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The association between psychiatrist numbers and hospitalization costs for schizophrenia patients: A population-based study ☆

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Abstract

Objective: This study explores the association between psychiatrist case volumes and costs for hospitalized schizophrenia patients.
Methods: The study uses the Taiwan National Health Insurance Research Database for 2003, identifying the study subjects from the database by ICD-9-CM principal diagnosis code 295. Our study sample comprises of 135,621 admissions treated by 787 psychiatrists in 181 hospitals, with the sample being divided equally into three psychiatrist volume groups: ≤300 (low volume), 301–600 (medium volume) and ≥601 admissions (high volume). After adjusting for psychiatrist, patient and hospital characteristics, multiple regression analyses were performed to determine the association between psychiatrist case volume and hospitalization costs (total, drug, and non-drug).
Results: The regression analyses showed that after adjusting for psychiatrist, patient and hospital characteristics, average treatment costs associated with hospitalized schizophrenia patients were inversely related to psychiatrist volume. The respective total costs, drug costs and non-drug costs of patients treated by high-volume psychiatrists were US$369 ($p<0.001$), US$26 ($p<0.001$) and US$343 ($p<0.001$) lower than those of low-volume psychiatrists. The respective total costs, drug costs and non-drug costs for those treated by medium-volume psychiatrists were US$248 ($p<0.001$), US$22 ($p<0.001$) and US$226 ($p<0.001$) lower than those of low-volume psychiatrists.
Conclusions: We find that after adjusting for patient, psychiatrist and hospital characteristics, an inverse volume–cost relationship exists for psychiatrists treating schizophrenia patients. Further studies should aim to investigate the volume-quality relationship to ensure that incremental cost savings associated with increased patient volume are not achieved at the expense of quality of patient care.

Keywords: Schizophrenia; Inpatient psychiatry; Outcome studies

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1. Introduction

Although schizophrenia is estimated to affect no more than 1% of the population at any given time, it is nevertheless amongst the most devastating and persistent diseases known to mankind (Warner and de Girolamo, 1995). Despite other mental disorders being far more prevalent than schizophrenia, the total economic burden of schizophrenia is comparable to the total costs of any other mental disorder (Rice, 1999). In most of the developed countries, current healthcare expenditure on schizophrenia accounts for 1.6% to 2.5% of the total healthcare budget (Davies and Drummond, 1994; Evers and Ament, 1995; Rupp and Keith, 1993). In Taiwan, the total schizophrenia-related healthcare expenditure accounted for 1.2% of the national healthcare budget in 1999, with 75.2% of this expenditure being attributable to hospitalization costs (Lang and Su, 2004).

Since hospitalization costs represent a major proportion of healthcare expenditure in cases of schizophrenia, the need to seek out improvements in the cost-effectiveness of inpatient treatment has become critical (Meltzer, 1999). Most of the prior analyses on cost-effectiveness have tended to focus on economic interests, in terms of the various types of anti-psychotic medication (Jerrell, 2002; Percudani and Barbui, 2003; Rey, 2002;), while other studies have attempted to explore the relationship between the clinical characteristics of treated patients and overall hospitalization costs (Byford et al., 2001; Mirandola et al., 2004; Sevy et al., 2004). However, one recent study has indicated that the differences in costs seem to be more related to the different practice styles applied by the various mental healthcare providers, as opposed to the clinical characteristics of either the patients or the drugs used (Peiro et al., 2004).

The practice styles of healthcare providers and, in particular, the volume of healthcare services provided by hospitals and physicians, have been investigated under various surgical procedures and medical conditions in an effort to determine their association with treatment costs, thereby providing a proxy for potential economies of scale (Gutierrez et al., 1998; Munoz et al., 1990; Shook et al., 1996). However, to our knowledge, no study has yet been undertaken focusing on an examination of the effects of provider case volumes on the cost outcomes for psychiatric disorders; thus, such economic implications have yet to be considered in the field of mental healthcare.

This study therefore sets out to explore the association between psychiatrist case volumes and the costs for hospitalized schizophrenia patients in Taiwan, using a nationwide population-based database. It is felt that the results of this study will have important policy implications for psychiatrists and policymakers alike, in terms of improving the cost-effectiveness of inpatient care for schizophrenia patients.

2. Research methods

2.1. Database

This study uses the National Health Insurance Research Database (NHIRD) for 2003, published at the end of 2004 by the Taiwan National Health Research Institute. The data contained within the NHIRD include a registry of contracted medical facilities, a registry of Board-certified psychiatrists, a monthly claims summary for inpatient claims, details of inpatient orders, and all expenditure on prescriptions dispensed at contracted pharmacies. The NHIRD provides principal operational procedures and one principal diagnostic code from the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM), in conjunction with up to four secondary ICD-9-CM diagnostic codes for each patient.

The NHIRD includes all claims data from the National Health Insurance (NHI) program, which was implemented in Taiwan in March 1995 as a means of financing healthcare for all of the island's citizens (over 23 million). The NHI Bureau contracts with most of the medical institutions in Taiwan, and indeed, since its inception, around 96% of the island's population has joined the program. With the NHI's characteristics of a single-payer payment system and unrestricted access to any mental healthcare provider of the patient's choice, the NHIRD offers a unique opportunity to identify the volume-cost relationship in the area of inpatient care for schizophrenia patients.

2.2. Study sample

The study subjects were identified from the database by principal diagnosis ICD-9-CM code 295

(schizophrenic disorders). Of the 2.8 million inpatient records in the 2003 NHIRD, a total of 136,122 admissions were identified for their principal diagnosis of schizophrenia. In order to limit this study to an adult population, all admissions with patients aged below 18 years ($n=501$) were excluded. Ultimately, our study sample comprised of 135,621 admissions treated by 787 psychiatrists in 181 hospitals.

2.3. Psychiatrist and hospital volume groups

The unique physician and hospital identifier provided by the NHIRD for each medical claim enables us to identify any particular psychiatrist or hospital with at least one admission of a patient principally diagnosed as schizophrenia during 2003. Psychiatrist and hospital volumes were calculated by counting all claims for the principal diagnosis ICD-9-CM code 295 submitted during that year. Since there were no defined psychiatrist and hospital volume thresholds, volume groups were created, in line with the methods used in the prior studies (Birkmeyer et al., 2002; Goodney et al., 2003; Nallamothu et al., 2005). This involved ranking providers in order of increasing volume, and then selecting cutoff points that would most closely sort the 135,621 sampled admissions into three evenly sized groups. The three psychiatrist volume groups were therefore ≤300 (hereafter referred to as low volume), 301–600 (medium volume) and ≥601 admissions (high volume), while the three hospital volume groups were those with a total number of admissions of ≤1100 (low volume), 1101–4000 (medium volume) and ≥4001 admissions (high volume) during the study period.

2.4. Statistical analysis

The SAS statistical package (SAS System for Windows, Version 8.2) was used to perform the statistical analyses. Descriptive analyses including frequency, percentage, mean and standard deviation were performed on all of the identified variables. One-way ANOVA and *t*-test analyses were also conducted to examine the relationship between hospitalization costs and psychiatrist volume groups. Following adjustment for psychiatrist, patient and hospital characteristics, multiple regression analyses were subsequently employed as a means of assessing the independent association between psychiatrist case volume and hospitalization costs.

This study also used the generalized estimating equation (GEE) method to account for potential clustering of the sampled admissions amongst particular psychiatrists. Clustering refers to the likelihood of the outcomes of all of the admissions of one particular provider being similar to one another, as opposed to the outcomes being similar to those of an alternative provider. The primary study outcomes were total costs (including drug costs and non-drug costs), drug costs, and non-drug costs per discharge. The costs per discharge were represented by the monetary value of the medical care claimed by the psychiatrist. All claims submitted to the NHI must show the itemized costs of all services/disposables provided. Costs per discharge represent the aggregate of these itemized costs billed to the NHI.

Psychiatrist characteristics comprised of the age (as a surrogate for practice experience) and gender of the psychiatrists. Hospital characteristics comprised of hospital ownership, hospital level and geographical location. The variable 'hospital ownership' was recorded as one of three types, 'public', 'private not-for-profit' and 'private for-profit'. Hospital levels were classified as medical centers (minimum 500 beds), regional hospitals (minimum 250 beds) or district hospitals (minimum 20 beds). Hospital level can therefore be used as a proxy for hospital size and clinical service capabilities.

Hospital teaching status was not included in the regressions since all medical centers and regional hospitals are teaching hospitals. In addition, given the small number of patients treated in medical centers, and the small number of 'high-volume' hospitals located in southern Taiwan, all of the medical centers and regional hospitals, and those hospitals located in the central, southern and eastern regions of Taiwan, were combined into a single category referred to as 'others' in the regression analyses.

Patient characteristics comprised of age and gender. A two-sided p value of less than, or equal to, 0.05, was considered to be statistically significant.

3. Results

Table 1 describes the distribution of the sampled admissions, by psychiatrist, hospital and patient character-

Table 1
Distribution and mean costs of sampled admissions, by psychiatrist, hospital and patient characteristics[a]

Variables[b]		Totals[c]	%	Total costs (US$)		Drug costs (US$)		Non-drug costs (US$)	
				Mean	SD	Mean	SD	Mean	SD
Psychiatrist volume	≤300	45,426	33.5	1361	1024	115	182	1205	931
	301–600	44,627	32.9	1030	583	101	100	929	543
	≥601	45,568	33.6	880	475	93	87	787	433
Hospital volume	≤1100	44,737	33.0	1260	963	151	181	1109	864
	1101–4000	43,167	31.8	1057	7118	112	107	945	660
	≥4001	47,717	35.2	962	527	88	84	874	494
Patient gender	Male	80,014	59.0	1110	817	115	118	961	665
	Female	55,607	41.0	1077	720	118	152	992	732
Psychiatrist gender	Male	123,012	90.7	1175	759	115	132	1045	700
	Female	12,609	9.3	1082	761	131	138	967	692
Hospital level	Medical center	8646	6.4	1405	1195	182	182	1223	1110
	Regional hospital	66,086	48.7	1147	830	119	145	1028	755
	District hospital	60,889	44.9	984	558	105	104	880	507
Hospital ownership	Public	77,518	57.2	1144	778	120	124	1025	718
	Private not-for-profit	26,723	19.7	1051	856	130	179	921	749
	Private for-profit	31,380	23.1	991	607	97	102	894	557
Hospital location	Northern	52,589	38.8	1074	772	112	144	963	697
	Central	33,433	24.7	1042	713	118	108	925	661
	Southern	37,011	27.3	1113	811	117	133	996	772
	Eastern	12,588	9.3	1222	666	136	142	1086	584

[a] The average exchange rate in 2003 was US$1.00 = NT$ 34.50.
[b] Differences were found for all variables in total costs, drug costs and non-drug costs (in all cases, $p < 0.001$).
[c] Total sample = 135,621.

istics. Of the 135,621 hospitalizations of schizophrenia patients during 2003, 45,426 (33.5%) were in the low-volume psychiatrist group, 44,627 (32.9%) were in the medium-volume group and 45,568 (33.6%) were in the high-volume group. Significant relationships were observed between psychiatrist volume and average total hospitalization costs, drug costs and non-drug costs (all $p < 0.001$), along with discernible downward trends in the average total costs, drug costs, and non-drug costs with an increase in psychiatrist volume. Table 1 also summarizes the average total hospitalization costs, drug costs and non-drug costs by psychiatrist, hospital and patient characteristics.

Table 2 presents the psychiatrist, patient and hospital characteristics according to the psychiatrist case volume of schizophrenia patient admissions. A total of 787 psychiatrists had admitted schizophrenia patients in 2003, with their volumes ranging from 1 to 2072 admissions, giving a mean admission volume per psychiatrist of 173 ± 260 (standard deviation). The mean age of psychiatrists was similar across all volume groups; however, patients in the high-volume group were more likely to be older than their counterparts in other groups.

Table 3 provides the results of the multiple regression analyses, with the three separate analyses each indicating that at least 15% (not shown in the table) of the observed variations in costs per discharge was explained with the help of the independent variables. The regression analyses also consistently revealed that after controlling for psychiatrist, patient and hospital characteristics, there was a significant association between costs per discharge and psychiatrist volume. More specifically, the indication is that for those patients treated by high-volume psychiatrists, the total costs were US$369 lower ($p < 0.001$), drug costs were US$26 lower ($p < 0.001$), and non-drug costs were US$343 lower ($p < 0.001$) than the comparative costs for those patients treated by low-volume psychiatrists. For those patients treated by medium-volume psychiatrists, the respective total costs, drug costs and non-drug costs were again lower, by US$248 ($p < 0.001$), US$22 ($p < 0.001$), and US$226 ($p < 0.001$), than the costs for those patients treated by low-volume psychiatrists.

Given the mean total costs per discharge for schizophrenia patients of US$1629, and the parameter estimate of US$369 for high-volume psychiatrists, after controlling for psychiatrist, patient and hospital characteristics, high-volume psychiatrists demonstrated that, on average, their costs were about 22.7% lower than those of the low-volume psychiatrists. In addition, with the exception of the widening of the confidence intervals, when these results were adjusted

Table 2
Psychiatrist, hospital and patient characteristics in Taiwan, by psychiatrist volume groups, 2003

Variables	Psychiatrist volume group		
	Low (1–300)	Medium (301–600)	High (≥601)
Psychiatrist characteristics (n=787)			
No. of psychiatrist	633	104	50
Mean (SD) of psychiatrist volume	72 (84)	428 (87)	913 (375)
Mean (SD) of psychiatrist age	40.5 (8.0)	40.7 (6.9)	40.7 (5.3)
Psychiatrist gender			
Male: no. (%)	547 (86.3)	92 (88.6)	48 (96.0)
Female: no. (%)	86 (13.7)	12 (11.4)	2 (4.0)
Patient characteristics (n=135,621)			
No. of patients	45,426	44,627	45,568
Mean (SD) of patient age	39.3 (11.9)	41.9 (11.4)	43.6 (11.3)
Patient gender			
Male: no. (%)	26,054 (57.4)	27,399 (61.4)	26,561 (58.3)
Female: no. (%)	19,372 (42.6)	17,228 (38.6)	19,007 (41.7)
Hospital characteristics (n=181)			
No. of hospitals	150	21	10
Hospital level			
Medical center: no. (%)	16 (10.7)	1 (4.8)	– –
Regional hospital: no. (%)	70 (46.7)	2 (9.5)	3. (30.0)
District hospital: no. (%)	64 (42.7)	18 (85.7)	7 (70.0)
Hospital ownership			
Public: no. (%)	57 (38.0)	6 (28.6)	3 (30.0)
Private not-for-profit: no. (%)	47 (31.3)	3 (14.3)	2 (20.0)
Private for-profit: no. (%)	46 (30.7)	12 (57.1)	5 (50.0)
Hospital location			
Northern: no. (%)	55 (36.7)	11 (52.4)	3 (30.0)
Central: no. (%)	38 (25.3)	2 (9.2)	5 (50.0)
Southern: no. (%)	49 (32.7)	8 (38.1)	– –
Eastern: no. (%)	8 (5.3)	– –	2 (20.0)

for clustering effects under the GEE method, all of the significant relationships remained.

4. Discussion

After adjusting for patient, psychiatrist and hospital characteristics, this study finds that psychiatrists with a lower volume of schizophrenia patient admissions are more likely to incur greater hospitalization costs, either in terms of the total costs, or drug costs. This finding comes in light of the conclusions of the studies undertaken by Munoz et al. (1990) and Shook et al. (1996), which found a significant association between high-volume physicians and lower treatment costs in patients undergoing either oncological operations or percutaneous transluminal coronary angioplasty.

Given that we aim to accurately reflect experience in the field of inpatient care for schizophrenia patients, only the volume of schizophrenia admissions is discussed in this paper; nevertheless, the impact on outcomes from entire case workloads should not be underestimated. With this point in mind, analysis of the relationship between the psychiatrist volume of all admissions, and the overall costs of schizophrenia patient admissions, was undertaken, but this yielded similar results (data not shown).

The majority of volume–outcome studies have simply adopted death as the primary outcome (Halm et al., 2002). Nevertheless, serving as an approximate process measure for the assessment of outcomes of inpatient care, hospitalization costs could be quite informative within the current cost-conscious environment of healthcare provision.

In an effort to explain the volume–outcome relationship in surgical procedures and medical conditions, the mechanisms underlying the association between psychiatrist volume and hospitalization costs

Table 3
Cost regression results[a]

Variables[b]	Total costs B (US$)[c]	Drug costs B (US$)[c]	Non-drug costs B (US$)[c]
Psychiatrist volume			
≤300 (Reference group)	–	–	–
301–600	−248***	−22***	−226***
≥601	−369***	−26***	−343***
Hospital volume			
≤1100 (Reference group)	–	–	–
1101–4000	8	−21***	29***
≥4001	−249***	−68***	−181***
Patient gender			
Female (reference group)	–	–	–
Male	−40***	−5**	−35***
Patient age	–	–	–
Psychiatrist gender			
Female (reference group)	–	–	–
Male	−39***	−8***	−31***
Psychiatrist age	–	–	–
Hospital level			
District hospital (reference group)	–	–	–
Medical center/regional hospital	111***	7***	104***
Hospital ownership			
Private for-profit (reference group)	–	–	–
Public	155***	40***	115***
Private not-for-profit	−19**	28***	−47***
Hospital location			
Others (reference group)	–	–	–
Northern	−81***	−15***	−66***
Intercept	1629***	229***	1400***

[a] The average exchange rate in 2003 was US$1.00=NT$34.50.
[b] Total sample=135,621.
[c] *$p<0.05$; **$p<0.01$; ***$p<0.001$.

for schizophrenia patient admissions can be paralleled to the hypotheses proposed in some of the prior studies (Luft et al., 1987). Under the first hypothesis, that of 'practice makes perfect', it is suggested that a larger volume of admissions will allow providers to develop more cost-effective skills in their inpatient treatment procedures for schizophrenia patients. Meanwhile, there is also the possibility that a larger caseload will encourage providers to adopt more effective inpatient treatment methods in order to reduce the overall length of stay, which may in turn lead to further reductions in total hospitalization costs.

The second hypothesis, 'selective referral', needs to be interpreted in a slightly different way within the unique context of Taiwan's mental healthcare system. Given the island's traditional failure to meet the demand for psychiatric beds, as well as its underdeveloped community psychiatric services (Hwu et al., 1996; Lang and Su, 2004), the 'real-world' practices of hospitals in Taiwan frequently reveal long waiting lists for psychiatric hospitalization. However, since the Taiwanese NHI provides unrestricted access to any of the island's mental healthcare services of the patient's choice, patients would ideally turn to providers with cost-effective inpatient treatment methods. This implies shorter hospital stays, and thus, greater turnover rates, with more beds ultimately becoming available. This 'selective referral' pattern could enhance the 'practice makes perfect' effect and further consolidate the volume–cost relationship with regard to inpatient care for schizophrenia patients.

Alongside these two well-accepted interpretations, there are various other hypotheses relevant to volume–outcome relationships that are also plausible in the field of mental healthcare services. For example, low-volume psychiatrists may be less likely to hospitalize

their schizophrenia patients either because they provide more successful outpatient care or because they adopt more strict criteria for schizophrenia patient admissions. In those cases where there is a need for the hospitalization of schizophrenia patients of low-volume psychiatrists, they may be worse off than patients of high-volume psychiatrists, and may thus incur higher costs. Since hospitalization costs can serve only as an approximate process measure, and since they are not a necessary element in inferring the quality of inpatient care for schizophrenia patients, it is possible that, with an increase in their caseloads, some psychiatrists may omit certain services (which might well be regarded as necessary services); this would have the result of reducing hospitalization costs, but at the cost of compromising the overall quality of care.

This study has also revealed that the proportions of drug costs to total hospitalization costs, currently estimated at around 10%, are similar across both low- and high-volume providers, although this proportion is much higher than the corresponding figures for the developed countries (Goeree et al., 1999; Knapp, 1997). Recent advances in atypical anti-psychotic drugs in these countries have attracted considerable attention, not only for their overall effectiveness, but also with regard to the higher medication costs incurred as a result of their use (Tunis et al., 2004).

The viewpoint in many of the cost-effective studies, is that the total amount of health expenditure associated with atypical anti-psychotic drugs is no higher than that associated with the offsetting of non-drug costs using conventional agents. In our study, however, we can find no evidence to support the notion of such a shift between drug and non-drug costs for similar proportions across different volume groups. This may suggest that for low- to high-volume providers, the patterns of drug use, in terms of conventional and atypical anti-psychotic drugs, are similar. The differences in costs, therefore, may well be related to the practice styles applied by the different volume groups.

This study has also found that on average, the costs for schizophrenia patients admitted to medical centers and regional hospitals are, as expected, higher than those for patients admitted to district hospitals; this can be explained partly by the apparent readiness of medical centers and regional hospitals to receive a relatively higher proportion of patients suffering from more serious illnesses than district hospitals. This was an issue clearly demonstrated in the findings of Horn et al. (1986) and Shanahan et al. (1999), where it was concluded that across different types of hospitals, considerable variability was demonstrated in hospital 'case mix costings'. Samuels et al. (1998) also indicated that 'adverse case mix/severity of illness' was a major contributor to the overall cost variations between different hospitals, since a higher severity of illness would undoubtedly result in a longer hospital stay, and thereby higher costs.

This paper suffers from two limitations which should be addressed. First of all, since our study used a cross-sectional dataset, we have been unable to determine the cause–effect relationship. Further longitudinal studies will therefore be required in order to determine whether psychiatrists with lower treatment costs for schizophrenia patient admissions at the initial time period, would subsequently acquire any greater volume of patients.

Secondly, while there are regulations in place in a number of European countries limiting the number of providers allowed to perform certain procedures – as is the case in some of the individual states of the US – the situation is quite different in Taiwan. Some psychiatrists have only very small schizophrenia caseloads and such small caseloads may prohibit any meaningful statistical comparisons between the individual psychiatrists concerned.

Despite these limitations, this study has found that after adjusting for patient, psychiatrist and hospital characteristics, an inverse volume–cost relationship does exist for psychiatrists in Taiwan treating schizophrenia patients. We suggest that further studies should be undertaken to identify the various differences in treatment approaches between high-volume psychiatrists with low costs, and low-volume psychiatrists with high costs; the results of such studies could help the latter to reduce the average costs of their patient care.

The potential cost savings could be as much as 22.7% of the mean treatment costs amongst low-volume psychiatrists. However, prior to any policy decisions being derived from the finding of this study, we also suggest that studies be undertaken to investigate the relationship between the volume of schizophrenia patients receiving psychiatric treatment, and patient outcomes. We must, however, ensure that the incremental cost savings associated with increased

patient volume are not achieved at the expense of the quality of patient care.

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