gill JM, Mainous AG. The role of provider continuity in preventing hospitalizations. *Arch Fam Med* 1998;7:352–7.
- 8 Knight JC, Dowden JJ, Worrall GJ, *et al.* Does higher continuity of family physician care reduce hospitalizations in elderly people with diabetes? *Popul Health Manag* 2009;12:81–6.
- 9 Pereira Gray DJ, Sidaway-Lee K, White E, *et al.* Continuity of care with doctors – a matter of life and death? A systematic review of continuity of care and mortality. *BMJ Open* 2018;8:1–12.
- 10 Pham HH, Schrag D, O'Malley AS, *et al.* Care patterns in Medicare and their implications for pay for performance. *N Engl J Med* 2007;356:1130–9.
- 11 Kern LM, Rajan M, Ringel JB, *et al.* Healthcare fragmentation and incident acute coronary heart disease events: a cohort study. *J Gen Intern Med* 2021;36:422–9.
- 12 Kern LM, Seirup JK, Casalino LP, *et al.* Healthcare fragmentation and the frequency of radiology and other diagnostic tests: a cross-sectional study. *J Gen Intern Med* 2017;32:175–81.
- 13 Romano MJ, Segal JB, Pollack CE. The association between continuity of care and the overuse of medical procedures. *JAMA Intern Med* 2015;175:1148–54.
- 14 Hussey PS, Schneider EC, Rudin RS, *et al.* Continuity and the costs of care for chronic disease. *JAMA Intern Med* 2014;174:742–8.
- 15 Katz DA, McCoy KD, Vaughan-Sarrazin MS. Does greater continuity of veterans administration primary care reduce emergency department visits and hospitalization in older veterans? *J Am Geriatr Soc* 2015;63:2510–8.
- 16 Nyweide DJ, Anthony DL, Bynum JPW, *et al.* Continuity of care and the risk of preventable hospitalization in older adults. *JAMA Intern Med* 2013;173:1879–85.
- 17 O'Malley AS, Reschovsky JD, Ground FC. Referral and consultation communication between primary care and specialist physicians: finding common ground. *Arch Intern Med* 2011;171:56–65.
- 18 Picco L, Achilla E, Abidin E. Economic burden of multimorbidity among older adults: impact on healthcare and societal costs. *BMC Health Serv Res* 2016;16:1–12.
- 19 Salisbury C, Johnson L, Purdy S, *et al.* Epidemiology and impact of multimorbidity in primary care: a retrospective cohort study. *Br J Gen Pract* 2011;61:12–21.
- 20 Glynn LG, Valderas JM, Healy P, *et al.* The prevalence of multimorbidity in primary care and its effect on health care utilization and cost. *Fam Pract* 2011;28:516–23.
- 21 Kailasam M, Guo W, Hsann YM, *et al.* Prevalence of care fragmentation among outpatients attending specialist clinics in a regional hospital in Singapore: a cross-sectional study. *BMJ Open* 2019;9:e022965.
- 22 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.
- 23 Kringos DS, Boerma GW, Hutchinson A, eds. *Building primary care in a changing Europe [online]*. Copenhagen (Denmark: European Observatory on Health Systems and Policies, 2015.
- 24 Meng Q, Mills A, Wang L. What can we learn from China's health system reform? *BMJ* 2019;365:1–5.
- 25 The Commonwealth Fund. International health care system profiles Singapore, 2020. Available: <https://www.commonwealthfund.org/international-health-policy-center/countries/singapore> [Accessed 24 Jan 2021].
- 26 World Health Organization. Health service delivery profile Republic of Korea, 2012. Available: http://www.wpro.who.int/health_services/service_delivery_profile_republic_of_korea.pdf [Accessed 24 Jan 2021].
- 27 Kato D, Ryu H, Matsumoto T, *et al.* Building primary care in Japan: literature review. *J Gen Fam Med* 2019;20:170–9.
- 28 United Nations. Population ageing 2019, 2019. Available: <https://www.un.org/en/development/desa/population/publications/pdf/ageing/WorldPopulationAgeing2019-Report.pdf> [Accessed 24 Jan 2021].
- 29 Sawa N. The changing scene of primary care in Japan. *InnovAiT* 2011;4:539–40.
- 30 Sakamoto H, Rahman M, Nomura S. Japan health system review. World Health Organization. Regional Office for South-East Asia, 2018. Available: <https://apps.who.int/iris/handle/10665/259941> [Accessed 24 Jan 2021].
- 31 Suzuki Y, Dohmae S, Ohyama K, *et al.* Demand for home medical care will continue to increase in the next decades: an analysis from the Yokohama Original Medical Database (YoMDB). *Geriatr Gerontol Int* 2018;18:1578–9.
- 32 Inaba M. Increasing poverty in Japan: social policy and public assistance program. *Asian Soc Work Policy Rev* 2011;5:79–91.
- 33 Liu S, Yeung PC. Measuring fragmentation of ambulatory care in a tripartite healthcare system. *BMC Health Serv Res* 2013;13:176.
- 34 Liu CW, Einstadter D, Cebul RD. Care fragmentation and emergency department use among complex patients with diabetes. *Am J Manag Care* 2010;16:413–20.
- 35 Henningsen A. censReg: censored regression (Tobit) models. R package version 0.5-32, 2020. Available: <https://cran.r-project.org/src/contrib/Archive/censReg/>
- 36 The Ministry of Health Labour and Welfare. How to find your kakaritsukei, 2022. Available: <https://kakarikata.mhlw.go.jp/> [Accessed 24 Jan 2021].
- 37 Ministry of Health Labour and Welfare. Promotion of long-term care and home care, 2016. Available: <http://www.mhlw.go.jp/stf/seisakunitsuite/bunya/0000061944.html> [Accessed 24 Jan 2021].
- 38 Kaneko M, Shimizu S, Kuroki M, *et al.* Ecology of medical care for 90+ individuals: an exhaustive cross-sectional survey in an ageing city. *Geriatr Gerontol Int* 2022;22:483–9.
- 39 Cabana MD, Jee SH. Does continuity of care improve patient outcomes? *J Fam Pract* 2004;53:974–80.