

BMJ Open Do informed consumers in Taiwan favour larger hospitals? A 10-year population-based study on differences in the selection of healthcare providers among medical professionals, their relatives and the general population

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ABSTRACT

Objectives Exploring whether medical professionals, who are considered to be ‘informed consumers’ in the healthcare system, favour large providers for elective treatments. In this study, we compare the inclination of medical professionals and their relatives undergoing treatment for childbirth and cataract surgery at medical centres, against those of the general population.

Design Retrospective study using a population-based matched cohort data.

Participants Patients who underwent childbirth or cataract surgery between 1 January 2004 and 31 December 2013.

Primary and secondary outcomes measures We used multiple logistic regression to compare the ORs of medical professionals and their relatives undergoing treatment at medical centres, against those of the general population. We also compared the rate of 14-day re-admission (childbirth) and 14-day reoperation (cataract surgery) after discharge between these groups.

Results Multivariate analysis showed that physicians were more likely than patients with no familial connection to the medical profession to undergo childbirth at medical centres (OR 5.26, 95% CI 3.96 to 6.97, $p < 0.001$), followed by physicians’ relatives (OR 2.68, 95% CI 2.20 to 3.25, $p < 0.001$). Similarly, physicians (OR 1.63, 95% CI 1.21 to 2.19, $p < 0.01$) and their relatives (OR 1.43, 95% CI 1.13 to 1.81, $p < 0.01$) were also more likely to undergo cataract surgery at medical centres. Physicians also tended to select healthcare providers who were at the same level or above the institution at which they worked. We observed no significant difference in 14-day re-admission rates after childbirth and no significant difference in 14-day reoperation rates after cataract surgery across patient groups.

Conclusions Medical professionals and their relatives are more likely than the general population to opt for service at medical centres. Understanding the reasons that medical professionals and general populations both have a preferential bias for larger medical institutions could help improve the efficiency of healthcare delivery.

Strengths and limitations of this study

- This is the first study to use matched samples to investigate differences among medical professionals, their relatives and the general population in the choice of healthcare provider for elective treatment.
- This study includes medical professionals other than physicians and a broad range of relatives.
- Patients who were not medical professionals/relatives may still have had interpersonal connections with individuals working in the healthcare sector.
- The spouse of a medical professional who was employed throughout the entire period of observation could be misclassified to the general population.

INTRODUCTION

In the past, many countries used to enforce strict gatekeeping systems in primary care, wherein patients were excluded from the process of selecting a healthcare provider. As a result, general practitioners (GPs) played an important role in selecting healthcare providers and mediating referrals for specialty care or hospital admission.¹ Gatekeeping was shown to limit unnecessary referrals; however, researchers found that the decision of whether to refer a patient to a specialist varied among GPs, resulting in the underuse and the overuse of referrals.² Beginning in the 1990s, the UK and several western European countries introduced systems in which patients were given a choice in healthcare providers with the aim of improving access, efficiency and quality of care.^{3–5}

Previous studies have shown that highly educated patients and those with clearly defined needs for elective treatments are more likely to exercise their choice, rather than being treated by local providers.^{6–8}

Moscone *et al* reported that the absence of information pertaining to the quality of hospitals often leads to patients selecting hospitals with low quality of care.⁹ This means that allowing provider's choice can improve access to healthcare and reduce waiting times; however, it also raises concerns about aggravating inequity in healthcare.^{4 10 11}

Physicians can be considered informed consumers of healthcare services with ready access to healthcare providers. Literature has shown that individuals working in the healthcare sector differ in their consumption patterns, compared with non-medical professionals. Bunker and Brown found that patients who are physicians and their spouses were more likely to undergo operations than were patients in other occupation groups (eg, lawyers or businessmen). Thus, they suggested that the demand for healthcare increases when patients are well informed.¹² Domenighetti *et al* investigated the consumption of medical and surgical services by physicians; however, they discovered that physicians are far less likely than the general population to undergo surgery.^{13 14} Moreover, another study based on data from a Swiss Health Survey found that medical professionals are significantly less likely to visit physicians, compared with those in the general population.¹⁵ Other studies comparing healthcare received by physicians and the general population have reported that physicians utilise healthcare less but tend to have better outcomes than the general population.^{16–19} Physicians are also less likely to undergo breast cancer screening²⁰ and treatments with deadly adverse effects²¹; however, they are more likely to use hospices and intensive care units (ICU) or critical care units (CCU).²² A number of studies have explored differences between medical professionals and non-medical professionals in terms of treatment choice and outcomes; however, very few have examined whether medical professionals are more likely than the general population to favour large hospitals. Many previous studies were also subject to limitations, including a failure to include medical professionals other than physicians and a broad range of relatives. There was also a failure to control for regional differences in the supply of healthcare providers.¹⁷

Unlike other countries that enforce gatekeeping in primary care, the National Health Insurance (NHI) in Taiwan is a single-payer system with free choice of providers for all enrollees. This allows patients to receive healthcare from any type of provider without the need for a referral. Healthcare in Taiwan is highly accessible; however, patients favour treatment at large hospitals (even for mild diseases), and this has been blamed for inefficiencies in healthcare utilisation.²³ This raises the question of whether medical professionals and their relatives (ie, informed consumers) also favour large providers for elective treatments.

In this study, we used the population-based NHI database of Taiwan to examine the preferences of medical professionals, their relatives and the general population in the choice of healthcare provider (in terms of size) for

elective treatments. We also compared the two groups in terms of the prevalence of re-admission or reoperation within a period of 14 days after discharge. This could shed light on important issues, such as the influence of health literacy and expert opinions on the utilisation and efficiency of healthcare delivery. Ordinary patients are widely blamed for inefficiencies in healthcare utilisation due to their lack of information pertaining to the care appropriate to their condition. It should be possible to adopt the choices made by medical professionals as a standard to determine whether the criticisms aimed at the general populace are justified.

METHODS

Data and study population

This study used a combination of data from two cohorts: the National Health Insurance Database of Taiwan 2005 (Longitudinal Health Insurance Database 2005) and 2010 (Longitudinal Health Insurance Database 2010). Each of the cohort data gave us access to all of the original claims data, pertaining to ambulatory and inpatient care for every case between 1 January 2003 and 31 December 2013, of 1 000 000 beneficiaries (a random sample) enrolled in 2005 or 2010. The combination of data provided a cohort that is representative of the general population including 1 959 927 (7.63%) of the 25.68 million NHI enrollees. No significant differences were identified between the patients, between the two cohorts and the general population in terms of gender, age or average monthly income.²⁴ The identities of the patients, physicians and hospitals were all encrypted using the same encryption algorithm to enable the cross-linking of data, while ensuring the protection of privacy. The medical personnel registry (PER file) was used to determine whether any of the patients was a physician or medical professional. We also used the National Health Insurance Enrolment file within the NHID to identify the socioeconomic status of patients (ie, level of income). For unemployed patients, the income of the insured spouse or relative was used.

This study included all patients who underwent childbirth (including vaginal delivery and caesarean section) or cataract surgery between 1 January 2004 and 31 December 2013, and who filed a claim with the NHI. Childbirth and cataract surgery were selected for this study because these two procedures are common in medical practice, they are elective/non-emergent and they can be delivered by small community hospitals, which are not necessarily equipped with high-tech or expensive equipment. Excluded were patients who were under 20 or over 100 years of age, those who received the care before receiving certification as a medical professional, and patients whose enrollment records were omitted. Patients who received treatment were not reported in this database or who paid for their treatment out-of-pocket were also excluded.

Setting

The NHI programme was initiated in Taiwan in 1995. The NHI is financed through a combination of premiums and taxes. The NHI provides universal access to healthcare and comprehensive benefits, including inpatient and ambulatory care, dental services, traditional Chinese medicine therapy, surgery, examinations, laboratory tests, prescribed medications, nursing care, hospital accommodation, preventive services and some over-the-counter (OTC) drugs.²⁵

Under the NHI, patients are expected to make copayments; however, mechanisms are in place to ensure that everyone has access to healthcare.²⁶ The provision of healthcare under the NHI is essentially a public-private partnership. In 2013, the private sector provided 71.6% of the total number of hospital beds.²⁷ Based on statistics published by the Administration of NHI, Yip *et al* reported that in 2014, 70% of the total outpatient visits in Taiwan were delivered by private clinics, 8% by public hospitals, 7% by for-profit hospitals, 14% by not-for-profit hospitals and 1% by public clinics. Approximately 48% of all hospital admissions were at not-for-profit hospitals, 19% were at for-profit hospitals and 31% were at public hospitals.²⁸

Study variables

Outcome variables

The primary outcome of this study is whether patient received treatment at a medical centre. Four types of healthcare providers were offering these two elective treatments: medical centres, regional hospitals, community hospitals (also known as 'district hospitals') and local clinics. The classification of healthcare providers was based on the results of hospital accreditation and based on their contracts with the National Health Insurance Administration (NHIA). We also compared the rate of 14-day re-admission (childbirth) and 14-day reoperation (cataract surgery) after discharge between these groups. Our rationale in comparing the rates of 14-day re-admission and 14-day reoperation after discharge was the fact that previous studies identified quality of care as a critical factor in the selection of healthcare providers.²⁹⁻³¹ Other studies used re-admission and reoperation as measures of quality in cases of child birth^{32 33} and cataract surgery.^{34 35}

Explanatory variables

Linking an 11-year NHI Enrolment file with the medical PER enabled the classification of patients into seven groups, based on whether they were medical professionals or relatives of medical professionals. The types of medical professional analysed in this study included physicians, nurses and other medical professionals (pharmacists, dentists and physical therapists). A relative or spouse of medical professional was defined as an individual enrolled in the NHI as (1) a relative or spouse of a medical professional (identified by linking data from the medical PER and the NHI Enrolment file) or (2) a medical professional who was previously enrolled in the

NHI as a relative (eg, when the medical professional was a child). In these cases, the enrollees (eg, parents of medical professionals) were identified as relatives of the medical professional. Identifying the parents made it possible to identify the siblings of the medical professional. The same approach was used to identify as relatives the siblings and spouses of the relatives of medical professionals (ie, distant relations).

Covariates

Our multivariable analyses controlled for age, gender, monthly income, comorbidity and year of treatment. The monthly salary-based income of patients (or the insured) was categorised into three classes: less than NT\$20 000 (US\$667), NT\$20 000–39 999 (US\$667–1334) and more than NT\$40 000 (US\$1334). For patients who were an unemployed spouse or relative, data of the insured individual were used. This study used the International Classification of Diseases (ICD) codes reported by Quan *et al*³⁶ to determine whether the patient was diagnosed with comorbidities included in the Elixhauser's index.³⁷ Morbidity was based on any diagnosis associated with an inpatient claim or any diagnosis that appeared on at least two outpatient claims listed among the insurance claims of a patient in the year prior to admission. All morbidity groups were treated as dichotomous variables. The geographic region (city/county) of healthcare providers was also used for matching patients.

Statistical analysis

To take into account that medical professionals and their relatives would likely be in a high socioeconomic class with greater access to large hospitals than were the general population, we performed greedy nearest neighbour matching to create a cohort of matched patients with similar characteristics.^{38 39} We calculated propensity scores to estimate the probability of each patient being treated at a medical centre on the basis of sex (except in the model for childbirth), age, comorbidities, monthly income, geographic region (city/county) and year of admission. We then grouped patients who were medical professionals (or their relatives) with up to two patients from the general population (1:2 match).

This study used multiple logistic regression to examine the ORs of undergoing elective surgery at a medical centre. Multiple logistic regression was also used to examine differences among healthcare providers in terms of the incidence of re-admission or reoperation within 14 days after discharge. Patient characteristics that might affect the choice of healthcare provider were matched and controlled for as covariates in multivariable logistic analysis. The level of statistical significance was set at $p < 0.05$. All statistical operations were performed using SAS V.9.4 (SAS Institution).

Patient and public involvement

No patients or members of the public were involved in the design or implementation of this study. Patients and

the general public will be informed of the study results via peer-reviewed journals.

RESULTS

Between 1 January 2004 and 31 December 2013, the number of patients who underwent childbirth or cataract surgery were, respectively, 172 477 and 125 573, as determined using NHI data. From this number, we excluded those who could not be linked to the NHI Enrolment data ($n=1645$, 0.6%), those under 20 or over 100 years old ($n=3036$, 1.0%) and patients who underwent childbirth or underwent cataract surgery before receiving certification as a medical professional ($n=1904$, 0.6%). [Tables 1](#) and [2](#), respectively, list the baseline characteristics of patients before and after matching. Prior to matching, the non-medical professionals admitted to a hospital for childbirth tended to be younger with lower monthly income and were less likely to be admitted to a medical centre, compared with medical professionals and their relatives. Non-medical professionals who underwent cataract surgery tended to be older with lower monthly income and were less likely to be treated at a medical centre.

After matching medical professionals and their relatives with non-medical professionals, the study cohort included 35 784 patients who underwent childbirth (including 8839 medical professionals and 3089 relatives) and 7941 patients who underwent cataract surgery (including 489 medical professionals and 2158 relatives) during the observation period. No significant differences were observed between the groups of medical professionals/relatives and the matched general population in terms of age and most comorbidities, except for complicated hypertension ($p=0.027$ in cataract surgery), peptic ulcer ($p=0.034$ in cataract surgery), chronic pulmonary disease ($p<0.001$ in childbirth) and rheumatoid arthritis/collagen vascular disease ($p=0.029$ in childbirth). Monthly income in the group of medical professionals/relatives was still significantly higher than that of the general population; however, the difference was reduced greatly after matching.

As shown in [table 1](#), 3666 (30.73%) medical professionals or their relatives and 5449 (22.84%) non-medical professionals underwent childbirth at medical centres. Among patients who underwent cataract surgery, 690 (26.07%) medical professionals/relatives and 1336 (25.24%) non-medical professionals received treatment at medical centres ([table 2](#)). Compared with non-medical professionals, a significantly higher proportion of medical professionals/relatives underwent childbirth or cataract surgery at medical centres ($p<0.001$ and 0.027, respectively).

Patient background and inclination towards large hospitals

As shown in [table 2](#), bivariate analysis revealed that a higher proportion of medical professionals and their relatives were treated at medical centres (except for the

relatives of nurses), compared with the general population. [Figure 1](#) summarises the results of two logistic regression models used to analyse the effect of patient background on receiving treatment at medical centres. Our results show that after controlling for age, gender (included in the model for cataract surgery only), income, comorbidity and year of receiving treatment, medical professionals/relatives were more likely to favour medical centres more than were the general population. Patients who were physicians were the most likely to undergo childbirth at a medical centre (OR 5.26, 95% CI 3.96 to 6.97, $p<0.001$), followed by physicians' relatives (OR 2.68, 95% CI 2.20 to 3.25, $p<0.001$). Nurses, other medical professionals and relatives of other medical professionals were also more likely to undergo childbirth at a medical centre (OR 1.27–1.54, all p values <0.001). Nonetheless, we did not observe a significant difference between the relatives of nurses and the general population in terms of preference for medical centres.

Patients who were physicians (OR 1.63, 95% CI 1.21 to 2.19, $p<0.01$) or their relatives (OR 1.43, 95% CI 1.13 to 1.81, $p<0.01$) were more likely to undergo cataract surgery at a medical centre. Among all of the medical professionals, nurses were presented the highest OR against receiving cataract surgery at a medical centre (OR 1.70, 95% CI 1.15 to 2.51, $p<0.01$). Conversely, the relatives of nurses were less likely to receive cataract surgery at a medical centre than were members of the general population (OR 0.75, 95% CI 0.64 to 0.88, $p<0.001$). However, we did not observe a significant difference among individuals in other medical professions, their relatives or the general population in terms of preference for medical centres.

We observed a large number of medical professionals who underwent treatment at healthcare facilities that were larger than the ones at which they worked (eg, physicians working at a community hospital but undergoing cataract surgery at a medical centre). As shown in [figure 2](#), the proportions of professionals who underwent childbirth at a healthcare facility larger than the one at which they worked were as follows: physicians (44.8%), nurses (30.2%) and other medical professionals (43.2%). Conversely, the proportions of professionals who underwent childbirth at a healthcare facility smaller than the one at which they worked were as follows: physicians (7.8%), nurses (16.9%) and other medical professionals (13.5%). Correspondingly, a large proportion of physicians (49.0%), nurses (41.9%) and other medical professionals (35.3%) chose to undergo cataract surgery at a healthcare facility larger than the one at which they worked, while less than 14% went to a healthcare facility smaller than the one at which they worked.

Difference in treatment outcomes among patients and healthcare providers

We did not observe a significant difference in the 14-day re-admission after discharge across patient groups, or the type of healthcare provider. [Table 3](#) shows that the

Table 1 Baseline characteristics of total cases and matched cases of childbirth

Characteristics	Medical professionals and relatives	General population			
	General population	All cases		Matched Cases	
	(N=11 928)	(N =155 217)	P value	(n=23 856)	P value
	n (%)	n (%)		N (%)	
Characteristics					
Age, mean (SD), year	30.70 (3.81)	30.29 (4.63)	<0.001	30.75 (3.94)	0.220
Income, NT\$, mean (SD)	36864.8 (21 189.0)	27492.0 (18 046.0)	<0.001	35294.0 (19 521.2)	<0.001
Background					
Physician	241 (0.67%)				
Physician's relative	442 (1.24%)				
Nurse	7244 (20.24%)				
Nurse's relative	1874 (5.24%)				
Other medical professional	1354 (3.78%)				
Other medical professionals' relative	773 (2.16%)				
Type of healthcare provider					
Medical centre (large)	3666 (30.73%)	27342 (17.62%)	<0.001	5449 (22.84%)	<0.001
Regional hospital (medium)	3853 (32.30%)	41114 (26.49%)		6778 (28.41%)	
Community hospital (small)	2386 (20.00%)	39393 (25.38%)		5938 (24.89%)	
Clinic	2023 (16.96%)	47368 (30.52%)		5691 (23.86%)	
Comorbidity					
Congestive heart failure	0 (0.00%)	33 (0.02%)	0.111	2 (0.01%)	0.556
Cardiac arrhythmias	55 (0.46%)	491 (0.32%)	0.008	84 (0.35%)	0.118
Valvular disease	33 (0.28%)	419 (0.27%)	0.892	49 (0.21%)	0.184
Pulmonary circulation disorders	0 (0.00%)	9 (0.01%)	0.406	0 (0.00%)	
Peripheral vascular disorders	0 (0.00%)	22 (0.01%)	0.194	5 (0.02%)	0.177
Hypertension, uncomplicated	69 (0.58%)	874 (0.56%)	0.829	144 (0.60%)	0.771
Hypertension, complicated	8 (0.07%)	186 (0.12%)	0.103	26 (0.11%)	0.225
Paralysis	5 (0.04%)	50 (0.03%)	0.573	6 (0.03%)	0.523
Other neurological disorders	15 (0.13%)	207 (0.13%)	0.826	32 (0.13%)	0.837
Chronic pulmonary disease	218 (1.83%)	2037 (1.31%)	<0.001	314 (1.32%)	0.000
Diabetes, uncomplicated	97 (0.81%)	1177 (0.76%)	0.506	211 (0.88%)	0.492
Diabetes, complicated	11 (0.09%)	133 (0.09%)	0.815	26 (0.11%)	0.642
Hypothyroidism	66 (0.55%)	883 (0.57%)	0.828	124 (0.52%)	0.681
Renal failure	3 (0.03%)	42 (0.03%)	0.903	7 (0.03%)	1.000
Liver disease	39 (0.33%)	344 (0.22%)	0.020	60 (0.25%)	0.200
Peptic ulcer disease excluding bleeding	121 (1.01%)	1298 (0.84%)	0.041	204 (0.86%)	0.134
AIDS/HIV	0 (0.00%)	14 (0.01%)	0.300	1 (0.00%)	1.000
Lymphoma	0 (0.00%)	12 (0.01%)	0.337	1 (0.00%)	1.000
Metastatic cancer	2 (0.02%)	8 (0.01%)	0.114	3 (0.01%)	1.000
Solid tumour without metastasis	21 (0.18%)	282 (0.18%)	0.889	41 (0.17%)	0.928
Rheumatoid arthritis/collagen vascular diseases	93 (0.78%)	717 (0.46%)	<0.001	139 (0.58%)	0.029
Coagulopathy	14 (0.12%)	138 (0.09%)	0.320	28 (0.12%)	1.000
Obesity	11 (0.09%)	85 (0.05%)	0.100	13 (0.05%)	0.194
Weight loss	19 (0.16%)	413 (0.27%)	0.027	43 (0.18%)	0.653

Continued

Table 1 Continued

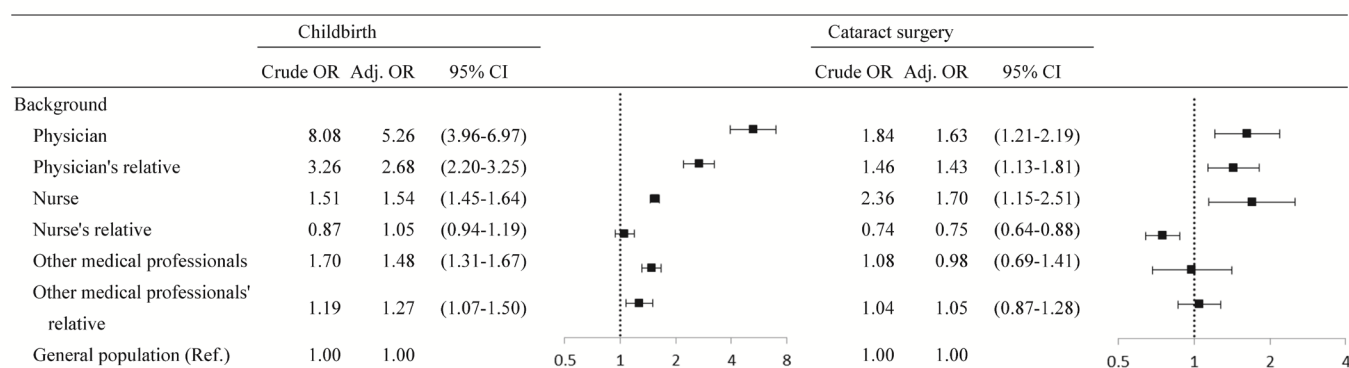
	Medical professionals and relatives General population		General population		
	(N=11928)		All cases (N =155217)	Matched Cases (n=23856)	
	n (%)	n (%)	P value	N (%)	P value
Fluid and electrolyte disorder	31 (0.26%)	236 (0.15%)	0.005	39 (0.16%)	0.052
Blood loss anaemia	33 (0.28%)	203 (0.13%)	<0.001	46 (0.19%)	0.111
Deficiency anaemia	99 (0.83%)	1062 (0.68%)	0.065	164 (0.69%)	0.137
Alcohol abuse	1 (0.01%)	40 (0.03%)	0.243	3 (0.01%)	1.000
Drug abuse	0 (0.00%)	36 (0.02%)	0.110	1 (0.00%)	1.000
Psychoses	14 (0.12%)	142 (0.09%)	0.372	20 (0.08%)	0.332
Depression	73 (0.61%)	826 (0.53%)	0.251	110 (0.46%)	0.059

14-day readmission rates after childbirth were between 0.23% and 0.57%, regardless of the type of healthcare provider. The crude (unadjusted) 14-day readmission rates after childbirth were higher among patients who received care at regional hospitals, compared with those who attended medical centres, community hospitals and clinics. However, the results of multiple logistic regression revealed no significant difference in the probability of readmission within 14 days after childbirth between medical professionals/relatives and those in the general population, after controlling for patients' age, gender, income, comorbidity and year of receiving treatment. We also failed to observe any difference among medical centres, regional hospitals, community hospitals or clinics in terms of 14-day readmission rates after childbirth. The 14-day reoperation rates after cataract surgery were between 0.79% and 5.74%. Multiple logistic regression revealed that regional hospitals, community hospitals and clinics had higher 14-day reoperation rates after cataract surgery (OR 4.75, 3.34 and 7.15, respectively), compared with medical centres. However, multiple logistic regression revealed no significant difference between medical professionals/relatives and those in the

general population in terms of the probability of reoperation within 14 days after cataract surgery.

DISCUSSION

In this study, we explored the difference among medical professionals, their relatives and the general population in their choice of healthcare provider in terms of size. Multiple logistic regression analysis revealed that medical professionals/relatives appear to have a more pronounced preference for medical centres than do patients in the general population. The result of bivariate analysis revealed that 30.2%–49.0% of medical professionals received treatment at healthcare facilities larger than the ones at which they worked, whereas only 7.8%–16.9% of medical professionals were treated at institutions smaller than the one at which they worked. We observed no significant difference in 14-day readmission rates after childbirth, across patient groups or type of healthcare facility. We observed no significant difference in 14-day reoperation rates after cataract surgery across patient groups; however, patients who underwent cataract surgery at medical centres were less likely than



Note: Adj. OR: adjusted odds ratio; Ref: reference group

Both models were controlled for age, monthly income, comorbidity, and year of treatment. The model of cataract surgery was also controlled for gender.

Figure 1 OR of receiving care at a medical centre: medical professional, their relatives and the general population.

Table 2 Baseline characteristics of total cases and matched cases of cataract surgery

Characteristics	Medical professionals and relatives	General population		P value	P value	
	(N=2647)	All Cases (N=1 21 673)	Matched cases (N=5294)			
	n (%)	n (%)	n (%)			
Age, mean (SD), year	68.0 (11.13)	69.7 (10.1)		<0.001	68.6 (10.98)	0.011
Gender						
Male	1288 (48.66%)	53905 (44.30%)		<0.001	2519 (47.58%)	0.365
Female	1359 (51.34%)	67768 (55.70%)			2775 (52.42%)	
Income, NT\$, mean (SD)	37213.4 (32 223.8)	22914.5 (20 812.5)		<0.001	30215.3 (28 590.1)	<0.001
Background						
Physician	209 (2.63%)					
Physician's relative	361 (4.55%)					
Nurse	115 (1.45%)					
Nurse's relative	1193 (15.02%)					
Other medical professional	165 (2.08%)					
Other medical professionals' relative	604 (7.61%)					
Type of healthcare provider						
Medical centre (large)	690 (26.07%)	22672 (18.63%)		<0.001	1336 (25.24%)	0.027
Regional hospital (medium)	416 (15.72%)	18387 (15.11%)			803 (15.17%)	
Community hospital (small)	123 (4.65%)	9205 (7.57%)			333 (6.29%)	
Clinic	1418 (53.57%)	71 409 (58.69%)			2822 (53.31%)	
Comorbidity						
Congestive heart failure	129 (4.87%)	6730 (5.53%)		0.143	296 (5.59%)	0.180
Cardiac arrhythmias	188 (7.10%)	8137 (6.69%)		0.398	366 (6.91%)	0.755
Valvular disease	81 (3.06%)	3605 (2.96%)		0.771	162 (3.06%)	1.000
Pulmonary circulation disorders	8 (0.30%)	319 (0.26%)		0.691	19 (0.36%)	0.683
Peripheral vascular disorders	60 (2.27%)	2800 (2.30%)		0.907	122 (2.30%)	0.916
Hypertension, uncomplicated	1043 (39.40%)	50 741 (41.70%)		0.018	2166 (40.91%)	0.196
Hypertension, complicated	402 (15.19%)	20 449 (16.81%)		0.027	907 (17.13%)	0.028
Paralysis	32 (1.21%)	969 (0.80%)		0.019	50 (0.94%)	0.272
Other neurological disorders	71 (2.68%)	2952 (2.43%)		0.397	135 (2.55%)	0.727
Chronic pulmonary disease	297 (11.22%)	15 858 (13.03%)		0.006	653 (12.33%)	0.149
Diabetes, uncomplicated	561 (21.19%)	28 176 (23.16%)		0.018	1194 (22.55%)	0.169
Diabetes, complicated	270 (10.20%)	13 626 (11.20%)		0.107	597 (11.28%)	0.147
Hypothyroidism	34 (1.28%)	1294 (1.06%)		0.274	65 (1.23%)	0.830
Renal failure	129 (4.87%)	6280 (5.16%)		0.508	303 (5.72%)	0.115
Liver disease	56 (2.12%)	3318 (2.73%)		0.056	117 (2.21%)	0.786
Peptic ulcer disease excluding bleeding	224 (8.46%)	13 094 (10.76%)		0.000	526 (9.94%)	0.034
AIDS/HIV	0 (0.000%)	30 (0.02%)		0.419	0 (0.00%)	
Lymphoma	11 (0.42%)	249 (0.20%)		0.019	21 (0.40%)	0.900
Metastatic cancer	11 (0.42%)	467 (0.38%)		0.794	22 (0.42%)	1.000
Solid tumour without metastasis	151 (5.70%)	6287 (5.17%)		0.217	302 (5.70%)	1.000
Rheumatoid arthritis/collagen vascular diseases	93 (3.51%)	4524 (3.72%)		0.582	197 (3.72%)	0.642

Continued

Table 2 Continued

	Medical professionals and relatives		General population		
	(N=2647)	n (%)	All Cases (N=1 21 673)	P value	Matched cases (N=5294)
			n (%)		n (%)
Coagulopathy	6 (0.23%)	379 (0.31%)	0.437	18 (0.34%)	0.386
Obesity	8 (0.30%)	259 (0.21%)	0.326	11 (0.21%)	0.417
Weight loss	4 (0.15%)	473 (0.39%)	0.050	15 (0.28%)	0.256
Fluid and electrolyte disorders	32 (1.21%)	2053 (1.69%)	0.058	84 (1.59%)	0.186
Blood loss anaemia	11 (0.42%)	417 (0.34%)	0.527	22 (0.42%)	1.000
Deficiency anaemia	24 (0.91%)	1104 (0.91%)	0.997	55 (1.04%)	0.576
Alcohol abuse	8 (0.30%)	587 (0.48%)	0.184	14 (0.26%)	0.763
Drug abuse	2 (0.08%)	35 (0.03%)	0.167	4 (0.08%)	1.000
Psychoses	6 (0.23%)	710 (0.58%)	0.016	18 (0.34%)	0.386
Depression	117 (4.42%)	4795 (3.94%)	0.211	216 (4.08%)	0.508

those treated in other facilities to undergo reoperation. To the best of our knowledge, this is the first study to use matched samples derived from national representative data to investigate differences among medical professionals, their relatives and the general population in the choice of healthcare provider for elective treatment.

Patients in Taiwan present a strong preference for large hospitals, with the result that larger institutions are almost constantly operating at full capacity.^{40 41} This preference could be due to any number of factors. First, there are no gatekeepers under the NHI; that is, patients can be treated by any provider they choose.²³ Second, co-payment schemes are inexpensive,^{26 41} such that there is no financial incentive for patients to select a smaller hospital over a medical centre. Third, large hospitals are more likely to use sophisticated radiological instruments and pharmaceuticals, due to global budget payments of the NHI.⁴² Cheng *et al* found that patients tend to base their judgement of hospital quality on medical equipment,

technical competence or medications, and many patients believe that smaller institutions cannot compete with larger facilities on these terms.⁴³ Finally, a preference for larger facilities may be due to the fact that hospitals (with a larger service volume) are associated with better outcomes.⁴⁴

We discovered that medical professionals/relatives tended to undergo childbirth or cataract surgery in medical centres. After matching and controlling for baseline characteristics in logistic regression models, there remained an inclination towards medical centres. Our findings are similar to those of Chou *et al*, who reported that a higher proportion of physicians and their relatives (75.9% and 48.6%, respectively) underwent childbirth in medical centres, whereas only 16.7% of the general population selected medical centres for childbirth. Chou *et al* pointed out that compared with the general population, physicians may have greater access to medical information on which to base their decisions.¹⁷ Other studies also reported that medical professionals (informed consumers) differ from the general population in their patterns of healthcare utilisation. Chinn *et al* explored the preferences of physicians for hospice enrollment in cases of terminal illness. In a survey of physicians who treated cancer patients, more than 80% of the respondents reported they would enrol or consider enrolling at a hospice if they were terminally ill.⁴⁵ However, based on Medicare Fee-for-Service claims data, Matlock *et al* found that in the USA, physicians were more likely to opt for hospice care or treatment in an ICU or CCU in their last 6 months of life.²² Liou *et al* explored whether medical professionals were more likely to be prescribed brand-name oral hypoglycaemic agents (OHA) for diabetes than were non-medical professionals. They found that pharmacists and physicians had the highest ORs of being prescribed brand-name OHA.⁴⁶ Huang *et al* reported that children with nasopharyngitis (common colds),

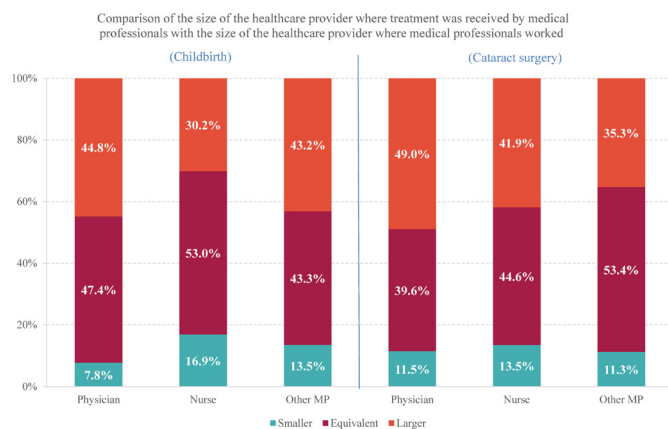


Figure 2 Comparison of the size of the healthcare provider where treatment was received by medical professionals with the size of the healthcare provider where medical professionals worked.

Table 3 Crude rate and OR of 14-day readmission and 14-day reoperation: medical professional, their relatives and general population

Characteristics	Childbirth (14-day readmission)			Cataract surgery (14-day reoperation)		
	Rate (%)	Adj. OR	95% CI	Rate (%)	Adj. OR	95% CI
Background						
Physician	0.41	1.08	(0.15 to 7.99)	5.74	1.76	(0.93 to 3.34)
Physician's relative	0.23	0.66	(0.09 to 4.81)	4.16	1.25	(0.72 to 2.18)
Nurse	0.57	1.45	(0.99 to 2.13)	1.74	0.63	(0.15 to 6.67)
Nurse's relative	0.43	1.18	(0.56 to 2.45)	4.11	1.03	(0.74 to 1.44)
Other medical professionals	0.30	0.86	(0.31 to 2.35)	4.24	1.01	(0.46 to 2.23)
Other medical professionals' relative	0.26	0.81	(0.20 to 3.31)	3.64	0.97	(0.61 to 1.53)
General population (Ref.)	0.35	1.00		3.48	1.00	
Type of Hospital						
Medical centre (large) (Ref.)	0.43	1.00		0.79	1.00	
Regional hospital (medium)	0.54	1.22	(0.80 to 1.86)	3.26	4.75	(2.63 to 8.58)***
Community hospital (small)	0.30	0.71	(0.42 to 1.20)	2.20	3.34	(1.49 to 7.48)**
Clinic	0.26	0.64	(0.36 to 1.11)	5.31	7.15	(4.27 to 11.98)***

p<0.01; *p<0.001.

Both models were controlled for age, monthly income, comorbidity and year of treatment. The model of cataract surgery was also controlled for gender.

Adj. OR, adjusted OR; Rate, unadjusted (crude) 14-day readmission rate; Ref., reference group.

upper respiratory infections or bronchitis were less likely to receive antibiotic prescriptions if their parents were physicians, pharmacists or nurses.¹⁹ Carrera and Skipper reported that Danish physicians were more likely than the general population to use brand name drugs to treat chronic conditions.⁴⁷ These findings suggest that medical professionals, who possess profound knowledge pertaining to the risks and benefits of various treatment regimes, would make rational clinical decisions. Nonetheless, medical professionals are still subject to receiving unnecessary or low-value treatments.²²

We observed inconsistencies between healthcare providers and outcomes after discharge. These findings contradict several previous studies that reported quality of care as a critical factor in the selection of a healthcare provider. Aggarwal *et al* conducted a systematic review of factors associated with patient mobility (ie, bypassing the nearest healthcare facility) for elective services in countries that allow patient to select their healthcare provider. They found that patients were more likely to move to providers of higher perceived quality or those offering more advanced technologies.²⁹ Lavery *et al* surveyed 1033 patients in England who were offered a choice of hospital for elective treatment in order to identify the factors influencing a patient's choice. In that study, 93.3% of the total respondents identified quality of care as the most important issue, outweighing cleanliness (92.6%) and reputation (80.3%).³⁰ Using data from all Dutch hospitals between 2008 and 2010, Beukers *et al* examined factors associated with hospital choice for non-emergency hip replacement. They identified hospital quality ratings as the second most important factor (after travel time) determining a

patient's choice of facility.³¹ Our failure to observe a significant difference in 14-day readmission among healthcare providers may be due to the fact that unlike hospital admissions for severe ailments (eg, heart failure or acute myocardial infarction), re-admission following childbirth is rare, thereby making it impossible to differentiate between healthcare providers.⁴⁸ Janakiraman *et al* reported that women receiving care from obstetricians in the lowest quartile of provider volume (fewer than seven deliveries per year) had a 50% higher likelihood of complications, compared with women receiving care from obstetricians in the highest quartile. They also reported that individual complications occur more frequently among providers with the lowest volumes.⁴⁹ Kozhimannil *et al* found that low service volume was a risk factor for postpartum haemorrhage in rural as well as urban non-teaching hospitals.⁵⁰ However, a recent study by Clapp *et al* revealed that facilities with lower service volumes were unstable for analysis. Therefore, they concluded that postpartum readmission rates do not necessarily provide an accurate reflection of obstetrical care quality.⁴⁸ Another plausible reason for this result is that the means by which patients select a healthcare provider was not affected solely by the outcomes of care but rather by a variety of factors.⁵¹ Medical professionals/relatives may select a provider based on factors other than expected outcome, such as capability to respond to an emergency, physician-patient communication and/or access to advanced technologies. Advocates of patient choice in the selection of a provider claim that allowing patients to select their own treatment provider puts pressure on healthcare providers to deliver better quality of care.⁵²

In this study, we found that the relatives of medical professionals are also more likely to receive care at a medical centre. This is a clear indication that patients with access to expert opinions and medical knowledge are more likely than the general population to favour large hospitals. Previous studies reported that patients judge a hospital based on the perceived quality of care, their previous experience with that hospital or recommendations from family or friends.^{30 43 53} Our findings suggest that as non-medical professionals become more fully informed, the demand for care from large hospitals will increase, thereby exacerbating inefficiencies in the overall healthcare system. This finding also supports the assertion that it is unfair to blame ordinary patients for inefficiencies in healthcare utilisation, based on the fact that one's inclination towards large hospitals is more likely to be a thoughtful decision based on medical insights.

Another concern is that pre-existing inequalities in socioeconomic status may have an impact on patients' access to information, with corresponding effects on the choices of provider.^{3 54} Robertson and Burge identified a social gradient in the selection of non-local hospitals. They pointed out that patients from lower socioeconomic groups may lack contacts and/or specialised knowledge by which to select an alternative provider. They also pointed out that those patients may be unable to make an informed comparison between hospitals based on performance.⁵⁵ Kronebusch *et al* reported that poorly informed patients (eg, minorities) find it difficult to identify higher-quality hospitals and therefore rely on convenience and local referral patterns, which leads them to hospitals of lower quality.⁵⁶ Madathil *et al* reported that patients with a lower level of education are more likely to use inaccurate information from the internet to guide their selection of healthcare providers.⁵⁷ Other studies highlighted the use of quality information by patients in order to make informed choices.^{58 59} To overcome potential inequities in patient treatment choices, interventions should be implemented to ensure the availability of reliable information related to the quality of care delivered by specific providers and guide patients to make decisions based on the meaningful use of this information.

This study has several limitations. First, patients who were not medical professionals/relatives may still have had interpersonal connections with individuals working in the healthcare sector. Second, the determination of whether a patient was a medical professional/relative was based on NHI Enrolment files and data from medical PER; however, the spouse of a medical professional who was employed throughout the entire period of observation would enrol in the NHI independently. This would lead to the misclassification of this type of patient within the general population. These two factors would lead to an under-estimation of the difference between medical professionals/relatives and the general population in terms of a preference for medical centres. Third, the only information in NHI claims data related to the socioeconomic background of patients was monthly income, thereby precluding the inclusion of other socioeconomic factors, such as education, marital

status, non-salary income, in our analysis. Previous studies reported that physician-patient relationships, occupation, education, marital status and healthcare resources within residential areas could affect the choices made by patients in terms of healthcare provider.^{12 54 60} Future researchers should make an effort to take these factors into account. Another limitation was the fact that income was determined by monthly, salary-based figures. The administration of the NHI has established a ceiling for the highest income group in the determination of premiums. This means that the income values used for matching and statistical controls may be biased, particularly for extremely high-income earners and employees who received bonuses as a major part of their income. The preference for large hospitals among medical professionals and their relatives may be due to the unique characteristics of the NHI system in Taiwan, particularly in terms of low copayments and free access to any healthcare provider. These unique characteristics may limit the generalisability of our findings to other countries.

CONCLUSIONS

This study identified a preference for large hospitals among medical professionals and their relatives. We also found that a high proportion of medical professionals received treatment at healthcare facilities larger than the ones at which they worked. We also found that patients who underwent cataract surgery at medical centres were less likely than those who attended regional hospitals, community hospitals or clinics 14-day to require reoperation; however, we did not observe a significant association between the choice of healthcare provider and 14-day readmission after childbirth. These findings suggest that efforts to inform non-medical professionals would increase demand for care from large hospitals. Understanding the reasons for a preferential bias towards larger medical institutions could help to improve the efficiency of healthcare delivery.

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access to them. Researchers who are interested in the data may apply to the Department of Statistics, Ministry of Health and Welfare, Taiwan by contacting Ms Wu Tzu-Hui (stcarolwu@mohw.gov.tw) or Mr Zongying Lin (st-zylin@mohw.gov.tw).

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