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ORIGINAL PAPER

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Is the volume-outcome relationship sustained in psychiatric care?

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■ **Abstract** *Background* Although much prior research has found a consistently positive volume-outcome relationship, there is scanty documentation on this issue in mental healthcare. This study examines the association between a hospitals' psychiatric inpatient volume and 30-day readmission rates. *Methods* Using administrative data from Taiwan's National Health Insurance Research Database for 2003, the likelihood of 30-day readmission is examined relative to the hospital's volume of voluntary psychiatric admissions and total bed-days. *Results* As hospital volume increases, so too does the 30-day readmission rates for patients with schizophrenia, bipolar disorder and major depressive disorders. *Conclusions* The positive volume-outcome relationship in patients suffering from psychiatric disorders suggests a different scenario from the 'practice makes perfect' phenomenon that may underlie the inverse volume-outcome relationship found among most physical disorders, both surgical and medical.

■ **Key words** volume-outcome – mental health – readmission

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Introduction

The relationship between hospital volume and patient outcomes has been of significant interest over recent decades, particularly in the context of possible policies to establish volume-based referral initiatives in certain surgical procedures. This issue has grown in significance since lower mortality rates were found among patients treated at hospitals with higher volumes [11]. A consistently positive impact of increasing case volume on desired patient outcomes is documented for many medical and surgical conditions [6]. Although the initial objective of such studies was to reduce preventable surgical deaths [1, 4], similar relationships have since been uncovered for several medical conditions [5, 14–18].

Druss et al. [3] have reported that lower volume of mental healthcare services by providers is associated with poor mental healthcare quality performance. Their finding is thus in line with the familiar volume outcome association documented in the literature for medical and surgical conditions. However, they analyzed plan-level case volume, as opposed to hospital-level volume; this leaves open the question of confounding between hospitals, because the service provision is at the level of hospital, which is the level at which quality performance actually varies. Druss et al. also did not differentiate by mental health diagnosis, and the association may likely vary by diagnoses, as seen in previous studies [5]. Using a population-based dataset on Taiwan, this study examined the relationship between hospitals' psychiatric inpatient volume and the 30-day readmission rates for patients with mental disorders.

Methods

■ Database

This study uses administrative claims data for 2003 from Taiwan's National Health Insurance Research Database (NHIRD), which

covers every medical encounter of its 21-plus million citizens (about 96% of its population). With the NHI's characteristics of a single-payer system and unrestricted access to any mental healthcare provider of the patient's choice, this database offers a unique opportunity to explore the volume-outcome relationship in mental healthcare.

Since the study used secondary data without patient, institution, or physician identifiers, the Ethics Committee of the authors' institution granted waiver of informed consent for the study.

Study sample

Claims data on 77,106 consecutive voluntary psychiatric admissions to 128 hospitals during 2003 was extracted, after excluding judicially ordered admissions, about 8% of all admissions (since the latter are not covered under NHI, and therefore, do not have detailed information on diagnosis, treatment and outcomes in the claims database). It is unlikely that these compulsory admissions could confound the findings, because of their relatively small number. The index hospitalization was defined as the patient's first psychiatric admission during the study period.

Patients aged below 18 years were excluded (n = 570). Those who expired during the index hospitalization (n = 20), discharged against medical advice (n = 2642), or transferred to another hospital after the index hospitalization (n = 809) were also excluded so that a reasonable window of opportunity was allowed for all patients to return to hospital. The eligible sample comprised of a total of 31,528 patients.

Volume measures

Two volume indicators at hospital-level are used; the total number of psychiatric admissions and the total number of psychiatric inpatient days. Hospital-level, rather than physician-level volume measures were selected because of the need for interdisciplinary teamwork in mental healthcare.

Consistent with the documented method of patient classification by the hospital's volume [1, 5], we rank ordered hospitals in ascending order of psychiatric inpatient volume, and defined three volume groups by selecting cutoff points such that the total sample got divided into three equal (or almost equal) groups.

Outcome measure

The primary outcome measure was the 30-day readmission likelihood (to any hospital), readmission within 30 days of discharge after the index hospitalization. The unit of analysis was the patient.

Statistical analysis

The SAS statistical package was used for analysis. Adjusting for length of stay for the index hospitalization, patient's age and gender, and hospital characteristics, (hospital ownership, level, teaching status and geographical location), multivariate logistic regressions were carried out to assess associations between the patient's hospital volume category and 30-day readmission likelihood for schizophrenia, bipolar disorder, major depressive disorders, and the combined sample. The generalized estimated equation (GEE) method was also employed to account for clustering of sample patients within hospitals. A two-sided p value of 0.05 was used to determine statistical significance.

Results

Of the total sample, 9,050 (28.7%) patients were readmitted to a hospital within 30 days of discharge, with schizophrenia showing the highest 30-day readmission rate (37.6%), and major depressive disorders, the lowest rate (16.6%). The vast majority of the hospitals fell into the low-volume group (Table 1).

Table 1 Psychiatric patient characteristics, distributed by hospital volume, 2003

Psychiatric disorder	Total no. of hospitals	Total no. of patients	Age (Years)		Male gender (%)
			Mean	S.D.	
Volume groups by total number of psychiatric admissions					
Schizophrenia (n = 14,548)					
Low	85	5,465	38	12	58
Medium	26	5,383	38	12	56
High	11	3,700	38	12	59
Bipolar disorder (n = 4,472)					
Low	80	1,492	40	13	46
Medium	25	1,687	40	14	52
High	10	1,293	37	14	54
Major depressive disorder (n = 4,119)					
Low	80	1,544	43	16	44
Medium	25	1,500	42	18	49
High	10	1,075	38	18	60
Total (n = 31,528)					
Low	91	11,197	41	15	56
Medium	26	11,351	41	16	58
High	11	8,980	37	15	64
Volume groups by total number of psychiatric inpatient days					
Schizophrenia (n = 14,548)					
Low	83	5,286	38	12	57
Medium	26	5,062	39	12	58
High	13	4,200	38	12	57
Bipolar disorder (n = 4,472)					
Low	79	1,551	40	14	46
Medium	25	1,164	40	14	47
High	11	1,757	38	14	57
Major depressive disorder (n = 4,119)					
Low	79	1,679	44	16	41
Medium	25	1,388	42	18	51
High	11	1,052	37	17	62
Total (n = 31,528)					
Low	89	11,420	41	15	55
Medium	26	11,023	40	17	61
High	13	9,085	38	15	61

Crude odds ratios for 30-day readmission rates, by volume groups, both number of admissions and number of inpatient days, are provided in Table 2.

Except for patients with major depressive disorders, across all other categories, patients admitted to low-volume hospitals had significantly lower 30-day readmission rates than those admitted to medium or high-volume hospitals. With increasing hospital volume, 30-day readmission likelihood for schizophrenia patients increases, as also bipolar disorder and major depressive disorders (Table 3). When these results are adjusted for cluster effects (using GEE), there is a widening of confidence intervals, but the significance of the relationships are unchanged.

Discussion

Using a large, population-based dataset, we find that, hospital volume of voluntary psychiatric admissions

Table 2 Crude odds ratios (OR) of 30-day readmission likelihood for psychiatric patients, by hospital volume groups, 2003

Psychiatric disorder	Hospital volume (No. of admissions)		
	Low (1–615)	Medium (616–1699)	High (≥1700)
Volume groups by total number of psychiatric admissions			
Schizophrenia (n = 14,548)			
Readmission%	28.6	32.1	58.7
OR	1.0	1.2	3.6
95% CI	–	(1.1–1.3)	(3.3–3.9)
Bipolar disorder (n = 4,472)			
Readmission%	15.4	22.2	45.0
OR	1.0	1.6	4.5
95% CI	–	(1.3–1.9)	(3.8–5.4)
Major depressive disorder (n = 4,119)			
Readmission%	11.1	12.4	30.1
OR	1.0	1.1	3.5
95% CI	–	(0.9–1.4)	(2.8–4.3)
Total (n = 31,528)			
Readmission%	20.8	24.5	43.8
OR	1.0	1.2	3.0
95% CI	–	(1.2–1.3)	(2.8–3.2)
Volume groups by total number of inpatient days			
Schizophrenia (n = 14,548)			
Readmission%	26.9	33.5	55.8
OR	1.0	1.4	3.5
95% CI	–	(1.3–1.5)	(3.2–3.8)
Bipolar disorder (n = 4,472)			
Readmission%	15.1	17.6	42.5
OR	1.0	1.2	4.2
95% CI	–	(1.0–1.5)	(3.5–4.9)
Major depressive disorder (n = 4,119)			
Readmission%	12.1	10.9	21.0
OR	1.0	0.9	3.3
95% CI	–	(0.7–1.1)	(2.7–4.0)
Total (n = 31,528)			
Readmission%	19.7	23.7	45.9
OR	1.0	1.3	3.5
95% CI	–	(1.2–1.3)	(3.3–3.7)

Table 3 Adjusted odds ratios (AOR) for 30-day readmission likelihood for psychiatric disorders, by hospital volume groups, 2003

Psychiatric disorder	Hospital volume (No. of admissions)		
	Low (1–615)	Medium (616–1699)	High (≥1700)
Volume groups by total number of psychiatric admissions			
Schizophrenia (n = 14,548)			
AOR*	1.00	1.36	4.41
95% CI	–	(1.24–1.49)	(3.95–4.92)
Bipolar disorder (n = 4,472)			
AOR*	1.00	1.59	8.61
95% CI	–	(1.27–1.98)	(6.67–11.11)
Major depressive disorder (n = 4,119)			
AOR*	1.00	1.64	4.75
95% CI	–	(1.27–2.12)	(3.55–6.36)
Total (n = 31,528)			
AOR*	1.00	1.55	4.55
95% CI	–	(1.44–1.67)	(4.19–4.94)
Volume groups by total number of inpatient days			
Schizophrenia (n = 14,548)			
AOR*	1.00	1.61	4.10
95% CI	–	(1.46–1.76)	(3.67–4.57)
Bipolar disorder (n = 4,472)			
AOR*	1.00	1.48	6.87
95% CI	–	(1.16–1.89)	(5.27–8.96)
Major depressive disorder (n = 4,119)			
AOR*	1.00	0.99	4.06
95% CI	–	(0.76–1.29)	(3.03–5.43)
Total (n = 31,528)			
AOR*	1.00	1.57	4.45
95% CI	–	(1.46–1.69)	(4.09–4.83)

Note: *Adjusted for patient's age and gender, length of stay of the index hospitalization, hospital ownership, hospital level, hospital teaching status and geographical location

has a positive correlation with 30-day readmission rates for patients with schizophrenia, bipolar disorder and major depressive disorders, and the magnitude of the association increases after adjusting for hospital and patient characteristics.

Our results may reflect differences in the quality of psychiatric inpatient care, as indicated by 30-day readmission likelihood, even when volume is measured by two different volume measures. Also we find consistent results across psychiatric diagnoses. These findings are in contrast to the existing surgical and medical literature [6]. It is unlikely that the discrepancy can be explained by differences in healthcare delivery systems between Taiwan and western country health systems. This is because our findings from the Taiwan setting regarding surgical conditions are consistent with the international literature [8, 10, 19, 21]. Our findings contradict the only other study of volume outcome relationships in mental healthcare, which however was at the health plan level [3], and open to confounding. Our study may be indicative of different predictors of outcome for psychiatric inpatient care relative to surgical and medical condition outcomes.

The notion that 'practice makes perfect' is often cited to explain the positive impact of volume on outcomes [12]. According to this hypothesis, high-volume providers are more likely to achieve better clinical outcomes, because increasing experience facilitates better clinical judgment and skills, as well as better planned treatment protocols conforming to practice guidelines and recommendations.

However, it is possible to argue that practice may not make perfect, in disease conditions where standard treatments available so far have variable and far from desirable level of impact on patient outcomes. This is particularly true of mental health care, in which the recommended evidence-based methods of treatment drawn from randomized clinical trials may not be highly effective in curing the patient [23]. Psychiatric disorders tend to make for clinically complex patients, who need significant psychosocial intervention in addition to pharmacologic treatment. Unfortunately, as technology-driven costs of care for physical (medical and surgical) ailments skyrockets, policy-makers' tendency has been to tighten budgets for mental health care, causing policy makers to cut down on the "soft" elements of treatment that cannot be easily quantified, such as psychosocial rehabilita-

tion. This has led to the current trend towards over-emphasizing pharmacological treatment, while overlooking psychosocial interventions, which may further compromise the integration of patients into society when discharged, causing readmission to be the only option for both the patient's family and the physician.

A recent survey found that only a small proportion of psychiatric patients had any access to psychosocial interventions [20]. Meanwhile, there is an additional possibility that large caseloads may encourage providers to adopt more cost-saving treatment methods, as noted in our previous study [9]. Hospital administrators may perceive a clear potential for incremental cost savings at the expense of the quality of patient care when treating increased patient volumes.

Two study limitations should be highlighted. First of all, although readmission rates are often used as an indicator of outcomes in mental health [2, 7, 22], it is still moot whether readmission represents a valid outcome measure in this field [13]. Moreover, readmission rates of hospitals may reflect general admission policies, and thus, higher readmission rates may be reflecting higher frequency of inappropriate admissions, rather than poor care quality during the antecedent episode of admission.

Secondly, sophisticated risk adjustment, including severity of the mental illness at admission, is not possible to accomplish based on administrative data. Clearly, the excess risk of readmission could be attributed to differences in case mix. Further studies should be aiming to control for the case mix so that differences in outcomes related to differences in treatment can be distinguished from the role of case mix differences across hospitals.

Despite these limitations, this study has found an inverse volume-outcome relationship for those hospitals admitting patients with schizophrenia, bipolar disorder and major depressive disorders. Although it may well be true that 'practice does make perfect', the study may be showing that only 'perfect practice makes perfect'.

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