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Prevalence of care fragmentation among outpatients attending specialist clinics in a regional hospital in Singapore: a cross-sectional study

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ABSTRACT

Objective To measure the extent of multispecialty care fragmentation among outpatients receiving specialist care and identify associated risk factors for fragmented care.

Design A retrospective cross-sectional study.

Setting Specialist outpatient clinics (SOCs) in a Singapore regional hospital.

Participants A total of 40 333 patients aged 21 and above with at least two SOC visits in the year 2016. Data for 146 792 physician consultation visits were used in the analysis and visits for allied health services and medical procedures were excluded.

Outcome measures The Fragmentation of Care Index (FCI) was used to measure care fragmentation for specialist outpatients. Log-linear regression with stepwise selection was used to investigate the association between FCI and patient age, gender, race and Most Frequently Visited Specialty (MFVS), controlling for number of different specialities seen.

Results About 36% experienced fragmented care (FCI >0) and their mean FCI was 0.70 (SD=0.20). FCI was found to be positively associated with age (p<0.001). Patients who most frequently visited Haematology, Endocrinology and Anaesthesiology specialities were associated with more fragmented care while those who most frequently visited Medical Oncology, Ophthalmology and Orthopaedics Surgery specialities were associated with less fragmented care.

Conclusion Multispecialty care fragmentation was found to be moderately high in the outpatient specialist clinics and was found to be associated with patients' age and certain medical specialties. With an ageing population and a rising prevalence of multimorbidity, healthcare providers should seek to eliminate unnecessary referrals to reduce the extent of care fragmentation.

Strengths and limitations of this study

- This is the first application of Fragmentation of Care Index (FCI) to measure care fragmentation in a hospital specialist outpatient setting.
- FCI not only accounts for frequency of outpatient visits, but also the dispersion of such visits and the combination of different medical specialties involved, thereby offering a balanced view of care fragmentation.
- The study identifies the association between fragmentation of care and outpatient specialities, providing valuable insights for multiple specialty care management.
- The accuracy of estimates for the prevalence of multispecialty care fragmentation in this study is limited by its scope within specialist outpatients from a single healthcare entity.

INTRODUCTION

With a life expectancy that is third highest in the world,[1] Singapore like many developed countries is facing the challenges posed by an ageing population. Due to an increasing prevalence of chronic conditions in the ageing population, chronic disease management has become vastly more complex and costly as more people require ongoing care over extended periods.[2–4] Therefore, co-ordinating and integrating care has become one of the looming healthcare challenges in Singapore today.

A lack of integrated or coordinated care commonly referred to as care fragmentation,[5 6] is associated with, compromised quality of care, increased healthcare cost, poor clinical outcomes and patient satisfaction.[7–12] Patient care involving multiple providers or organisations often raises concerns about fragmentation of care.[5] Previous studies have shown that frequent care delivery through different providers could result in ineffective coordination across different aspects of care.[11 13 14] Compounding the issue is the rise in multimorbidity—defined by WHO as the coexistence of two or more concurrent chronic conditions.[15 16] Estimates of global multimorbidity prevalence ranged from 15% to 25% for the general population and 50% to 85% for the older adults.[17–19] In Singapore, about half of the residents aged 60 years and above reported having multiple chronic conditions.[18] Multimorbidity requires medical

expertise across multiple domains to provide the best patient care possible. For instance, a patient with poorly controlled diabetes and ischaemic heart disease may have to consult specialists from endocrinology, ophthalmology, nephrology and cardiology to manage his or her condition. Previous studies have looked at the extent of fragmented care in certain group of patients seeking care in both primary and specialist care settings.[20 21] Other studies looked at care fragmentation with a broader scope, for instance, the extent of care fragmentation across tripartite care system in Hong Kong.[22] These studies focused on measuring care fragmentation either from a broader perspective across entities within healthcare systems or only specific disease conditions across multiple healthcare settings. However, patient care is prone to fragmentation even within a single entity due to the involvement of multiple providers as well as the influence of patient factors such as age, socioeconomic, education and health status.[23 24] In spite of that, the extent of multispecialty care fragmentation within single entities has not been well explored.[5 25] This study therefore aims to determine the extent of multispecialty care fragmentation in a public hospital's specialist outpatient setting and explore patient risk factors that are associated with it.

In Singapore, subsidised referral to specialists in public hospitals are made either by primary care doctors in public sector-based polyclinics or by other specialists through internal referral. Primary care doctors and specialists do not use the same electronic medical record. However, specialists are able to access important lab test results done at the polyclinics and some participating private general practitioners through a national electronic medical record. Public sector provides 80% of the secondary and tertiary healthcare services in Singapore.[26]

METHODS

Study setting and data

Anonymised hospital data of all patient visits to the specialist outpatient clinics (SOCs) in Ng Teng Fong General Hospital (NTFGH) for the year 2016 were extracted retrospectively from the hospital's patient management database. This does not include data on visits to family medicine or primary care. A total of 355 328 SOC attendances were made by 79 964 patients in 2016. Among them, about 65% of the patient visits were from hospital internal referrals, 30% were from General Practitioners and government polyclinics' referrals, and the remaining were from other sources such as cross-hospital referrals. SOC attendances at NTFGH constituted to about 7% of the total SOC attendances that were made in Singapore in the year 2016.[27]

In order to accurately determine the number of different specialties attending to each patient, only physician or specialist consultations were included for analysis. Clinic visits for allied health services or medical procedures such as medical imaging, day surgery, renal dialysis and dental procedures were excluded. As the study focused on adult population, patients below the age of 21 were excluded. Only patients with two or more attendances were included in the study. The study population consisted of 40 333 patients with 146 792 clinic visits. Data for patient demographics and clinical specialty of that consultation were available for analysis. The data included a total of 25 clinical specialties.

All the specialists in the hospital shared the same electronic medical record. However, the principal problems/diagnoses for each visit were usually recorded as free text in the consult notes for outpatients unlike the inpatient setting where they are discrete fields. In the outpatient setting, care co-ordination programmes were only available for those patients with certain specific diagnosis such as diabetes and stable heart failure. Even these programmes serve to mainly right site care of patients with stable conditions to the primary care setting.

Measure of multispecialty care fragmentation

The Fragmentation of Care Index (FCI) was developed from the Continuity of Care Index,[20 22] introduced by Bice and Boxerman.[25 28] It is a measure of dispersion of the patient care based on the number of patient visits, number of different providers visited and number of visits to each provider. This measure was adopted from other studies[20 22] which had used either clinics or type of clinics as their unit of measurement. The FCI was used in this study to measure the extent of care fragmentation for individual patients and was defined as:

$$\mathrm{FCI} = 1 - \mathrm{CCI} = \frac{n^2 - \sum_k^l n_k^2}{n(n-1)}$$

where n is the total number of outpatient visits; n_k, is the number of visits to outpatient specialty k; and l is the total number of outpatient specialties visited. Different providers were defined as different outpatient specialities in the computation. The range of possible FCI values lie between 0 and 1 with a larger FCI corresponding to a greater extent of care fragmentation. In general, the FCI increases with number of specialties visited and with greater dispersion in the distribution of visits to each specialty.

Statistical analysis

FCIs were calculated for each patient in our study population, and stratified by their age group, gender, race and the MFVS. The specialty that a patient visited most frequently in 2016 was termed as MFVS for that particular patient. As each patient may have visited multiple specialties, MFVS had to be used instead of type of specialty. Patients without a unique MFVS were classified as having multiple MFVSs. Mann-Whitney test or Kruskal-Wallis test was used to examine significant differences in FCI between the different subgroups. Log-linear regression with stepwise selection was used to model the association between FCI and the following variables: age, gender, race and MFVS, adjusting for the number of specialties seen by each patient. A numerical constant of 1 was added to the

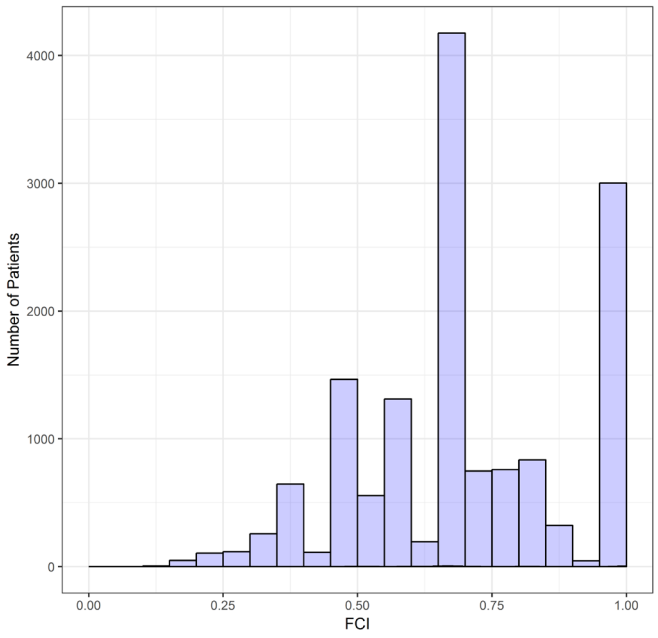

Figure 1 Distribution of the Fragmentation of Care Index (FCI) for patients with FCI>0.

FCI before modelling so as to account for patients with an FCI of 0. Statistical tests yielding a p value of less than 0.05 were deemed to be statistically significant. Analyses were carried out in R V.3.3.2.

RESULTS

The mean age of the study population was 55 years; 54% were male; 72% were Chinese. The study population had an average of 3.5 outpatient visits per patient across 1.5 medical specialties per patient and an overall mean FCI of 0.26. Females had slightly larger mean FCI compared with males (FCI_{female}=0.26, FCI_{male}=0.25, p<0.001); Chinese had the largest mean FCI among the different races ($FCI_{chinese}$=0.261, FCI_{malay}=0.257, FCI_{indian}=0.256, FCI_{others}=0.216, p<0.001); and the mean FCI increased with increasing age (p<0.001).

About 64% of the patients had visits to only one medical specialty (ie, FCI=0). The remaining 36% with FCI >0 had a mean FCI of 0.70 (SD=0.20). The distribution of FCI among patients with FCI >0 showed a peak (9% of the study population) at FCI=0.67 (see figure 1), and this group of patients had the most common visitation pattern of three visits across two different medical specialties. The study population had 7% with FCI=1, within which 87% had two visits, and the rest had three to five visits.

Proportions and mean FCIs for each subgroup are summarised in table 1. Mean FCI was largest for patients without a unique MFVS ($FCI_{multiple}$=0.89). Patients with Medical Oncology and Radiation Oncology as their MFVS also had relatively larger mean FCIs ($FCI_{Med\ Onco}$ = 0.50, $FCI_{Rad\ Onco}$ = 0.46), even though each of these specialties were visited by less than 1% of all patients. Also, the mean age of these patients (65.8 years) was significantly (p<0.001) higher than the rest of the study population (55.3 years).

MFVSs with the highest volume of patients were orthopaedics, ophthalmology, general surgery and otorhinolaryngology. These patients had mean FCIs less than 0.20. Also, the average number of specialties visited by these patients (1.3) was significantly lower (p<0.001) compared with the rest of the study population (1.8).

The log-linear regression model chosen through stepwise selection, modelled FCI against age, gender and MFVS (table 2). FCI was positively associated with age (p<0.001). No statistically significant difference in FCI was found between genders. Patients who visited Haematology, Endocrinology and Anaesthesiology specialties most frequently had relatively larger FCIs while those who visited Medical Oncology, Ophthalmology and Orthopaedics Surgery specialties most frequently had the smallest FCIs.

DISCUSSION

With the growing concerns of care fragmentation in medical care,[11 14] there is a greater need to measure and analyse multispecialty care fragmentation in an outpatient setting. The advantage of using FCI to measure care fragmentation is that it accounts for both frequency and dispersion of outpatient visits to different medical specialties to offer a balanced view of care fragmentation.

Studies related to fragmentation of care delivery across multiple providers have shown that a mean FCI of 0.50 corresponds to moderate levels of care fragmentation and a mean FCI of 0.70 corresponds to moderately high levels of care fragmentation.[20 22] While our study did not factor in care fragmentation associated with coordinating care across multiple healthcare entities and focused on multispecialty care fragmentation in a single institution, we found that moderately high (FCI ≥0.7) levels of care fragmentation persists in around 36% of the outpatient population. Our findings underscore the possibility of underestimating the extent of care fragmentation in the healthcare system as most studies do not factor in care fragmentation that could occur within a single healthcare entity. The actual situation of care fragmentation might be more worrying than what is perceived.

Our study shows that care fragmentation is positively associated with age. This concurs with the literature findings that there is an increased prevalence of multimorbidity among older adults,[29 30] that they are more likely to consume multispecialty care and hence are at a higher risk of experiencing fragmented care. However, every 10 year increase in age only resulted in a limited increase of 0.003 in FCI after controlling for gender, MFVS and number of specialties. Outpatients with Haematology, Endocrinology and Anaesthesiology as their MFVS experienced the most fragmentation among the different specialties. This could be because endocrinologists are commonly involved in the co-management of disease conditions such as diabetes along with other specialists from different

Table 1 Characteristics of the study population and Fragmentation of Care Index (FCI) of the subgroups

	N	%	FCI mean	FCI SD	P value
Total	40333	100	0.256	0.358	
Gender					<0.001
Male	21897	54.3	0.251	0.357	
Female	18436	45.7	0.263	0.360	
Race					<0.001
Chinese	28979	71.8	0.261	0.359	
Malay	4399	10.9	0.257	0.360	
Indian	3545	8.8	0.256	0.360	
Others	3410	8.5	0.216	0.342	
Age group (years)					<0.001
21–39	9003	22.3	0.150	0.303	
40–59	14374	35.6	0.247	0.355	
60–79	14004	34.7	0.310	0.371	
80 and above	2952	7.3	0.370	0.382	
Most frequently visited specialty					<0.001
Orthopaedics surgery	8723	21.6	0.101	0.230	
Ophthalmology	5117	12.7	0.123	0.248	
Multiple	4838	12.0	0.891	0.146	
General surgery	4548	11.3	0.173	0.285	
Otorhinolaryngology	3453	8.6	0.158	0.284	
Urology	2669	6.6	0.161	0.280	
Cardiology	1832	4.5	0.218	0.316	
Respiratory medicine	1298	3.2	0.246	0.317	
Endocrinology	1288	3.2	0.348	0.328	
Gastroenterology	1178	2.9	0.192	0.304	
Dermatology	780	1.9	0.150	0.270	
Psychiatry	774	1.9	0.203	0.295	
Rheumatology	694	1.7	0.264	0.303	
Geriatric medicine	652	1.6	0.246	0.310	
Renal medicine	610	1.5	0.325	0.329	
Neurology	425	1.1	0.263	0.329	
Neurosurgery	310	0.8	0.254	0.319	
General medicine	279	0.7	0.275	0.326	
Gynaecology	215	0.5	0.196	0.302	
Medical oncology	214	0.5	0.496	0.227	
Plastic surgery	179	0.4	0.261	0.309	
Infectious diseases	103	0.3	0.348	0.319	
Anaesthesiology	92	0.2	0.350	0.325	
Haematology	40	0.1	0.359	0.321	
Palliative medicine	16	<0.1	0.272	0.291	
Radiation oncology	6	<0.1	0.456	0.366	

medical disciplines.[20] Similarly, blood-related disorders referred to haematology are often associated with other systemic diseases and/or involve multiple specialties in their management.[31 32] As for anaesthesiology, the specialty's clinical practice usually includes pain management and total care of surgical patients throughout the course of planning, preparation and post-recovery from a surgery. Close teamwork between anaesthetists and other

Table 2 Results of log-linear regression of Fragmentation of Care Index (values represent back transformation of coefficients)

	Coefficient (95% CI)
Age	0.0003*** (0.0002 to 0.0004)
Gender (Ref: male)	
Female	0.0017 (–0.0007 to 0.0041)
Most frequently visited specialty (Ref: otorhinolaryngology)	
Haematology	0.0743*** (0.0354 to 0.1147)
Endocrinology	0.0477*** (0.0397 to 0.0557)
Anaesthesiology	0.0457*** (0.0203 to 0.0716)
Neurosurgery	0.0303*** (0.0162 to 0.0446)
Gynaecology	0.0282*** (0.0115 to 0.0452)
Neurology	0.0260*** (0.0138 to 0.0383)
Plastic surgery	0.0198* (0.0018 to 0.0381)
Cardiology	0.0159*** (0.0091 to 0.0228)
Respiratory medicine	0.0109** (0.0033 to 0.0186)
General medicine	0.0104 (–0.0041 to 0.0251)
Gastroenterology	0.0028 (–0.0050 to 0.0107)
Infectious diseases	0.0010 (–0.0220 to 0.0245)
Geriatric medicine	0.0009 (–0.0092 to 0.0112)
Palliative medicine	0.0001 (–0.0564 to 0.0600)
Urology	–0.0001 (–0.0061 to 0.0060)
Renal medicine	–0.0012 (–0.0114 to 0.0091)
Rheumatology	–0.0017 (–0.0113 to 0.0080)
Dermatology	–0.0069 (–0.0159 to 0.0023)
General surgery	–0.0073** (–0.0125 to -0.0021)
Psychiatry	–0.0105* (–0.0196 to -0.0013)
Orthopaedics surgery	–0.0194*** (–0.0240 to -0.0148)
Ophthalmology	–0.0222*** (–0.0272 to -0.0171)
Radiation oncology	–0.0262 (–0.1142 to 0.0706)
Medical oncology	–0.0647*** (–0.0800 to -0.0491)
Multiple	0.3393*** (0.3320 to 0.3465)
Number of specialty	0.2332*** (0.2313 to 0.2351)

Adjusted R^2=0.80.
*p<0.05; **p<0.01; ***p<0.001.

specialty doctors are needed for quality care delivery. Interestingly, patients with MFVS Medical Oncology and Radiation Oncology are associated with smallest FCIs after controlling for other factors. This could be because the patients who most frequently visited Medical Oncology or Radiation Oncology were generally older in age.

A limitation encountered with the use of the FCI as a measure of care fragmentation is the lack in its ability to differentiate the reasons for which care is fragmented among patients with an FCI of 1. For instance, it would not be able to differentiate between a patient with one visit each to five different specialties (FCI=1) and another patient with one visit each to two different specialties (FCI=1). The accuracy of the estimates for the extent of multispecialty care fragmentation in this study is limited by its scope within specialist outpatients from a single hospital as patients in our study population might also have sought specialist care at other healthcare institutions. Hence, our estimates for the extent of multispecialty care fragmentation are conservative. Primary care is the first point of contact in the provision of care and serves to integrate specialist care. Hence, it is not considered as a specialty in the calculation of FCI. This study does not address the issue of a patient visiting different providers within the same specialty as team-based care is the main model of subsidised care in Singapore. Another limitation is that the data on case mix, social factors such as social support, socioeconomic status could not be extracted as they are not available as discrete data in the electronic medical records for outpatients. Therefore, there is limited information available to analyse the causes or reasons of fragmentation of care. Nevertheless, this index could still be used as a first step to flag out those at higher risk of receiving fragmented care. These patients may then be referred to care co-ordination team who could then profile the patients, elicit a detailed history to identify the issues and address them with relevant interventions. In addition, further qualitative and quantitative studies could be done to deep dive into the causes of such fragmentation.

CONCLUSION

This study found that multispecialty care fragmentation in the outpatient specialist clinics was moderately high and it was associated with patient's age and particular medical specialties. Coupled with an ageing population and earlier onset of chronic conditions, this situation seems likely to worsen in the future. Given the complex nature of chronic conditions and the rising prevalence of multimorbidities, multispecialty care is probably unavoidable. Nevertheless, healthcare providers could look into ways to eliminate unnecessary referrals to reduce the extent of care fragmentation.

Contributors KSY, MK and YMH conceived and designed the study, carried out tasks related to ethics approval and data acquisition. WG completed statistical analysis and interpreted the results. WG drafted the manuscript and MK, YMH revised the manuscript. KSY reviewed and approved the final draft as submitted.

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