表２．DPC 評価分科会資料データの内容（平成 20 年 5 月 9 日版）

参考資料１	各病院の再入院率
	在院日数の平均の差の理由の検討
	高度医療
参考資料２	(1)ＭＤＣ別医療機関別件数
	(7)疾患別手術別件数在院日数　施設別 01～16
	(8)疾患別手術有無別処置１有無別集計　施設別 01～16
	(8)疾患別手術有無別処置２有無別集計　施設別 01～16

DPC データを用いた地域医療の分析

本稿では特に、公開データを用いて地域の医療機関の機能を評価する分析の実際を紹介する。分析の第一歩として、傷病別の患者数や手術数などの診療実績の分析からはじめるのが良いであろう。DPC データでは傷病分類別に手術の種類別、化学療法や人工呼吸などの処置の内容別に患者数と平均在院日数が集計されている。最初は手術の有無別に集計したデータを使用して分析し、次の段階で手術手技の違いなども含めて分析を進めていくことができる。

手術有無別の患者数の集計は表３の「疾患別手術有無別処置１有無別集計　施設別」データから作ることができる。公開データでは 10 症例以下の集計はマスクされてしまっているので多少誤差があるが、処置１別の集計を用いると誤差を少なくできる。このデータは、施設別に、DPC 診断群分類、手術の有無、処置１の有無別に集計された件数と平均在院日数である。このデータの「処置１あり」と「処置 1 なし」の欄を合計すると手術の有無別の患者数が得られる。

表３．(8)疾患別手術有無別処置１有無別集計　施設別データの例

	010010							
	脳腫瘍							
	件数				在院日数			
	手術あり		手術なし		手術あり		手術なし	
施設名	処置１あり	処置１なし	処置１あり	処置１なし	処置１あり	処置１なし	処置１あり	処置１なし
札幌医科大学附属病院	－	22	－	13	－	37.7	－	9.8
北海道大学病院	－	36	－	46	－	33.1	－	26.7
旭川医科大学病院	－	15	－	48	－	51.7	－	17.1

現在 1428 病院のデータが公開されているが、分析は同じ都道府県内の病院のみで充分であろう。公開データには都道府県名が記されていないが、病院名は DPC 対象となった年度別に都道府県順に並んでいるので、同じ都道府県内の病院を抽出するのは難しくないはずである。

一例として新潟県の食道がん診療の分析例を表 4 に示す。DPC 公開データだけで新潟県内の主要な急性期病院はほぼカバーされているので、新潟県の食道がん診療の実態がほぼ明らかとなる。手術は大学病院を筆頭にわずか 5 病院でしか実施されていないことがわかる。このデータから、地域住民や地域の医師が食道がんの手術をどこの病院に依頼すれば良いかは自明である。手術以外の治療は他の数病院でも実施されているが、他の DPC データの分析から放射線治療などが 10 例以上実施されているのは済生会第二病院と長岡赤十字病院であることがわかる。

表 4．新潟県の食道がん治療の実績

DPC コード	060010	
DPC 傷病名分類	食道の悪性腫瘍（頸部を含む。）	
施設名略称	手術あり	手術なし
新潟大学	49	51
長岡中央綜合病院	40	30
新潟県立がんセンター	39	174
新潟県立中央病院	20	39
新潟市民病院	16	21
済生会新潟第二病院	0	16
長岡赤十字病院	0	12
立川綜合病院	0	11
新潟県立十日町病院	0	10
新潟中央病院	0	0
桑名病院	0	0
亀田第一病院	0	0
燕労災病院	0	0
小千谷総合病院	0	0
町立湯沢病院	0	0
新潟労災病院	0	0
上越総合病院	0	0

地域シェア分析

もう一歩進めて、疾患毎の手術実施数と医療圏内の手術実績シェアを対比させると、個々の病院の地域での役割や地域医療への貢献度などを分析することができる。図２は新潟県内の DPC 病院の胆管結石症の手術実績と二次医療圏内の全手術に占める割合（シェア）をグラフにしたものである。このグラフからは各病院の手術数とともに地域への貢献度を読み取ることができる。

このグラフの縦軸はそれぞれの病院の手術数である。横軸はそれぞれの病院の手術数が同じ二次医療圏内の全病院の手術数の合計に占めるシェアを示している。二次医療圏内シェアを計算するためには、二次医療圏毎に病院をグループ分けして合計する必要がある。公開データには二次医療圏は記されていないので、地域医療計画などの資料から判断する必要がある。難しいようであれば、近隣の病院のみを選んで医療圏内の合計値としても構わないであろう。自院が DPC 対象外の病院である場合は、自院の数値も含めて合計値を計算した方がよい。

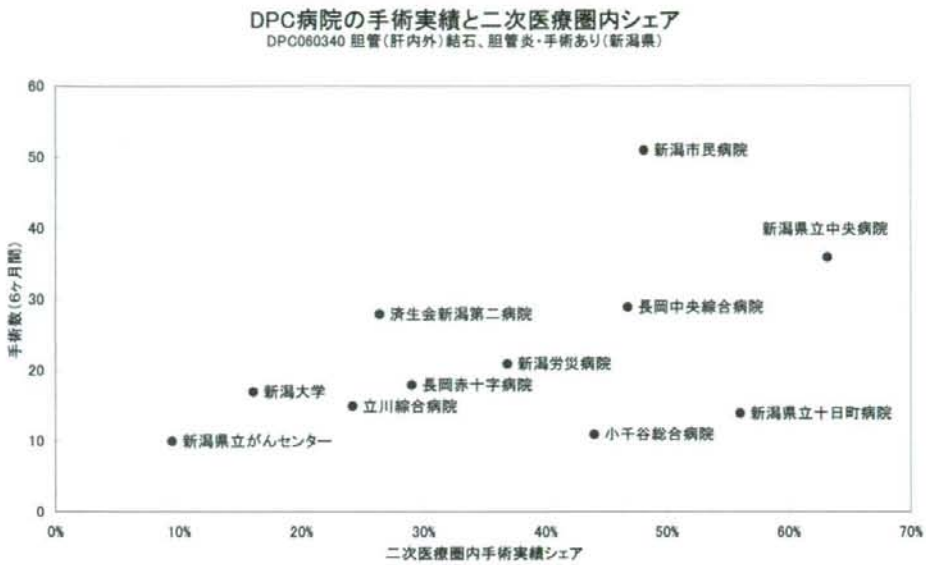
必ずしも手術実施数が多い病院ほど手術成績が良いとは限らないが、少なくともほとんど手術実績がない病院よりはある程度実績がある病院のほうが望ましいであろう。わが国では専門的な手術を実施する病院が集約されていないため、専門医の育成に困難が生じているとされる。また、近年の医師不足の一因も不充分な医療機関の機能集約にある。

一方、地理的な条件から医療機関の集約が困難な地域があることも見逃してはならない。たとえ手術実績が少なくても地域医療を支えなくてはならない医療機関も多い。医療機関の機能集約と地域医療の確保のバランスを評価するために、図２のような地域シェア分析が有用である。

手術数が多く、シェアが大きい病院は文句なく地域の基幹病院といえる。新潟市民病院、新潟県立中央病院などは胆管結石手術のこの地域の基幹病院である。手術実績が少ない病院の評価は、二次医療圏内シェアによって分かれる。新潟県立がんセンターのように手術数が月に１～２例程度で、二次医療圏シェアが 10%以下と低い場合は、胆管結石の手術は同じ医療圏内の他の病院に任せた方が良いかもしれない。その分がんの専門分野の治療に集中できるであろう。近隣には市民病院や済生会第二病院のように手術実績が多い病院があるので、積極的に連携を進めるべきであろう。

一方、小千谷総合病院と十日町病院のように手術実績は少なくても地域シェアが高い病院は、地域での役割を評価して診療を続けられるように支持する必要があろう。但し、この２病院は実は同じ二次医療圏内にあるので、できればどちらかの病院に胆管結石の手術は集約した方が、外科医の負担を減らし医師不足への対策になるかもしれない。自院がこのような立場に立っていることが明らかとなった場合は、病院の経営責任者には、是非積極的に決断をしていただきたい。

図２.



地域患者 SWOT 分析

同様の方法で MDC 分類毎の患者数と二次医療圏内シェアを用いると、自院の地域での位置づけを把握するための地域患者SWOT分析を行うことができる。SWOT分析とは、経営に関する諸条件を、自己の能力(内部環境)と周囲の環境(外部環境)との二つの要素に便宜的に整理して、二次元的にマッピングする方法である。内部環境の強み(Strength)、弱み(Weakness)、外部環境の好機(Opportunity),脅威(Threat)の頭文字に由来する。これを患者マーケット分析に応用することで、自院の特徴と地域における役割を可視化することができる。

内部環境は MDC 別の患者数で表し、外部環境は他医療機関との競合を念頭に置き、二次医療圏での患者シェアとしてシェアが多い分野を好機、少ない分野を脅威とする。このようにして、自院における得意分野、地域における競合医療機関の状況、診療分野毎の地域への貢献度などを評価することできるので、自院内の診療科間の資源配分や、地域の競合医療機関への対抗策などの経営戦略を立案することが可能となる。

DPC データを用いて新潟県内の同じ二次医療圏内にある S 公的病院(図3)と C 公立病院(図4)を比較してみる。データは表2の(1)MDC別医療機関別件数からダウンロードできる。両病院とも MDC06 消化器系は強みで地域シェアも大きい。S 病院は MDC12 産婦人科系と MDC11 泌尿器科系が強みで地域シェアが大きいのが特徴である。これらの分野は「積極的攻勢」がいいとされている。

S病院の MDC13 血液系、C 病院の MDC01 脳神経系、MDC14 新生児系は、手術患者数は

あまり多くないが、地域シェアは比較的大きい。地域において一定の役割を担っていると考えられる。これらの分野は「段階的施策」が必要とされ、地域医療のために診療分野を維持していかなくてはならない。地域において頼りにされている分野と言えよう。

両病院ともMDC07整形外科系、MDC09乳腺外科系ともに手術数が少なく、地域シェアも小さい。このような分野は「専守防衛」または「撤退」が必要とされている。この地域のDPCデータを見ると、がんセンターなどの他の病院がこれらの手術を多数実施していることがわかる。自院で実績の少ない手術は近隣の実績の豊富な病院へ紹介することは、地域医療連携の重要なポイントであろう。その分、自院の強みをより伸ばすことが期待できる。

図3. S病院の地域患者SWOT分析

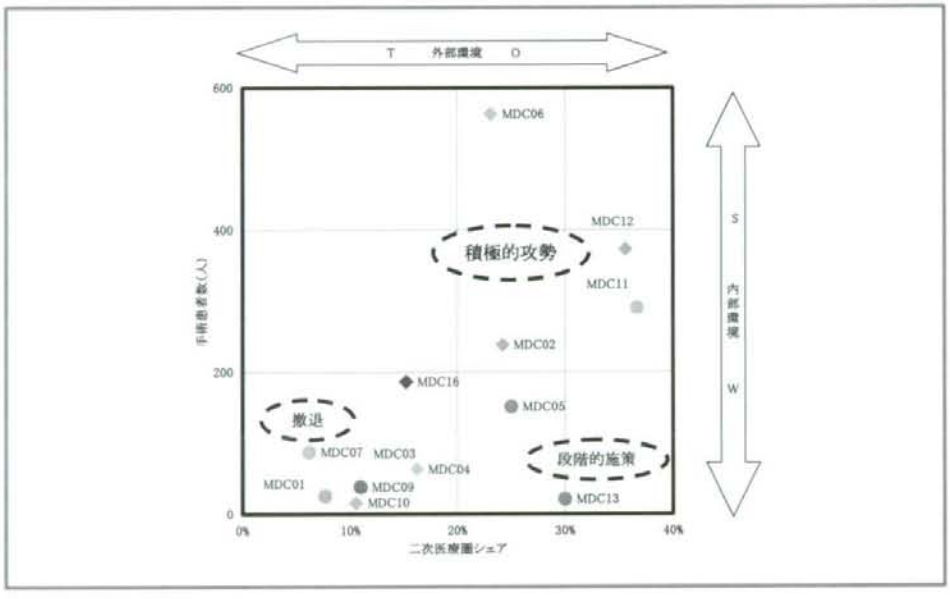
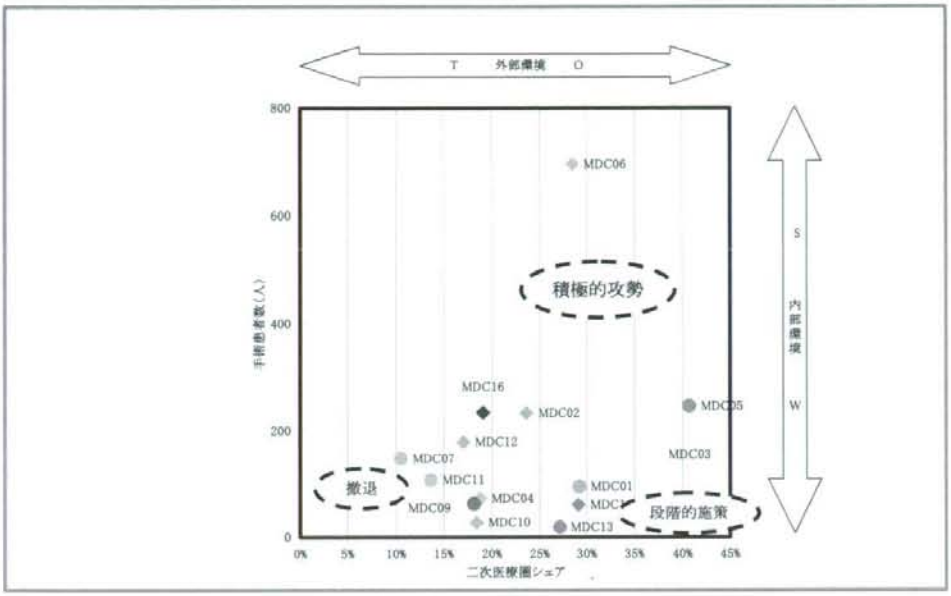


図4. C病院の地域患者SWOT分析



おわりに

本稿では公表されているDPCデータのみを用いた地域医療分析の手法を示した。興味があるかたは是非、近日発刊予定の「DPC データ活用ブック(第2版)」を参考にして、より詳細な地域分析を試みて頂きたい。この本には DPC 病院以外のデータを含めた急性期、慢性期の地域患者データベースが収載されているので、中小の医療機関も含めて多くの医療機関の患者マーケット分析に役に立つはずである。

本稿で紹介したような分析によって、個々の医療機関が自院の特徴と地域から期待されている役割を正確に認識し、様々な分野で地域医療連携の要となるように医療機能分化が進むことを期待したい。

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Travel of patients to distant hospitals for elective surgery in Japan

Surgery Today

Travel of patients to distant hospitals for elective surgery in Japan: A cross-sectional analysis of a nationally representative sample

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Abstract

Purposes: The principles and methods of geographical allocation of healthcare resources and their relationships with patient behaviour have long been issues in health policy research in many countries. This study aimed to investigate the associations between specific healthcare services such as surgical procedures and patient hospital selection behaviour that may be related to health service allocation under the relatively de-regulated social health insurance settings in Japan.

Methods: A total of 520,976 discharge records were analyzed to examine the relationships between patient characteristics, primary diagnoses, interventions, distance to hospitals of admission and medical areas designated by local governments.

Results: Patients undergoing cardiac and orthopaedic surgery were admitted to hospitals in distant medical areas more than twice as frequently and about 1.7 times as far from their residences compared to patients without such surgeries. In contrast, elderly patients and patients undergoing trauma or gastro-intestinal surgery were admitted to nearby hospitals.

Conclusions: Patients who needed non-emergency and relatively complicated surgical interventions tended to be admitted to distant hospitals, suggesting that patients may select better hospitals for elective, technically demanding surgeries.

Introduction

Optimization of the spatial allocation of limited healthcare resources, balancing the quality of care and improving geographical access to health services comprise a major health policy challenge for many countries [1]. Patients generally have two paradoxical demands, i.e. high-quality health services consisting of concentrated healthcare resources and fair geographical access to those services. Governments and health planners responsible for health insurance systems have to properly allocate the available resources to centralized healthcare services including surgical procedures for better quality and for providing such services to beneficiaries within the distance of an acceptable travel time. Previous studies on health resource allocation, hospital competition and access to services in the United States have shown that patient behaviour to select distant hospitals, bypassing the nearest ones, was related to the severity of illness [2–4], complexity of procedures [5], higher functionality of distant hospitals, and younger [6,7] or male [8,9] patients. On the contrary, in European countries, most of which have universal social health insurance systems and relatively regulated hospital markets, research interests have tended to focus on service centralization and the quality of care [10-12], rather than on patient behaviour.

Japan has a social health insurance system that covers most residents and most health services with a limited amount of co-payments. Under this insurance system, patients are free to choose any hospital with almost no socio-economic restrictions. On the other hand, extensive centralization of healthcare services is urgently needed because health resources are currently exceedingly scattered [13]. The number of hospital

beds per population in Japan is 2.1 times higher than the OECD average [14]; however, the staff density per bed is far below the OECD standard, resulting in a heavy workload of medical staff and a high risk of medical errors[15]. We have previously reported that admissions for colon cancer surgery to high-volume hospitals are related to hospital functioning and the distance to the hospitals [16], however, hospital selection for other surgery has not been investigated so far in Japan. In this research, we have aimed to clarify the relationships between hospital selection behaviour of patients and required health services and have tested a hypothesis that patients who need complicated surgery tend to be admitted to distant hospitals by using a nationally representative healthcare dataset of Japan. Prior to health reforms, further investigations are necessary to achieve the consolidation of healthcare services including surgical procedures in fewer facilities.

Materials and methods

Data set

Records of patients discharged from medical facilities during September 1999 from the Patient Survey in Japan were used for this study [17]. The Patient Survey is conducted every three years, in which approximately 70% of hospitals and 7% of clinics in Japan are randomly selected for investigation and the number and profiles of patients discharged during one month are reported for the survey. Data of the survey are considered representative of the entire population of Japan [18]. The patient profile includes age, gender, the International Statistical Classification of Diseases and Related Health Problems 10th Revision codes (ICD10) for the primary diagnosis, the site of

surgical procedure if any, and the city code of the patient's residence. The data do not include the emergency status of patients.

Records of patients with the following conditions were excluded from analyses: length of hospital stay (LOS) less than 2 days, LOS more than 90 days for patients with surgery and more than 30 days for patients without surgery, patients discharged from long-term care wards, and females undergoing normal delivery.

Patient classification

Patients were classified into 10 groups according to primary diagnosis and surgical interventions. Percutaneous interventions such as angioplasty, embolisation and stenting were included in surgery in this study. Patients with surgery and a primary diagnosis of cancer were grouped into 'cancer surgery'. Patients other than 'cancer surgery' were classified as 'brain surgery' for diseases such as subarachnoid haemorrhage and intracranial haemorrhage, 'cardiac surgery' for such as angina, acute myocardial infarction and arrhythmia, 'gastro-intestinal surgery' for such as colon polyps and inguinal hernia, 'orthopaedic surgery' for such as spinal canal stenosis and arthropathy of knee joint, 'urological surgery' for such as urolythiasis and benign prostatic hyperplasia, 'gynaecological surgery' for such as uterine myoma, 'trauma surgery' for such as bone fracture, 'other surgery' for such as cataract and sinusitis or 'no surgery' according to the assignment of the ICD10 primary diagnosis into the Major Disease Categories of Japan [18].

Geographical definition

To assess whether patients were admitted to local hospitals or distant hospitals, two indicators were used: whether the patient was admitted to a hospital within the secondary medical area (MA) designated for the patient's residence and the distance to the hospital of admission. MA is defined as a medical administrative area by local governments under the Medical Care Law, where most medical services are expected to be provided to residents [19, 20]. Although MAs have been assigned for all areas of Japan, it is possible that for some patients, no hospital within their resident MA has the facilities for the required surgery. To eliminate such cases that did not have the opportunity for active hospital selection, records in our data set were excluded from analysis when there was no hospital within the patient's MA that provided the required surgical procedures. After elimination of 4381 records according to this definition, 520,976 patient records were submitted for analysis.

To estimate the distance between the patient's domicile and the hospital of admission, the patient and hospital addresses were first expressed as latitudinal and longitudinal coordinates (Tokyo Datum) and converted into the Cartesian plane coordinate system. Next, the distance between the two points was calculated. The patient's address was substituted with the address of municipal offices to serve as a basis for calculation of the population centre of gravity. The distances to the hospitals for admittance were calculated as Manhattan distances [21]. The population of each MA was determined from the 2005 Population Census of Japan.

Statistics

The association between patient and hospital attributes and admission to a distant hospital or the distance to the hospital of admission was examined by logistic regression analysis or linear regression analysis, respectively. As the distribution of the distance to the hospital of admission was skewed, log-converted values were used for the estimation of the average and analysis. All statistical analyses were performed using Stata 10.0 MP, and the level of significance was set at $p < 0.05$.

Results

The characteristics of the subjects analysed in this study are shown in Table 1. Approximately 20% of patients were admitted to hospitals located in a distant MA other than that of the patient's residence, with young and male patient predominance. The length of hospital stay was shorter than that previously reported for acute hospital care in Japan [14] because patients with long hospital stay were eliminated from the analysis, and it was slightly longer for patients admitted to a distant MA, which may indicate that patients with more complex conditions tended to be admitted to distant hospitals, similar to the findings of previous reports [2, 3]. Patients admitted to a distant MA had a high probability of undergoing cancer, cardiac, orthopaedic, urological or gynaecological surgery and of admission to a teaching or large hospital. The distance to hospitals of admission in distant MAs was more than 7 times greater than that to the hospital within the MA. Although the area size and patient numbers for the 363 MAs

under study varied considerably, the distribution of the rate of admission to distant MAs and the geometric mean of the distance to hospitals of admission among MAs was not very wide, as planned and expected in the regional health plans of local governments.

INSERT TABLE 1 HERE

The individual effects of patient attributes, hospital attributes and types of surgery on admission to a distant MA and the distance to the hospitals of admission are summarized in Table 2. Significant positive relationships were observed between admission to a distant MA and the patient attributes of male; child; and cancer, cardiac, orthopaedic, urological, gynaecological and other surgeries as well as the following hospital attributes of teaching hospital and large bed size. Among these, the odds ratios of admission to a distant MA for a patient needing cardiac or orthopaedic surgery were greater than 1.8, suggesting that patients travel further for non-emergency and technically demanding interventions. In contrast, there was a significant tendency for preference to admission within the MA for elderly and gastrointestinal surgery patients. Similarly, the distance to the hospital of admission was greater for cardiac and orthopaedic surgery patients and lesser for aged and gastrointestinal surgery patients. It was shown that on average for cardiac and orthopaedic surgery, patients travelled approximately 1.5 times or more than 2 km further than the controls, who did not undergo specific surgery, and that aged patients travelled approximately 20% or 1 km lesser than did the controls.

INSERT TABLE 2 HERE

Lastly, we performed multivariate logistic analysis and linear regression analysis for admission to a distant MA and the distance to the hospital of admission with all variables, respectively (Table 3). Male patients selected hospitals in a distant MA with 1.08 times higher probability and ~6% further in distance, and elderly patients had a 0.65 times lower probability of selecting a distant MA hospital and selected hospitals that were ~20% nearer to the domicile, when other factors were controlled. There were no significant differences for paediatric patients when factors of gender, surgery and hospital were adjusted. Cardiac and orthopaedic surgery had the most significant effect on selection of a distant hospital; admissions to hospitals in a distant MA were more than twice as frequent and the average distance to the hospital was approximately 70% greater than that in controls. In contrast, nearby hospitals were chosen for trauma and gastrointestinal surgery, showing that patients who needed elective and complicated surgery tended to select distant hospitals and those who needed emergency or ordinary surgery selected nearby hospitals. The distance to teaching hospitals or large hospitals was greater than that to other hospitals, consistent with previous observations [6, 7].

INSERT TABLE 3 HERE

Discussion

This study first described quantitatively how patients select hospitals according to their need for healthcare services under the universal social health insurance system of Japan, where patients are free to select almost any hospital, with little socio-economic or health insurance barriers. Patients tended to select distant hospitals, bypassing nearby hospitals, for non-emergency, technically demanding surgery such as cardiac and orthopaedic surgery. Because approximately 70% of cardiac surgery and most orthopaedic surgeries are non-emergent, and the waiting time for such surgeries is usually not problematic in Japan [22], it is conceivable that the length of the waiting list has little effect on patient behaviour concerning hospital selection. In contrast, for emergency surgery or ordinary surgery such as trauma and general abdominal surgery, patients tended to select a nearby hospital. Because very little information regarding the quality of care or surgery volume in each hospital is publicly available in Japan, the reasons why patients select distant hospitals for specific types of surgery are unclear. It is speculated that patients may select hospitals on the basis of the local reputation or recommendations by primary care physicians, who do not have any economic incentives to refer patients to a particular hospital.

In addition, tendencies were observed for males or younger patients to select distant hospitals, whereas females or older patients selected nearer ones; among distant hospitals, large or teaching hospitals tended to be selected, consistent with most previous observations on patients' hospital selection [6–9]. Previous observations of hospital selection behaviour, mostly in care settings in the United States, have been re-confirmed by our large-scale nationwide examination, indicating that patient

behaviour patterns are similar in a setting with universal social health insurance, i.e. Japan. The Japanese healthcare system may be featured as a system of universal social health insurance with relatively lower regulation of patient behaviour and moderate competition among hospitals for patients; therefore, observations in this setting may be expected to provide crucial insights for countries with a social health insurance system moving towards a de-regulated and competitive healthcare market [12]. In addition, the results may indicate the existence of an imbalanced access to advanced healthcare services based on gender and age even in a setting like Japan where there is almost no disparity in healthcare access [23]. It is possible that the lower availability of transportation to aged or female patients (than to young and male patients) may diminish their opportunity to select distant hospitals although public transportation in most of Japan is adequate and efficient. Secure access to advanced healthcare services for aged, female, and other patients with transportation difficulties needs to be emphasized in the future centralization of services and de-regulation of the healthcare market.

Our results may have some political implications for the centralization of special healthcare services including surgical procedures and secure geographical access for those services. Although the centralization of surgical procedures is expected to improve the quality of care, it also limits geographical access to surgical units for patients. The results of the present study suggest that residents may accept the allocation of healthcare services according to the level of medical technology available for such services. It was shown that patients might willingly select distant hospitals for a specific

surgery versus nearby hospitals for other surgeries. Our results may implicate that patient behaviour of hospital selection needs to be considered for supply-side controls of priority settings and health resource allocation [1], and that patients may willingly pay distance cost for the centralization of advanced surgery.

One of the limitations of this study is the difficulty in completely eliminating the possibility of the lack of adequate hospitals nearby as the reason for selecting distant hospitals. However, the lack of nearby hospitals is unlikely to be the reason for selection of distant hospitals for the following reasons: (1) MAs have been demarcated so that most healthcare services should be provided in these areas by the Regional Health and Medical Care Plans of local governments [18] and (2) there is a marked excess of hospitals and beds in most areas of Japan compared to those in other developed countries [14]. To reduce such a possibility, cases that had no hospitals providing the required healthcare services in the MA of their domicile, which comprised only 0.83% of total cases, were removed from the analyses.

The administrative data used in this study do not include information regarding the occupation, income and care history of patients, which have been shown to potentially affect hospital selection [3]; however, little effect of these factors on hospital selection are expected because of minimal socio-economic barriers under the universal social health insurance system of Japan. The effects of referrals of primary physicians have not been examined in this study. Because patients are provided access to ambulatory care in acute care hospitals without referrals from a primary physician in Japan, it is conceivable that patients' own decisions on hospital selection are significant

[23]. Further study will be needed to examine the effects of referrals, physician-hospital relationship and surgery volume of hospitals on hospital selection behaviour.

Conclusions

We have shown that patients who need non-emergency advanced surgical interventions tend to select distant hospitals, implicating the possible selection of better hospitals for elective surgery under the universal social insurance system that permits voluntary hospital selection without socio-economic barriers. We observed that patient hospital selection behaviour may be similar across healthcare systems and independent of the type of the system.