

Causes of Unplanned Readmission within 14 Days – A Preliminary Study

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The rate of readmission to the hospital within 14 days after previous discharge is an indicator of a hospital's health care quality. We retrospectively studied 400 unplanned readmissions occurring within 14 days of index discharge over a one-year period from 1 January to 31 December 1999. Our readmission rate for all admissions was 3.4%. The most common causes for patients' readmitted to the hospital were disease factors (63.25%) and unrelated new diagnoses (28.5%). We also found males (56.5%) and the elderly (≥ 65 years old, 48.25%) were prone to readmission. The three leading diagnosis accounting for readmission were hepatobiliary and pancreatic diseases (12%), chronic lung disease (11.25%) and urinary tract disease (10%). In addition, the two most prominent ICD-9 code categories of unplanned readmissions that distinguished from all admissions were treatment complications and neoplasm. Having an established readmission baseline, we should create a computerized automatic alert monitoring system to assist physicians. The system would alert them to the need for a more cautious or efficient approach in their medical practice as well as reducing readmission rates and inpatients' expenditures during admission.

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INTRODUCTION

Early readmission has been recognized

as an indicator of medical treatment quality^[1,2]. Anderson and Steinberg (1984) demonstrated that 22% of Medicare

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hospitalizations were followed by readmission within 60 days, and that the cost of these readmissions accounted for 24% of total Medicare inpatient expenditures^[3]. Recent trends in health care delivery have been increasing interest and heightened awareness of the care quality and economic considerations relating to readmissions on the part of physicians, health care administrators, and governments^[4]. Reports show most preventable readmissions occurring early, within one month of discharge, therefore this time interval has been recommended for comparative studies^[4]. According to the Taiwan National Health Insurance (NHI) payment regulations, when a patient is admitted to the same hospital within 14 days of previous discharge for the same disease (same International Classification of Diseases 9th Edition [ICD-9-CM] code), the number of admission days need to be totaled. These two individual admissions are then considered part of the same treatment course^[5]. Although hospital accreditation in Taiwan uses readmissions within a 14-day period as an indicator of medical care quality, few studies comparing all admissions and 14-day readmission rates in Taiwan have been published^[6,7]. This study intends to evaluate potential risk factors that affect readmission rates within 14 days of previous discharge. We identify factors that may be modified or improved through systematic intervention to reduce the possibility of early readmission.

MATERIALS AND METHODS

This study was conducted at a 450-bed regional teaching hospital in Tao-Yuan, Taiwan. Using the hospital computer system, we identified all patients readmitted within 14 days of discharge who were released from the hospital between January 1 and December 31, 1999. After excluding planned readmissions, which were defined as pre-arranged admissions after discharge, the rest were defined as unplanned readmissions.

Data collection included basic demographic variables such as age, sex, marital status and insurance. The chief complaints at admission and the diagnoses, according to the ICD-9-CM codes were also collected. The authors reviewed each readmitted patient's chart to identify potential risk factors in one of four categories: (1)medical error, defined as misdiagnosis, lack of diagnosis or inappropriate treatment; (2)disease factors, defined as reasonable expectation of symptoms recurring, failing to improve, or worsening, or adverse effects from treatment that could be reasonably anticipated; (3)unrelated new diagnoses, defined as newly diagnosed medical problems unrelated to the prior admission; (4)patient-related factors, defined as patients leaving against doctors' advice, requested discharge or poor drug compliance^[8,9]. The process of reviewing and sorting was done collaboratively with discussions to resolve differences among reviewers.

All data were directly entered into a

computer with Microsoft Excel-2000 and applied SPSS-10 software. The leading diagnoses were ranked by the percentage of readmissions in relation to all admissions. Differences in categorical variables were analyzed by chi-square test with the appropriate degrees of freedom. $p < 0.05$ was considered statistically significant.

RESULTS

During the one-year study period, there were 13,579 admissions to the hospital. Four hundred and seventy six readmissions were found in the hospital computer log and 15 cases attributed to logging errors were excluded. A total of 461 readmissions represented an overall readmission rate of

3.4% for the one-year period. Of these, 400 (2.95%) were unplanned readmissions within 14 days of previous discharge (Table 1). The ratio of males to females for unplanned readmissions was 1.3:1, and the ratio for all admissions was 0.87:1 ($p=0.000$). Grouped by age, the readmission rate for patients of <18, 18-39, 40-64 and ≥ 65 years old were 0.91%, 1.28%, 5.03% and 6.67% ($p=0.000$), respectively. It seemed that males and elders (≥ 65) were more susceptible to readmission. The trend toward increasing readmission was not proportional to the age groupings for all 13,579 admissions, however the readmission rate gradually increased in an age-dependent fashion. Married patients showed a higher readmission rate (4.85%) than non-married

Table 1. Demographic Characteristics and Readmission Rate of the Patients

	Readmissions (n=400)	All Admissions (n=13,579)	Readmission rate (%)
Age*			
<18	40 (10.00%)	4,411 (32.48%)	0.91
18-39	51 (12.75%)	3,970 (29.24%)	1.28
40-64	116 (29.00%)	2,306 (16.98%)	5.03
≥ 65	193 (48.25%)	2,892 (21.30%)	6.67
Sex*			
Male	226 (56.50%)	6,299 (46.39%)	5.59
Female	174 (43.50%)	7,280 (53.61%)	2.41
Marital status*			
Married	206 (51.50%)	4,248 (31.28%)	4.85
Single	130 (32.50%)	6,649 (48.97%)	1.96
Unknown	64 (16.00%)	2,682 (19.75%)	2.39
Insurance			
Health insurance	400 (100.00%)	10,747 (79.14%)	3.72
Without insurance	0 (0.00%)	2,832 (20.86%)	0.00

* $p=0.000$

patients. All 400 readmitted patients were covered by national health insurance (NHI) while patients without NHI accounted for 20.86% of all admissions.

Of the 400 unplanned readmissions, the most common causes were disease factors (63.25%) and unrelated new diagnoses (28.5%). Medical errors and patient-related factors accounted for 2.5% and 5.75%, respectively (Table 2). Regardless of whether the readmitted patients were over

or under age 65, disease factors accounted for significantly higher readmission rates (55.96% and 70.05%, respectively) than the other three causes ($p=0.022$). Although there were no statistical differences, unrelated new diagnoses in those over 65 accounted for 35.23% of readmissions whereas this accounted for only 22.22% of readmitted patients under the age of 65. Additionally, there were no significant differences by gender and marital status for the four classified factors (Table 3).

As regards average number of diagnoses after discharge, readmissions (4.21) showed significant differences when compared with all admissions (2.25). Table 4 lists the leading diagnoses for unplanned readmissions and for all admissions by ICD-9 code. Hepatobiliary and pancreatic diseases (12%), chronic pulmonary disease (11.25%), and urinary tract disease

Table 2. The Causes of Unplanned Readmissions

Categories	No (n=400)	%
Medical error	10	2.5
Disease factor	253	63.25
Unrelated new diagnosis	114	28.5
Patient factors	23	5.75

Table 3. Analysis of Different Categories of Unplanned Readmissions by Age, Gender or Marital Status

Variable	Medical Error	Disease factor	Unrelated New Diagnosis	Patient Factors
Age*				
≥65	6 (3.11%)	108 (55.96%)	68 (35.23%)	11 (5.70%)
<65	4 (1.93%)	145 (70.05%)	46 (22.22%)	12 (5.80%)
Gender				
Male	6 (3.4%)	111 (63.8%)	48 (27.6%)	9 (5.2%)
Female	4 (1.8%)	142 (62.8%)	66 (29.2%)	14 (6.2%)
Marital Status				
Married	5 (2.4%)	125 (60.7%)	62 (30.1%)	14 (6.8%)
Single	3 (2.3%)	89 (68.5%)	31 (23.8%)	7 (5.4%)

* $p=0.022$

Table 4. Top Nine Leading Diagnoses of Unplanned Readmissions

ICD-9 code	Readmissions (n=400)	All Admissions (n=13,579)	Readmissions/ All Admissions
Complications of treatment (996-999)	24 (6.00%)	67 (0.49%)	35.82%
Neoplasm (150-199)	22 (5.50%)	177 (1.30%)	12.43%
Hepatobiliary / Pancreatic disease (570-579)	48 (12.00%)	567 (4.18%)	8.47%
Chronic lung disease (490-519)	45 (11.25%)	741 (5.46%)	6.07%
Diabetes mellitus (250-251)	15 (3.75%)	253 (1.86%)	5.93%
Peptic ulcer disease (530-537)	22 (5.50%)	389 (2.86%)	5.66%
Urinary tract disease (590-599)	40 (10.00%)	856 (6.30%)	4.67%
Cardiovascular disease (393-429)	24 (6.00%)	540 (3.98%)	4.44%
Pneumonia (480-487)	22 (5.50%)	549 (4.04%)	4.01%

(10%) were the most common diagnoses among the 400 readmitted patients. On the other hand, The rate of readmissions to all admissions for complications from treatment and for neoplasms were 35.8% and 12.4% respectively.

DISCUSSION

Readmission rate is one of the major tools for measuring health care outcomes. Monitoring the numbers of readmissions is a simple process, depending on the availability of database resources. To examine and report actual reasons for readmissions allows insights for improving specifics of patient care.

Our readmission rate to all admissions was 3.4%. Compared with other studies adopting 14~15 days as the interval defining readmission, the ratio of readmissions to all admissions in Fan's, Tsai's and Ludke's studies was 7.75%, 3.22% and 6.61%, respectively^[6,7,10]. The readmission rate for

all patients receiving discharge planning services in Yan's and Chang's studies was 4.93% and 5.7%, respectively^[11,12]. The much higher proportion of admitted obstetric and pediatric patients (32.48% of all our admissions with the lowest readmission rate of 0.91% for all pediatric admissions, Table 1) could be a contributing factor to this result, since age has been regarded as an important factor in readmission^[3,13-18]. Our data demonstrated significantly higher readmission rate (6.67%, $p=0.000$) for the elderly. It was different from Yang's and Chang's studies from discharge planning service to readmission, which had more younger patients^[11,12]. Although pediatric patients comprised the greatest number of readmissions in Tsai's study, the study was conducted before implementation of the NHI^[7]. The hospital in question was a religiously-affiliated one with a well-developed pastoral (social) service department and home health care provided by the Family Medicine Department. These

might be other factors accounting for the relatively lower readmission rate, since inpatient care (such as discharge planning services), home health care, as well as support and education for caregivers, have been regarded as important factors affecting readmission^[1,2,12,14,17,19-21].

Our study showed no readmission for patients without NHI coverage (Table 1). As a result, NHI beneficiaries had an absolutely higher readmission rate than patients without coverage, consistent with Frankl's, Tsai's & Wong's reports^[4,7,22]. It seems that health care insurance is an important factor for readmitted patients because insurance can alleviate patients' economic burden while offering the same medical service. Although Ludke's study reported no significant differences by marital status^[10], our data showed married patients had a significantly higher readmission rate (4.85%, $p=0.000$), but their age distribution might account for this, as most married patients were elderly (48.25%). This study also demonstrated significantly higher readmission rates for males (5.59%, $p=0.000$), consistent with Billings' and Kossovsky's studies, but not with Fan's report^[6,16,23].

Among the four categories we evaluated for this study, disease factors (63.25%) were the main cause of unplanned readmissions. This result was similar to many studies^[6,12,14,24]. However, it played a less important role for readmitted patients over 65 than for younger patients (55.96% vs. 70.05%). Unrelated new diagnoses (28.5%) were the secondary cause of unplanned readmissions. The proportion of

unrelated new diagnoses was greater among elder readmissions than for those below (35.23% vs. 22.22%). Although results were not statistically significant ($p=0.22$), they demonstrated that elderly patients were susceptible to various diseases. Au's study showed the majority of elderly required readmission because of medical problems which could not be entirely prevented in light of multiple chronic illnesses^[25]. Therefore, general medicine including multi-subspecialty training is particularly important for geriatrics.

Among the 400 unplanned readmissions, the top three leading diagnoses were hepatobiliary disease, chronic pulmonary disease and urinary tract disease. These results differ from other studies' findings that chronic obstructive pulmonary disease^[11,13,14,17,26], congestive heart failure^[17,26] and diabetes mellitus^[14] were the major causes of hospital readmission rates. In addition, the two most prominent ICD-9 codes in the ratio of unplanned readmissions to all admissions were complication of treatment and neoplasm. These results are similar to Chang's & Fan's studies^[6,12].

As for patient-related factors, Benbassat & Taragin reviewed the literature on hospital readmissions and showed that 12% to 75% of all readmissions can be prevented by patient education, pre-discharge assessment, and domiciliary aftercare^[14]. Lerman et al demonstrated that 15% of their hospital's readmissions could have been avoided by better patient education^[27]. Maccantonio et al also reported that among the elderly, lack of documented patient or family education

was one of the factors independently associated with unplanned readmissions^[19]. Furthermore, effective strategies should include regular home visiting by public health care nurses and/or medical personnel to optimize medication management, the usage of home monitoring, and to intensify medical follow-up and education by medical personnel^[12,20,21]. Education is urgently important for patients with poor drug compliance, for those who leave against a doctor's advice or who ask for discharge. Additionally, early discharge with incomplete treatment is believed to be associated with the deterioration of clinical conditions^[26]. In this study, four of 23 patients classified as readmitted due to patient-related factors were readmitted after a previous request for transferring to another hospital but failed to be accepted, because of no available bed or due to other personal reasons. These situations occurred rarely after the study hospital developed strong coordination with another medical center in the Tao-Yuan area.

As for medical errors, including misdiagnosis, lack of diagnosis or inappropriate treatment, these reduce the hospital's quality of care and reputation. In this study, we had ten such cases (2.5% of all readmissions). In these cases, the patients may have been sicker than originally thought or the physicians recognized that their initial management approach was erroneous.

One of the major limitations of this study is that we could not identify how many of our patients visited other hospitals within

14 days of discharge, rather than returning to this one. Moreover, retrospective reviews do not allow differentiation between the natural course of disease, inadequate patient communication, sub-optimal therapy, and an overanxious patient. Further studies are needed to determine whether we should change our discharge criteria, treatment strategies, or recognize these readmissions as acceptable, and to focus on those diseases with higher readmission rates, using in-depth exploration to establish effective preventive strategies that fit for our community.

A second limitation is the classification of readmission factors; although the classifications were followed by references, it seemed too simple to be an applicable approach for hospital administrators trying to manage these problems. Also, our data collected by chart review could not be verified by doctors at the scene. Lastly, while sorting into categories, we didn't measure the percentage of agreement among the reviewers, which may make the classification system less objective. Future studies should classify the factors in greater detail, such as changing or unchanging disease factors. This approach may provide more understanding of the phenomena and produce more applicable strategies to improve the care quality.

This was a preliminary, retrospective and descriptive study. Despite several limitations, we have tried to identify factors in patients readmitted within 14 days. Our study methods differed significantly from that in the published

literature. Ludke et al pointed out that using computerized medical record discharge abstract systems, readmitted patients can be easily identified^[10]. Having an established readmission baseline, we could refine the auditing process by creating an automatic, computerized alert system to assist physicians, signaling them to take a more cautious and faster medical approach with certain patients in order to reduce the readmission rate and inpatients' consequent expenditures.

In conclusion, we suggest that patients with high-risk factors, such as males, elders, those likely to experience complications from treatment, and those with neoplasms, hepatobiliary disease and chronic pulmonary diseases are most likely to be readmitted within 14 days of discharge. Several detailed methods of evaluation and discharge planning have been recommended^[13,17,19,20]. Using this baseline study, more detailed analysis of the readmission causes may identify inadequate clinical, educational, and psychological needs. Interventions consisting of augmenting clinical expertise and patient education are known to affect the readmission rate. Furthermore, close follow-up, home monitoring, medication adjustment, and regular communication with clinical experts may improve clinical outcomes and decrease the readmission rate.

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十四天內非計畫性再入院原因初探

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十四天內非計畫性再住院率為醫療品質監測指標中結果面的指標之一。本研究針對某區域醫院自1999年一月一日至十二月三十一日一年期間，400位十四天內非計畫性再住院病患進行統計分析。整體再住院率為3.4%，病患再住院原因中最常見者為疾病因素（63.25%）以及新發生之疾病診斷（28.5%）；研究結果亦發現男性（56.5%）及大於65歲之年長者（48.25%）較易發生再住院；再住院者中以肝膽疾病（12%）、慢性肺部疾病（11.25%）及泌尿道疾病（10%）較多；在所有住院案例中，依ICD-9診斷碼歸類後，相對於整體住院案例，十四天內非計畫性再住院病患以治療的併發症及惡性腫瘤兩者之再入院率為最高。在建立對病人再住院原因的了解後，未來可利用電腦資訊工具建構自動化的監測系統，協助醫師對相關病患之處置更為迅速而嚴謹，進而降低病人再住院率及相關醫療支出。

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