Hospital readmissions – are they predictable and avoidable?

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Summary

Questions under study: In the context of limited resources in the healthcare system, factors that can be used as indicators for the effective use of diagnostic and therapeutic management of patients are of interest. The rate of hospital readmission (RA) is a potentially important parameter of quality in hospital care. In the present preliminary study, our aim was to measure the rate of readmissions, and to qualify the readmissions as avoidable or not.

Principles/Methods: We performed this pilot study at the Department of Internal Medicine (DIM) of the Kantonsspital Winterthur (KSW). Between March 1st. and May 31st 1998 all patients admitted to our hospital were included in the study. Each patient was followed up for a period of 90 days after discharge. RA was classified as planned, unplanned, avoidable or unavoidable. Only the first RA of a patient was investigated. RAs were divided into those occurring within 30 and those occurring within 90 days of discharge.

Results: 884 index admissions (IA) were recorded. 83 patients (9.4%) died and 28 (3.2%) were referred to another clinic in the KSW. These 111 patients were excluded from the analysis. 773 (87.4%) patients were discharged from the DIM and are taken as 100% for the sake of calculation of the rates of RA. 95 (12.3%) RAs occurred within 30 days, 68 (8.8%, 95%-CI 6.8–10.8) of these being RAs related to the IA. 27 (3.5%) had no relation to the IA. 36 (4.7%) of these 68 RAs were planned and 32 (4.1%) were unplanned. Three unplanned RAs (0.4%) were considered to have been avoidable.

When the observation period was extended to 90 days, 151 (19.5%) RAs occurred. 100 (12.9%) of the RAs were related to the IA. Of these 100 RAs 46 (5.9%) were planned and 54 (7.0%) were unplanned. Of these 54 RAs 10 (1.3%) were considered to have been avoidable.

The highest rate of RAs occurred within the first 10 days of discharge, followed by a substantial decrease in RAs over the next 20 days and a constant low rate over the next 60 days. Unplanned RAs occurred in 59.3% within the first 30 days. Patients admitted on a Friday had the longest length of stay (LOS) in hospital and those admitted on a Sunday, the shortest.

Conclusions: The present pilot study indicates that RA should be monitored regularly. Most RAs occurred within 30 days of discharge. Extension of the observation period to 90 days did not change the overall conclusions.

Key words: rehospitalisation; readmission; outcome; quality; treatment

Introduction

The rate and the cause of readmission to hospital (RA) have become important parameters in health care systems because they may be a reflection of the quality of treatment and an indicator of health costs [1, 2]. Hospital admissions are responsible for a significant share of the costs in the health care system, thus a reduction in the length of stay (LOS) and of RAs may save considerable amounts of health care expenses. The average LOS has decreased substantially over the last few years [3] and in general we have reliable data on the development of LOS. In contrast, only little is known about the occurrence and the causes of RA.

When planning the present pilot study, we encountered problems finding relevant publications dealing with RA. In various papers only specific diseases [2–6] or specific age groups [4, 5] were investigated. We have chosen a more general approach and have included all patients over the age of 18 years admitted to hospital. Although this general approach makes the interpretation of the results more difficult, the overall rate of RAs in a department of general internal medicine is of significant importance and a reflection of the whole patient population. Furthermore, this helps to identify specific diseases with a high risk of RA

and thus may enable us to improve the management of these patients in the future. However, the index hospital admission was of necessity that to the Department of Internal Medicine of the Kantonsspital Winterthur (KSW).

A comparison between the rates of RA may be difficult because of different definitions of RA. In the literature we found a wide scatter between 4 and 29 percent of the rate of RA [1–3, 7, 8]. A further problem is that RA to another hospital and patients dying outside the hospital are difficult to monitor, which can lead to a systematic error as mentioned in the literature [2].

The rate of RA may be directly linked to the quality of treatment, thus RA may be an indicator of the quality of the management of disease. In a former metaanalysis [9] no strong correlation between the index hospitalisation and the diagnosis at RA was found. Many confounding factors have to be taken into consideration, such as co-morbidity, progression of disease, non-compliance, disability and handicap. RA is therefore an uncertain indicator of the quality of in-hospital management of disease, in particular when treatment and management of the patients outside the hospital cannot be controlled.

Methods

The study was performed in the Department of Internal Medicine (DIM) at the KSW between March 1st and May 31st 1998, i.e. covering 90 days. The DIM has 158 beds in general internal medicine including all medical specialities such as cardiology (with interventional cardiology), nephrology (with haemodialysis) etc. The hospital serves an area of 200,000 inhabitants in the northeastern part of the canton of Zürich (Switzerland) and includes both urban and rural communities. More than 4000 patients are admitted to the DIM every year.

Study aims

Primarily, we aimed at assessing the rate of RA. Furthermore, we have tried to classify each RA as planned or unplanned and as avoidable or unavoidable. The main investigator (PPM) classified all readmissions as avoidable or not. If he felt uncertain in his judgment, he presented the case to an experienced senior clinician (PEB). Secondary aims were to define the causes of RA, and to assess

the correlation between primary diagnosis and diagnosis at RA.

Definitions

Index hospital admission (IA): first hospital admission to the DIM between March 1st and May 31st 1998

Readmission (RA): readmission to any clinic of the KSW within 30 and 90 days (see below)

"True" RA: main diagnosis in IA and RA are identical or a direct relation between the diagnoses exists as assessed by the investigators

"False" RA: completely different main diagnosis, no relation between IA and RA

Planned RA: diagnostic or therapeutic measures planned, i.e. chemotherapy or coronary angiography

Unplanned RA: no additional diagnostic or therapeutic measures planned

Avoidable: see Table 1

Unavoidable: see Table 1

The interval of 30 days (RA-30) between discharge and readmission is a common parameter used for RA as described in several studies [1, 2, 8–11]. We have extended the observation period to 90 days, i.e. RA-90.

Study design

Prospective study of all patients admitted to the DIM between March 1st and May 31st 1998. All patients were followed up for 3 months after discharge. Only the first RA was assessed, further RAs were not included in the analyses.

Disease was classified according to ICD-10 by professional independent specialists. Data were collected from the patients' notes and without personal interviews.

RAs were classified according to the categories of Clarke [10] (Table 1).

Table 1

Classification of hospital readmissions [10].

Unavoidable
Chronic or relapsing disorder; care at home desirable if possible.
Unavoidable complication.
Readmission for social or psychological reason. Reason probably beyond control of hospital services (may include compliance).
Completely different diagnosis from previous admission.
Avoidable
Recurrence or continuation of disorder leading to first admission.
Recognised avoidable complication.
Readmission for social or psychological reason. Reason probably within control of hospital services (may include compliance).

Results

Between March 1st and May 31st 1998, 884 patients were admitted to the hospital (= IA), of which 83 (9.4%) died and 28 (3.2%) were later referred to other clinics in the KSW. 773 patients were discharged directly from the DIM. In the following, 100% represents these 773 patients.

The patients' mean age was 64.5 (± 17.8) years (mean ± standard deviation). Length of hospital

stay (LOS) was 12.7 (± 10.4) days. 47.0% were women (65.7 (± 19.3) years), LOS 13.4 (± 10.8) days) and 53.0% were men (63.4 (± 16.4) years), LOS 11.9 (± 10.0) days).

95 (12.3%) patients were readmitted within 30 days of discharge (RA-30). 68 patients (8.8%, 95%-CI 6.8–10.8) were classified as true RAs, while 27 cases (3.5%) were classified as false (e.g.
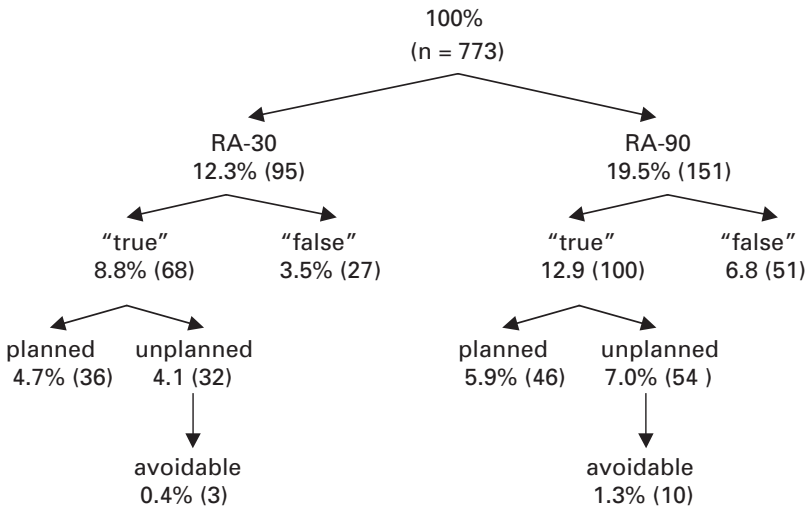
100%
(n = 773)

RA-30
12.3% (95)

RA-90
19.5% (151)

"true"
8.8% (68)

"false"
3.5% (27)

"true"
12.9 (100)

"false"
6.8 (51)

planned
4.7% (36)

unplanned
4.1 (32)

planned
5.9% (46)

unplanned
7.0% (54)

avoidable
0.4% (3)

avoidable
1.3% (10)

Figure 1

Overview of all readmissions until day 30 (RA-30) and day 90 (RA-90).

admission for delivery). In 36 (4.7%) of these 68 patients RA was planned (1 died) and in 32 (4.1%) it was unplanned. 29 of these (4 died) RAs were judged to have been unavoidable (for definition see Table 1) and 3 cases were judged as avoidable (Table 1, Figure 1).

151 (19.5%) patients were readmitted within 90 days (RA-90). 100 cases were classified as true RA (12.9%) with 46 (5.9%) planned (1 died) and 54 (7.0%) unplanned. Of these 54 patients, 44% (8 died) were judged unavoidable and 10% (1 died) were avoidable (Figure 1).

Planned RA showed a LOS of 8.8 (± 7.8) days, and unplanned of 14.0 (± 10.0) days.

Table 2 summarises the avoidable RA.

Temporal aspects of IA and RA

IA was most frequent on a Monday with a decreasing number of admissions until Sunday. Discharge increased from Monday to Friday and decreased substantially on Saturday and Sunday (Figure 2).

Patients admitted on a Sunday (mostly emergency admissions) spent on average 10.5 (± 8.3) days in hospital, those admitted on a Friday 15.0 (± 10.2) days.

RA followed a similar pattern (see Figure 3).

Most RAs occurred within 10 days of discharge. Between day 11 and 30 a decreasing rate of RAs was noted and from day 31 to 90 we found a stable low rate of RAs as previously described [12].

In summary, 68% of RAs (with a follow up of 90 days) occurred within the first 30 days and only 32% in the next 60 days.

Planned RAs occurred earlier then unplanned RAs, 44.4% vs. 40.6% within 10 days in RA-30 and 78.3% vs. 59.3% within 30 days in RA-90.

Unavoidable unplanned RA-30 occurred in 34.4% (RA-90 in 20%) while the number of avoidable unplanned RAs was too small to be commented on.

Aspects of the diseases

The different diseases were classified in accordance with ICD-10 (International Classification of Diseases, 10th edition, Table 3). For IA and RA the most frequent classifications were diseases of the circulatory system (ICD-10 I), neoplasms (ICD-10 C and – D49), the respiratory system (ICD-10 J), the nervous system (ICD-10 G), and the digestive system (ICD-10 K). The average LOS was similar in all categories of ICD-10.

Table 3 also shows that patients with neoplasms (n = 26) and cardiovascular diseases (n = 25) were more often readmitted compared to other disease groups. Also, there were more planned RAs in the two groups (n = 24 of total 36 planned RA), as they were readmitted for either chemotherapy (n = 9) or diagnostic or interventional coronary angiography, vascular surgery or percutaneous transluminal angioplasty of peripheral arteries (n = 15).

In the group of unplanned RA-30 (n = 32) the variety of diagnoses was broader, and RAs occurred at a higher rate only in patients with neoplasms. There were many different reasons for unplanned and unavoidable RAs (n = 29) such as thrombosis of an av-shunt after first use, pulmonary infection in a patient with cystic fibrosis or asthma, pneumonia in a patient with bronchial carcinoma, progression of disease, e.g. patients with HIV or with a second myocardial infarction.

Finally, the number of avoidable RAs was very

Table 2

Avoidable RA.

Nr.	Main diagnosis at IA	Days between IA and RA	Reason for RA
1	Haematemesis, chronic abuse of alcohol and NSAR	26	Malcompliance, recurrent haematemesis
2	Hypertensive heart disease with left ventricular failure	67	Insufficient dosage of cardiac medication
3	Werlhof's disease with thrombocytopenia	7	Insufficient dosage of medication
4	Dilative and hypertensive cardiomyopathy with pulmonary oedema	47	Malcompliance, irregular intake of diuretics
5	Pneumonia with P. aeruginosa	52	Too early dismissal due to pressure from the patient after initial rapid recovery with relapse
6	Suicide attempt with gas intoxication, chronic alcohol abuse	48	Malcompliance, withdrawal symptoms
7	Chronic alcohol abuse for detoxification	42	Ongoing alcohol abuse
8	Pneumonia with Klebsiella	36	Malcompliance and insufficient instruction
9	Suicide attempt with tablets	51	Malcompliance and difficult social conditions
10	Crohn's disease	3	Too early dismissal due to pressure from the patient after initial rapid recovery with relapse

IA index hospital admission   RA readmission

Figure 2

The graph shows admission and discharge of the patients at first admission in relation to days of the week
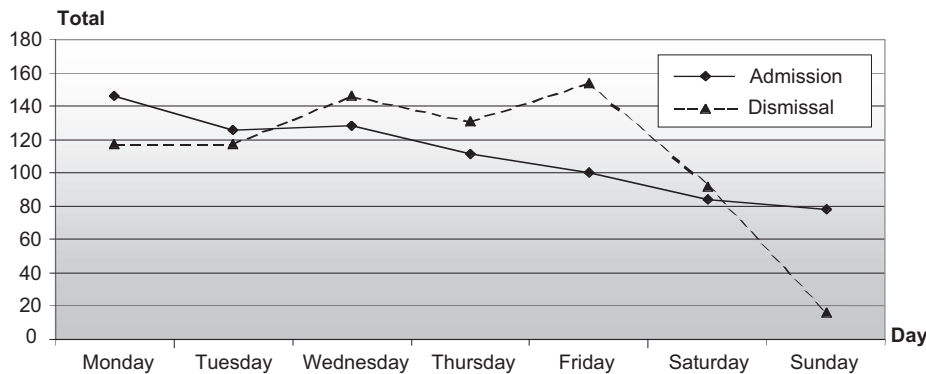

Figure 3

The graph shows admission and readmission of readmitted patients in relation to days of the week
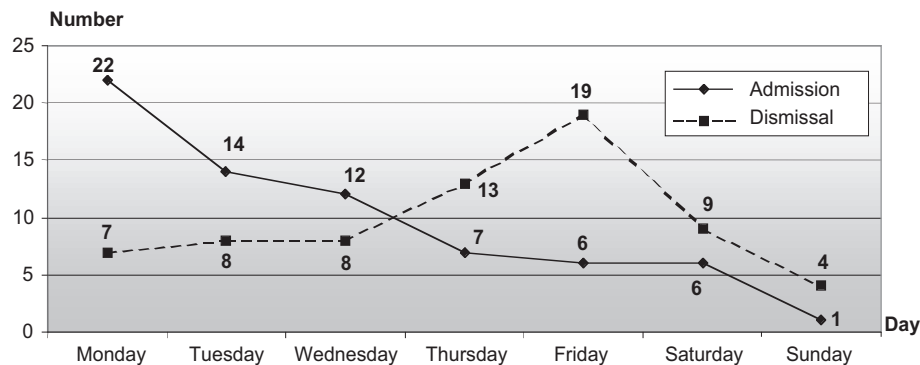

Table 3

Diagnoses and rate of RA according to ICD-10 code.

			Discharged patients		RA 30 days		RA 90 days	
			n	%	n	%	n	%
Certain infectious and parasitic diseases	A + B		33	4.3	2	2.9	2	2.0
Neoplasms	C + D	–D49	49	6.3	18	26.5	26	26.0
Diseases of the blood and blood-forming organs and certain								
Disorders involving the immune mechanism	D	from D50	11	1.4	1	1.5	2	2.0
Endocrine, nutritional and metabolic diseases	E		25	3.3	3	4.4	4	4.0
Mental and behavioural disorders	F		49	6.3	0	0.0	3	3.0
Diseases of the nervous system (includ. cerebrovascular disorders)	G	incl. I60–69	71	9.2	7	10.3	9	9.0
Diseases of the eye and adenexa and the ear and mastoid	H		8	1.0	0	0.0	0	0.0
Diseases of the circulatory system (exclud. cerebrovascular disorders)	I	excl. I60–69	214	27.8	23	33.8	25	25.0
Diseases of the respiratory system	J		100	12.9	2	2.9	7	7.0
Diseases of the digestive system	K		56	7.2	5	7.4	10	10.0
Diseases of the skin and subcutaneous tissue	L		5	0.6	0	0.0	1	1.0
Diseases of the musculoskeletal system and connective tissue	M		23	3.0	2	2.9	3	3.0
Diseases of genitourinary system	N		31	4.0	3	4.4	3	3.0
Pregnancy, childbirth and the puerperium	O		0	0.0	0	0.0	0	0.0
Certain conditions originating in the perinatal period and congenital malformations, deformations and chromosomal abnormalities	P + Q		0	0.0	0	0.0	0	0.0
Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified	R		71	9.2	2	2.9	2	2.0
External causes of injury and poisoning	S + T		11	1.4	0	0.0	3	3.0
External causes of morbidity and mortality	V-Y		10	1.3	0	0.0	0	0.0
Factors influencing the state of health leading to the use								
of the health system	Z		2	0.3	0	0.0	0	0.0
Not specified			4	0.5	0	0.0	0	0.0
Total			773	100.0	68	100.0	100	100.0

RA readmission

Table 4

Characteristic examples of "false" RA.

IA	RA
Monoarthritis with fever	Clinic of Urology
Suicide attempt	Clinic of Rheumatology
Atrial flutter	Transurethral prostatectomy
Lower back pain	Clinic of Gynaecology
Viral infection	Osteotomy of the knee
Unstable angina pectoris	Clinic of Urology
Unstable angina pectoris	Transurethral prostatectomy
Pulmonary embolism suspected	Birth
Epigastric pain	Birth
Main diagnoses at IA	**Side diagnosis at RA**
Unexplained impairment of leg	Respiratory failure
Chronic ischaemia of leg	Erysipelas

IA   index hospital admission
RA   readmission

Discussion

The aim of the present pilot study was to obtain information on the frequency of RA in an unselected patient population admitted to a Clinic of General Internal Medicine. Moreover, we tried to classify RA as planned/unplanned and avoidable/unavoidable. The results are likely to be representative as there is no other hospital in the neighbourhood. Most patients, therefore, will have been readmitted to the KSW.

The time interval between IA and RA was chosen against the background of information from various papers [2, 3, 8, 9, 11, 12, 14, 15], and RA was thus defined as a second hospital admission within the 30 days of discharge. [It is generally assumed that the longer the time between discharge and RA, the less likely it is that the medical management played a significant role in the RA [8]. This hypothesis is supported by Clarke, who showed that more unplanned RAs were judged avoidable when occurring within 0 to 6 days of discharge than within 21 to 27 days [10].

From the point of view of our own data this time interval seems to be reasonable as most RAs occurred within 30 days. Whether the RA was planned or unplanned was irrelevant in regard to the time interval. Avoidable unplanned RAs, however, occurred more often after 30 days, but the number of cases was very small and no firm conclusion can been drawn from this finding.

Our RA rate of 8.8% is similar to the rate of 5–29% in the literature [1, 9], although no independent second investigator was involved in the judgment of RA. In another study, the correlation in classification of RA was 86% between two investigators [8]. Our data also compare well with the results of the Swiss study of Dirr et al. [8], where the rate of RA was 6.9%. However, a second Swiss study showed a higher rate of RA [13] at 12.5%, which we cannot explain. In all three studies neoplasms and cardiovascular diseases were the leading causes for RA.

small (n = 3). One patient was not willing to follow the instructions for the medical treatment, a second was inadequately treated and a third was judged to have been discharged too early.

Table 4 illustrates some characteristically false RAs, where the diagnosis at the index hospitalisation had no relationship to the condition diagnosed on readmission or the department readmitting the patient.

In the work of Dirr et al. [8] 68.1% of the RAs were unplanned, while we have classified only 47.1% and Kossovsky et al. [13] only 46.2% of the RAs as unplanned. The reason for this may be a difference in the definition of planned and unplanned RA. Thus, Dirr et al. [8] report more diseases with a natural progression or relapses as unplanned RA.

Rich et al. [4] have demonstrated nicely that early planning of discharge including instruction of relatives, involvement of social services and, in particular, of out of hospital nursing organisations led to a reduction in the rate of RA in patients with congestive heart failure.

Ashton et al. [2] investigated patients with chronic pulmonary disease or heart failure and showed that patients with RA within 14 days of discharge were more likely to have been hospitalised in the preceding 24 months [9].

In the paper of Marcantonio et al. [1], five risk factors leading to unplanned RA were identified: age ≥80 years, previous RA, ≥five comorbidities, depression and lack of documented education of the patient or family. Surprisingly, they investigated only 154 patients and were nevertheless able to draw such conclusions. In our study with more than 700 subjects we were unable to identify any such risk factors.

Patients who were admitted on a Sunday displayed the shortest, and patients who were admitted on a Friday, the longest LOS. The reason for the long LOS in patients admitted on a Fridays is obvious, namely the diagnostic and therapeutic efforts over the weekend are minimal and are regularly postponed until a weekday. However, one would expect that patients admitted between a Monday or a Thursday would not differ in LOS compared to a Sunday. Unfortunately, we were not able to show that the patient population admitted on a Sunday was comparable to that admitted on a Friday. Nevertheless, the findings are of general

interest, because they suggest that weekend days may be lost and expensive times, which should be avoided whenever possible. However, if a hospital organisation were willing and able to extend their full services to weekend days, the suspected ineffective weekends could well be avoided.

There are several limitations of the present study. The lack of a second independent examiner to judge a RA as planned/unplanned or avoidable/unavoidable is the critical shortcoming. However, the close correlation of the classification of RAs to those of Dirr et al. [8], suggests that the quality of our data is reasonably good. In a further study we intend to analyse all hospital admissions to our department, i.e. more than 4000 per year. With the limited number of RAs presented here we were unable to clearly distinguish between the characteristics of the disease causing the RA. Moreover, it would be of great interest to know whether malcompliance following hospital discharge was an important factor causing RA.

In summary the present pilot study indicates that RA should be regularly monitored as a quality parameter, and that 30 days is a reasonable time period in which to assess RA. An increase in the rate of RA might indicate a decrease in the quality of disease management. Moreover, monitoring of RA may pick up changing patterns of disease. However, the present preliminary study was not able to elucidate such changes as the duration of the study was too short. Elective patients should not be admitted to hospital on a Friday as they showed the longest LOS. Patients with malignant or cardiovascular disease have the highest likelihood of RA, which may reflect the character of the disease.

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