

## **30-Day Readmission Rate as an Indicator of the Quality of Elective Surgical Inpatient Care at one of the Eastern Province's Hospitals, Kingdom of Saudi Arabia**

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*Abstract.* 30-day re-admission rate is a performance indicator used to reflect adverse events and complications of treatment. High rates could indicate poor quality of care and clinical incompetence. The study aims to measure a 30-day readmission rate as a performance indicator of the quality of elective surgical inpatient care at teaching hospitals, and to determine predictors and reasons of readmission. This is a retrospective cohort study and conducted in some surgical departments. Target populations were patients that underwent any of the elective operations, and readmitted for unplanned related reasons within 30-days for four consecutive years (2006-2009). However, patients not readmitted were those that underwent any of the elective operations and not readmitted within 30-days. Data were extracted from the computerized and paper medical records. Multivariate regression analysis determines predictors of readmission (rate of 20.4%) on preoperative and postoperative length of stay >3 days. Hence, major operation and lack of discharge plan for follow up. However, co morbidities other than *diabetes mellitus* and hypertension were protective. Majority of reasons of readmission were infection, then bleeding. The hospital should manage pre and post operative stay properly, emphasize the role of discharge plan and apply infection control surveillance.

*Keywords:* Elective surgery, Readmission rate, Risk factors.

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## Introduction

Health care organizations use different clinical indicators as a mean of evaluating and monitoring their performance that assumed to reflect adverse events and complications of treatment. One of these indicators is a 30-day re-admission rate. High rates could indicate poor quality of care and clinical incompetence<sup>[1-4]</sup>. Hospital readmissions are classified as unplanned and planned readmissions. Unplanned readmissions refer to those admissions due to an unexpected requirement for further treatment of the condition. The patient was either previously hospitalized or treatment of a complication, or treatment of condition related to the hospitalization, either through the outpatient or emergency<sup>[5]</sup>. While planned readmission is “any planned diagnostic or therapeutic measure”<sup>[2,6-11]</sup>. Only unplanned readmissions may reflect substandard care offered during the preceding stay, while planned readmissions may be linked with suboptimal hospital use (multiple admissions for reimbursement purposes or a waiting list for diagnostic or therapeutic procedures), but not with inadequate quality of care<sup>[12]</sup>. A wide scatter between 4 and 29 percent of the rate of readmission was found<sup>[2,6,7,11]</sup>. In addition, depending on the diagnosis, 5% to 29% of adults were readmitted within a month after a medical-surgical stay<sup>[13]</sup>. However, some early readmissions are possibly avoidable<sup>[14]</sup>. Literature revealed that 9% to 48% of readmissions have been judged to be preventable. Thus, they were associated with indicators of substandard care during the index hospitalization, such as poor resolution of the main problem, unstable therapy at time of discharge, and inadequate post discharge care<sup>[15]</sup>. Furthermore, randomized prospective trials have shown that 12% to 75% of all readmissions can be prevented by educating patients, pre-discharge assessment, and domiciliary aftercare<sup>[16]</sup>. Literature illustrates that surgical readmissions are more ‘avoidable’ than medical readmissions. Readmission after elective surgery is less common than that after emergency surgery. This perhaps attributed to the fact that elective surgery technically performed under planned, under controlled conditions, with more thorough preparation by anesthetic and surgical specialists. When ward is prepared and staffed for the patient, who is anticipated to have expected and stable recovery, the rate of readmission is expected to be low<sup>[17-19]</sup>.

Readmissions that occur within 30 days of discharge are related to many variables such as patient co-morbidities, preoperative care, length of stay, patient's demographics<sup>[20-21]</sup>. Other studies proved that male older age group and primary diagnosis of heart failure and chronic obstructive pulmonary disease/asthma were significantly associated with increased readmission risk, independently of the length of follow-up. In addition, shorter length of stay is associated with higher readmission risk at discharge and immediately afterwards<sup>[22]</sup>. Differences in readmission rates have been well documented across diagnostic groups and surgical procedures, with patients having certain chronic conditions or undergoing certain surgical procedures revealing higher readmission rates. Some studies found the presence of multiple chronic conditions, and the performance of multiple surgical procedures has been associated with increased risk of readmission<sup>[23]</sup>. Hospital readmission rates after major surgeries have a significant impact on hospital costs, patient discomfort and quality of care. Reduction in readmissions may save considerable amounts of health care expenses<sup>[7]</sup>.

### **Aim of the Study**

The objective of this study is to measure 30-day readmission rate as a performance indicator for all elective inpatient surgeries (2006 to 2009), at the teaching hospital. Furthermore, determine the risk factors and reasons of readmission.

### **Material and Methods**

#### ***Study Setting***

The study was conducted in the surgical departments of the teaching hospital in the eastern region, Kingdom of Saudi Arabia (KSA). Surgical departments under study were the general surgery, vascular, cardiac, urology, and neurosurgery.

#### ***Study Design***

This report was based on a retrospective cohort study.

#### ***Target Population***

Patients who underwent any of the elective operations and readmitted for related unplanned reasons within 30-days for four consecutive years

(2006-2009) were considered. Not-readmitted patients were those that underwent any of the elective operations, and not readmitted within 30-days during the study period. Based on the data obtained retrospectively from computerized management information system, the total number of patients discharged from elective surgery during the study period was 7060. Among them, 370 patients were readmitted within 30 days. Those readmitted for related unplanned reasons were 144 patients. Not-readmitted patients were randomly selected and they amounted to 149. Since the majority of the readmitted patients were discharged from the general surgery department (120 patients), therefore, not-readmitted patients were selected from the general surgery department due to availability of complete information.

### ***Exclusion Criteria***

1. Patients readmitted for planned visits.
2. Patients readmitted for unrelated reasons.
3. Patients readmitted after more than 30 days.
4. Patients readmitted under 15 years old.

### ***Data Collection Tool***

A pre-coded data collection sheet was designed to collect the required variables. This includes patient's demographics, co morbidities, length of stay (LOS) before and after operation, discharge plan, category of the physician who signed the initial discharge, type of discharge, *etc.* Data were extracted from the computerized management information system and the paper-based medical records from the years 2006 to 2009. Formal approval from the teaching hospital administrator was obtained before conducting the research. Confidentiality of the data collected from medical records was considered.

### **Statistical Analysis**

All data were statistically analyzed using SPSS program version 16.0. Continuous data were presented as mean and standard deviation, and categorical data were presented as number and percentages. Readmitted and non-readmitted patients were compared for risk factors associated with readmission; test of significance at 5% p value was used. Odds ratio (OR) and 95% confidence interval were calculated. Binary logistic regression analysis was used to model the predictors of readmission.

Fifteen variables were screened for entry into a logistic regression model. Variables were of two types including: preoperative clinical characteristics, and operative and postoperative in hospital clinical characteristics. Univariate logistic regression of inference was applied to the variables, which produced a list of candidate variables for entry into the multivariate logistic regression model. A variable was considered a candidate predictor variable for the regression model if the univariate tests of inference were significant at less than .05 probability level. Accordingly, seven variables were included in the multivariate logistic regression. In addition, after reviewing the literature, the gender and the marital status play an important role in the patient's readmission within 30 days after operation, and based on that, they were included.

## Results

One hundred forty-four (20.4%) of 7060 discharged patients had related unplanned readmission after elective surgeries. Figure 1 showed the rate of readmission per year for the period 2006 to 2009 was at 22.74%, 20.11%, 20.95%, and 17.86%, respectively.

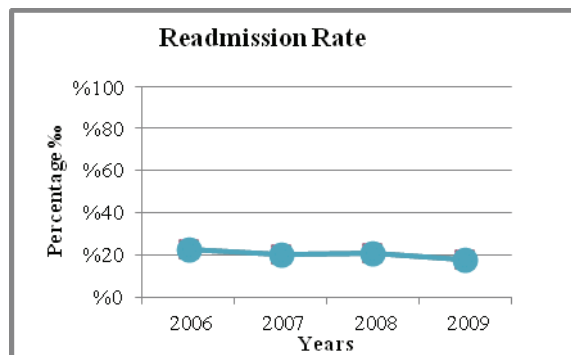
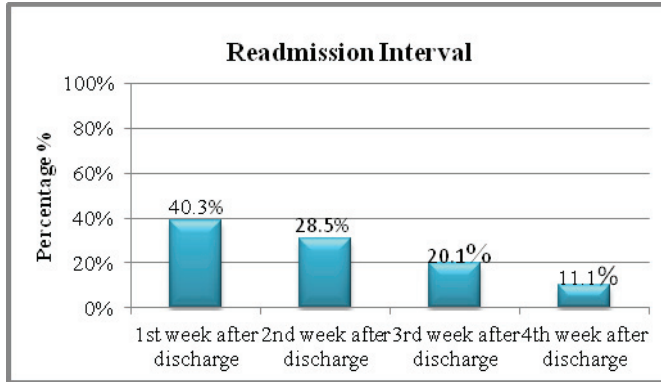


Fig. 1. Rate of hospital readmission per 1000 discharged patients after elective surgical operations through the years 2006-2009.

Figure 2 demonstrated that most of the patients had been readmitted in the first week after discharge (40.3%).

Table 1 showed that patients with co-morbidities had 47% less readmission risk than those without co morbidities and the difference was statistically significant ( $p = .011$ ). In addition, patients with co-morbidities other than *diabetes mellitus* (DM) and hypertension had 48%

less readmission risk than diabetics. The difference was also statistically significant ( $p = .007$ ).



**Fig. 2.** Distribution of readmitted cases by the time of readmission through the years 2006-2009.

**Table 1.** Univariate analysis of preoperative clinical characteristics of the study patients grouped by readmission status during the period 2006-2009.

Clinical Characteristics	Readmitted (n = 144)		Not-readmitted (n = 149)		P Value	Odds Ratio	
	No	%	No	%		Calculated	95% CI
<b>Age (Y)</b>							
Mean $\pm$ SD	47.1 $\pm$ 17.9		45.5 $\pm$ 16.5		P = .443	1.005	.922 - 1.019
15 - < 30	31	21.5	31	20.8	P = .763	Reference	
30 - < 45	37	25.7	41	27.5		.902	.463 - 1.759
45 - < 60	36	25.0	39	26.2	P = .816	.923	.471 - 1.809
$\geq 60$	40	27.8	38	25.5	P = .880	1.053	.540 - 2.051
<b>Gender</b>							
Men	75	47.9	72	48.3	P = .520	1.162	.735 - 1.838
Women	69	52.1	77	51.7		Reference	
<b>Nationality</b>							
Saudi	108	75	113	75.8	P = .868	.956	.561 - 1.627
Non-Saudi	36	25	36	24.2		Reference	
<b>Marital Status</b>							
Not Married	46	31.9	39	26.2		Reference	
Married	98	68.1	110	73.8	P = .277	.755	.455 - 1.253
<b>Presence of Co-morbidities</b>							
Yes	84	58.3	108	72.5	P = .011*	.531	.326 - .867
No	60	41.7	41	27.5		Reference	
<b>Co-morbidities</b>							
Diabetes Mellitus	50	34.7	48	32.2		Reference	
Hypertension	51	35.4	61	40.9	P = .331	.791	.493 - 1.269
Others <sup>†</sup>	68	47.2	94	63.1	P = .007 <sup>‡</sup>	.524	.328 - .835

\*p value < .0; <sup>†</sup>Other diseases such as bronchial asthma, hyperlipidemia, obesity, renal failure, cancer, hepatitis etc.

Table 2 revealed patients that underwent major operations had 2.08 times of readmission than those who underwent minor operations. Regarding LOS, patients stayed > 6 days had 1.62 higher readmission risks than those stayed 6 days or less; those stayed > 3 days had higher

readmission risk (OR = 1.90) than those stayed ≤ 3 day; and those stayed > 3 days postoperatively had 1.96 higher readmission risks than those stayed ≤ 3 days. Finally, patients discharged without discharge plans had 2.51 higher readmission risks than those who had discharge plans. The differences were statistically significant for all the aforementioned variables.

**Table 2. Univariate analysis of operative and postoperative in hospital clinical characteristics of the study patient as grouped by readmission status during the period 2006-2009.**

Clinical Characteristics	Readmitted (n = 144)		Not- Readmitted (n = 149)		P Value	Odds Ratio	
	No	%	No	%		Calculated	95% CI
<b>Type of Operation</b>							
Major	79	54.9	55	36.9	P = .002*	2.08	1.27-3.41
Minor	65	45.1	94	63.1		Reference	
<b>Surgery within 24 h</b>							
Yes	5	3.5	12	8.1	P = .103	Reference	
No	139	96.5	137	91.9		2.435	.836 – 7.096
<b>Type of Anesthesia</b>							
General	90	62.5	76	51.0	P = .815	1.184	.286 – 4.895
Local	40	27.8	62	41.6	P = .551	.645	.153 – 2.728
Spinal	4	2.8	4	2.7	P = .679	1.429	.264 – 7.737
Others <sup>†</sup>	10	6.9	7	4.7		Reference	
<b>LOS</b>							
Mean±SD	11.9 ± 15.6		8.1 ± 10.9		P = .026*	1.027	1.03 – 1.051
≤6	64	44.4	84	56.4	P = .042*	Reference	
>6	80	55.6	65	43.6		1.615	1.018 – 2.562
<b>Preoperative LOS</b>							
≤3	91	63.2	114	76.5	P = .014*	Reference	
>3	53	36.8	35	23.5		1.897	1.141 – 3.153
<b>Postoperative LOS</b>							
≤3	66	45.8	93	62.4	P = .005*	Reference	
>3	78	54.2	56	37.6		1.963	1.231 – 3.128
<b>Category of Surgeon</b>							
Consultant	87	60.4	81	54.4	P = .280	Reference	
Senior Registrar	6	4.2	10	6.7		.559	.194 – 1.607
Registrar	4	2.8	6	4.0	P = .472	.621	.169 – 2.279
Resident	40	27.8	45	30.2	P = .478	.828	.491 – 1.395
Trainee Resident	7	4.9	7	4.7	P = .898	.931	.313 – 2.770
<b>Type of Discharge</b>							
Normal Discharge	139	96.5	147	98.7	P = .250	Reference	
DAMA	5	3.5	2	1.3		2.644	.505 – 13.851
<b>Discharge Plan</b>							
Yes	122	84.7	139	93.3	P = .022*	Reference	
No	22	15.3	10	6.7		2.507	1.142 – 5.501

\* P value < .05; <sup>†</sup>Epidural anesthesia

Table 3 revealed that patients stayed more than 3 days preoperatively had a risk (odds) of readmission 2.9 times than those who stayed 3 days or less and the difference was significant (p = .002). Also, patients stayed more than 3 days postoperatively had a risk (odds) of readmission 2.4 times that who stayed 3 days or less, and the difference was

significant ( $p = .029$ ). Patients discharged without discharge plans for follow up had 2.45 times risk of readmission than those with discharge plans and the difference was significant ( $p = .039$ ). Patients underwent major operation had 2.05 higher risk of readmission than those underwent minor surgeries, and the difference was significant ( $p = .008$ ). On the other hand, patients with co-morbidities other than DM and hypertension were 59% less likely to be readmitted than those suffering from DM, and the difference was significant ( $p = .038$ ).

**Table 3. Predictors of readmission by multivariate logistic regression analysis.**

Variables	P value	Odds Ratio (OR)	Confidence Interval (95% CI)
Men	.140	1.473	.880 - 2.464
Presence of co- morbidities	.708	.847	.354 - 2.022
Co-morbidities other than <i>diabetes mellitus</i> & hypertension*	.038	.406	.173 - .953
LOS > 6	.253	.605	.256 - 1.433
Preoperative LOS > 3*	.002	2.895	1.469 - 5.707
Postoperative LOS > 3*	.029	2.354	1.093 - 5.071
No discharge plan*	.039	2.452	1.044 - 5.755
Major operation*	.008	2.046	1.202 - 3.485
Married	.386	.781	.446 - 1.366

\*  $p \text{ value} < .05$

Table 4 demonstrated that the most frequent reasons of readmission were infection and bleeding (52.8% and 11.8%, respectively).

**Table 4. Problems leading to 30- day re-admission during the period 2006- 2009.**

Re-admission Diagnosis	Number (n)	Percentage %
Infection	76	52.8
Bleeding	17	11.8
Vascular System Complications	6	4.2
Encephalocele	4	2.8
Inguinal hernia	5	3.4
Paraumbilical hernia	4	2.8
Myocardial infarction	3	2.1
Glossopharyngeal neuralgia	4	2.8
Varicocele	5	3.4
Coronary artery disease	4	2.8
Hydrocele	5	3.4
Renal failure	3	2.1
Trigeminal neuralgia	4	2.8
Heart Failure	4	2.8



## Discussion

A wide scatter between 4 and 29 percent of the rate of readmission was found<sup>[2,6,7,11]</sup>. Many studies calculated readmission rate and determined the association between various patients' characteristic and readmission. Results of the present study showed that readmission rate after elective surgery for the period extending from 2006 to 2009 was 20.4‰ (Fig. 1). This rate was comparable to previous studies that showed that readmission rate was (< 2%) after elective surgery<sup>[24]</sup>. One cited study reported an average intensive care unit readmission rate of 7.8%<sup>[25]</sup>. Another study reported intensive care unit readmission rate of 9.4% after major surgeries<sup>[26]</sup>.

Literature has been shown that several patient characteristics such as age, gender, marital status, medical history, and co-morbidities are correlated with hospital readmission<sup>[27,28]</sup>. Result of the present study showed that male had 1.47 higher risk of readmission than the female. However, married patients had 22% less risk of readmission than the unmarried patients (Table 3), but the differences were not significant. Results also revealed that patients aged 60 years and above had a higher risk of readmission (OR = 1.05, Table 1) than those 15 years and above; however, the difference was not significant. Literature review revealed parallel results that where there, but was no statistically significant difference of marital status among readmitted, and not readmitted patients with heart failure (64.2%, 64.0%, respectively)<sup>[29]</sup>. Consequently, literature reported that rate of readmission was high among patients aged 65 years and above for readmitted patients with congestive heart failure, and patients readmitted after coronary artery bypass graft surgery<sup>[30-31]</sup>. For gender, literature reported similar results where men had a higher risk of readmission (OR = 2.8) than women<sup>[32]</sup>. However, other study showed a contradictory result where women had a high risk of readmission (61%)<sup>[24-26]</sup>.

The present study revealed that patients suffered from co-morbidities other than DM and hypertension had .59 less readmission risks than those with DM, and the difference was significant ( $p = .038$ , Table 3). This could be attributed to the fact that these diseases (such as hyperlipidemia, obesity, bronchial asthma, *etc...*) are milder than DM.

Concerning the discharge plan, results of the present study clarified that patients without discharge plans had a higher risk of readmission

than those with discharge plans (OR = 2.45), and the difference was significant  $p = .039$  (Table 3). This could be attributed to the fact that availability of discharge plans and follow up make sure that patients have received follow up instructions that lead to the decline of their readmission. In contrary, literature review detected no statistically differences in the availability, neither in the discharge plan nor in the medical stability of patients at discharge between patients experienced readmission and those patients who do not<sup>[33]</sup>.

Regarding the length of stay, the present study showed that patients stayed preoperatively more than 3 days had 2.9 times higher risk of readmission than those stayed 3 days or less, and the difference was significant  $p = .002$ . Also, patients stayed postoperatively more than 3 days had 2.35 times higher risk of readmission than those stayed 3 days or less, and the difference was significant  $p = .029$  (Table 3). This can be explained by exposure of the patient to risks of hospitalization. This is constant with other study that revealed that the risk of readmission rises with increasing length of stay<sup>[34]</sup>. Furthermore, another study found that cardiovascular readmission rates were less for those patients discharged early as compared with those with longer hospital stays<sup>[35]</sup>.

Patients underwent major operations had 2.05 times higher risk of readmission, than those underwent minor operations, and the difference was significant  $p = .008$  (Table 3). This could be referred to the fact that major operations are complex, take longer time to perform, and may be of greater complications than minor ones.

The association between readmission rate and quality of care has been validated in meta-analyses of cohort and case-control studies<sup>[29,36]</sup>. The three most threats that cause readmission in this study were infection, bleeding, and vascular system complication (52.8%, 11.8%, 4.2%, respectively) (Table 4). Thus, parallel to unplanned readmissions following ambulatory plastic surgery that displayed that bleeding (60%) was the most important surgical reason<sup>[37]</sup>.

### **Conclusion and Recommendations**

The present study showed that the trend of readmission rate during the period of 2006 to 2009 is more or less stable. Moreover, it is considered low in comparison to other studies. Results of multivariate logistic regression analysis, after adjusting confounding variables,

revealed that risk factors of readmission after elective inpatient surgeries were preoperative LOS more than 3 days, postoperative LOS more than 3 days, lack of discharge plan for follow up at time of discharge, and major operations. However, co morbidities other than DM and hypertension were protective. Nonetheless, the most frequent reasons of readmission were bleeding and infection. Therefore, the following is recommended:

1. Proper management of the pre- and post-operative stay needs shortened.
2. Application of infection control surveillance.
3. Emphasize the role of the discharge plan.

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معدل إعادة الدخول الى المستشفى خلال ٣٠ يوما كمؤشر لجودة الخدمات المقدمة لرعاية مرضى الجراحات غير العاجلة في إحدى مستشفيات المنطقة الشرقية بالمملكة العربية السعودية

عزة على المحلي<sup>١</sup> ، و هبة يعقوب النجيدى<sup>٢</sup> ، و نورة عبد الرحمن الطريّف<sup>٢</sup> ،  
 و سارة سامى الراشد<sup>٢</sup> ، و صالحه فايع العسيري<sup>٢</sup>  
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المستخلص. يعد معدل إعادة الدخول للمستشفى خلال ٣٠ يوما مؤشراً لتقييم الأداء الذى يعكس السلبيات والمضاعفات. ويشير إرتفاع هذا المعدل لسوء جودة الرعاية والكفاءة السريرية. وتهدف الدراسة لقياس معدل إعادة الدخول للمستشفى خلال ٣٠ يوما لمرضى الجراحات غير العاجلة بالمستشفى التعليمي ومعرفة عوامل الخطورة وأسباب إعادة الدخول للمستشفى. وقد صممت دراسة كوهرت بأثر رجعى ونفذت ببعض أقسام الجراحة. والفئة المستهدفة هي المرضى الذين تمت لهم جراحات غير عاجلة وتمت إعادة دخولهم للمستشفى خلال ٣٠ يوما لأسباب متعلقة بسبب الدخول وغير مخطط لها وذلك خلال ٤ سنوات متتالية من ٢٠٠٦-٢٠٠٩م. وقد تم أيضاً دراسة المرضى الذين أجريت لهم جراحات غير عاجلة ولكن لم يتم إعادة دخولهم خلال ٣٠ يوما. وقد استخرجت البيانات من نظام إدارة المعلومات الصحية والسجلات الورقية. استخدم الانحدار اللوجستي المتعدد لتحديد عوامل الخطورة للعودة للمستشفى. وكان

معدل الدخول ٢٠,٤٪ وعوامل الخطورة: مدة الإقامة بالمستشفى قبل وبعد الجراحة أكثر من ٣ أيام، وإجراء الجراحات الكبيرة، وعدم وجود خطة متابعة للمريض عند الخروج. من ناحية أخرى وجد أن الأمراض المصاحبة غير الداء السكري وإرتفاع ضغط الدم يقلل من العودة للمستشفى. ووجد أن معظم أسباب العودة هي العدوى ثم النزيف. فعلى المستشفى أن تقوم بتحسين خدمات المرضى خلال الإقامة قبل وبعد الجراحة. وتأكيد دور خطة المتابعة عند الخروج، وتطبيق برنامج لمكافحة العدوى.