DOI Number: 10.5958/0974-1283.2019.00267.6

Variance of Rates and Costs of Unplanned Readmissions in Tertiary Hospitals in South Korea

Min Sun Shin[1], Won Jae Lee[2], Hyun Sook Oh[3]

[1]Researcher, Div. of Innovative Research, Health Insurance Review & Assessment Service; [2]Professor, Dept. of Healthcare Management, [3]Professor, Dept. of Applied Statistics, Gachon Univ.

ABSTRACT

This study attempted to estimate rates and costs of unplanned readmissions of high level hospitals Korea. Unplanned readmissions are used as a proxy of the quality of medical services. Korean Health Insurance reimburses tertiary hospitals 5% more fees than general hospitals. The gaps of the health insurance reimbursement rates are not based on the difference in quality of medical services among the level of hospitals. It needs to be reviewed whether the gaps are reflecting difference of the quality of medical services.

The Health Insurance Claims Data of patients readmitted within 28 days after discharge from tertiary hospitals in 2014 were classified into unplanned claims. Unplanned readmissions were compared with planned readmissions.

The risk-adjusted average readmission rate was 6.4% in all tertiary hospitals, but 5.7% in general hospitals with 500 beds or more. Coefficient of variance (CV) of readmission rate was higher in tertiary hospitals (32.8) than general hospitals with 500 beds or more (17.5). However, there was no significant difference in mean medical fees per unplanned readmission between two groups of hospitals. It was 3,810 Won in the tertiary hospitals and 3,834 Won in general hospitals with 500 beds or more.

The findings of this study showed that higher costs did not necessarily yield higher quality of care, suggesting that quality control measures should be required to reduce unplanned readmissions in tertiary hospitals.

Keywords: *readmission, unplanned readmission, healthcare insurance, admission cost*

Introduction

The reimbursement scheme that differentiates medical fees (hospitalization fees, examination fees, and meals) by types of medical institutions to compensate higher investment costs and manpower is being implemented in South Korea. Higher level hospitals usually specialize in more complicated medical treatment cases and are required to have more sophisticated equipment, facilities and highly skilled workforce that demand higher investment and operation costs. For these reasons, 130% medical fee rate is applied to tertiary hospitals compared with 125% to general hospitals and 120% to hospitals with standard 100% [1, 2].

The designation criteria for tertiary hospitals include mostly quantitative characteristics of hospitals and do not include the quality of medical care. Higher payment rates are applied to tertiary hospitals as long as they are able to meet the criteria regardless of the quality of medical care. However, there might be cases that quality of their medical care is lower than general hospitals. It should be confirmed that higher quality of medical care justifies higher fee rates.

It can be assumed that quality medical care services have been provided if a patient is able to recover and discharged from hospital after inpatient care. However, if the patient has to be readmitted to the same hospital or another within a short period of time after discharge, the quality of medical care services should be suspected because the patient could be readmitted by insufficient or

Corresponding Author:
Won Jae Lee
Professor, Dept. of Healthcare Management,
Gachon Univ.
Email: health21@gachon.ac.kr

inadequate care of the previous admission. A readmission has been suggested as a proxy indicator to evaluate the quality of inpatient care services as it usually occurs as a result of poor or inadequate medical services. Because readmission index is considered as a useful indicator for outcome of medical care, efforts are needed to reduce inadequate readmissions [3].

The U.S. Centers for Medicare & Medicaid Services reported that the readmission rate of Medicare beneficiaries age 65 or older was about 20% during the period of 2003-2004. As a consequence, it was reported that some $17 billion was spent due to unnecessary readmissions. It was also pointed out that estimated $1.9 billion could be saved annually by reducing readmission rates. In 2013, maximum 1% cut of the total reimbursement was applied to penalize hospitals when their 30-day unplanned readmission rates for the previous three years exceeded the average [4].

There have been some concerns in associating quality of medical care with readmission rate since readmissions can occur due to co-morbidity regardless of efforts in improving medical care services of hospitals[5]. However, readmission rate is an indicator that can be measured by administrative data along with mortality rate. It is easier to measure than mortality rate as it happens more often. There have been many evidences that it is a valid marker to compare outcomes of hospital inpatient services [6].

Readmission rate is considered a reliable indicator to assess the quality of medical care of a hospital. It is necessary to examine whether the additional medical fees are commensurate with higher quality of medical care based on readmission rates by types of medical institutions. Since reimbursements made for tertiary and general hospitals were as much as 50% of the total amount of medical care reimbursements in 2014[7], unplanned readmissions should be reduced to prevent unnecessary costs.

This study attempted to examine whether higher medical fees of tertiary hospitals are commensurate with higher quality of medical care services by comparing frequencies of unplanned readmissions between tertiary hospitals and general hospitals.

Method

Data Source: In this study, we try to compare the tertiary hospitals with the general hospitals over 500 beds. Based on the assumption that the medical services of advanced tertiary hospitals would be similar, we compared data of the hospitals with 500 or more beds.

Medical care claim statements (submitted to the Health Insurance Review and Assessment Service) of adult patients (age 18-120) who had been admitted to and discharged from tertiary hospitals and general hospitals more than 500 beds during January and December of 2014 were used as index admission. The subjects for comparison were patients discharged from tertiary hospitals and general hospitals. Based on index admission statements, readmissions were defined as cases of patients who were first hospitalized in tertiary hospitals, general hospitals, or hospitals and then readmitted to the same or other hospitals within a 28-day period from the date of discharge during January 2014 and January 2015 [Table 1].

Table 1: Categorizing of admissions

Category	Index Admits	Readmits
data	Health Insurance Claims data	
Target	Adult(age of 18~120) inpatient	
Date	2014. 1. ~ 2014. 12	2014. 1. ~ 2015. 1.
Institutions	Tertiary hospitals and general hospitals more than 500 beds	Tertiary hospitals, general hospitals, hospitals
Definitions	All admission statements (excluding in-hospital mortality)	First readmission to medical institutions within 28 days after discharge

The cases of in-hospital mortality were excluded from index admissions. The cases of patients who were transferred to other medical institutions were also not counted as it was hard to establish a causal attribution relationship between index admissions and subsequent readmissions. Only a claim statement of the final point medical institution was recognized as an index admission. In addition, diseases like cancers with frequent readmissions were excluded. Psychiatric and obstetric hospitals were also not accounted as the quality of these medical services because they could not be easily measured.

Multiple contiguous admissions were consolidated into a single episode of care with one claim statement.

Of 2,363,888 cases of admission statement collected and 1,585,857 cases (67.1%) were analyzed.

Research Model: Index admission statements were classified into two steps, first, single admission and readmission, then, readmissions were classified into planned or unplanned ones [Table 2].

Time frames for readmission, subjects, methods to classify readmissions into planned and unplanned ones, and risk adjustment methods are different from one research to another. Comprehensive criteria[8] to evaluate readmissions to assess the quality of hospital medical services developed by CMS in cooperation with Yale University were used for this study. The planned readmission is defined always a planned diagnostic group such as chemotherapy, radiotherapy, delivery, rehabilitation, or non-acute disease. All the readmissions not included in the planned readmission were defined as unplanned readmission [8-10].

Based on the research conducted by Shin and Lee[9], we used 28-day time frame for readmission. A dependent variable was unplanned readmissions of all-cause, any reason.

All readmissions (all cause and any reason) were included in the analysis if they were readmitted 28 days or less after the previous discharge. The reason that readmission was not distinguished by main diagnosis is that there is no objective basis for the correlation between previous hospitalization and current hospitalization, and it was difficult to deduce quality or reason for readmission based only on documented record on admission [8].

Table 2: Definition of terms

Terms	Definition
Index admission	All admission statements (in-hospital mortality excluded)
One single admission	Not readmitted
Readmission	Readmitted to medical institutions in 28 days or less after discharge
Planned Readmission	All planned diagnosis (planned diagnostic group such as chemotherapy, radiotherapy, delivery, rehabilitation, or non-acute disease) or non-acute diagnosis and potentially planned readmissions
Unplanned Readmission	All readmissions excluding planned ones

Analysis Method: The 2013 version AHRQ CCS (Agency for healthcare research and quality clinical classifications software), which classifies diseases into 259 diagnosis groups based on ICD-10 code, was applied [11].

Screening claim statements for the presence of surgical procedure was based on DRG (diagnosis related group) numbers as it classifies diseases based on the KCD code and clinical procedure[12]. The medical history of previous one year of an index admission subject was traced and classified by the presence of co-morbidity, based on Charlson Index of Quan [13].

For the calculation of risk-adjusted unplanned readmission rates, hierarchical generalized linear models (HGLMs) was applied, including hospital-specific effect to adjust them for medical institutions. The geometric mean which applied weighted values to five cohorts (medicine, surgery, cardiorespiratory, cardiovascular, and neurology) was used (U.S. CMS method applied) [8]. SAS Enterprise Guide 4.2 version was used to analyze Health Insurance Claims Data.

For the comparison of variance of the difference between groups the coefficient of variation (CV) was used. It is a simple and intuitive method to use when comparing two data when there is a difference in the average even though the units of analysis are different or the mean numbers are different.

The purpose of this study was to compare the difference between the two groups using the CV, assuming that the quality of care is different between the tertiary hospitals and the general hospitals with 500 or more beds.

A statistical hypothesis testing to verify whether a sample reliably represents total subjects was not necessary since the data analyzed in this study was a complete claims data of admission covering all health insurance beneficiaries. Difference in the analysis of this study can be interpreted as statistically significant, if any.

Result and Discussion

Cost of Admissions: Considering the total cost of medical care without regard to the LOS and the severity of illness, the total cost of the tertiary hospitals and general hospitals 500 beds or more was $3,825 million. The total cost of the tertiary hospital was $2,369 million, which was higher than the cost of the general hospital

by $1,456 million. The cost of single admission of the tertiary hospital was $1,962 million, and the cost of the planned readmission of general hospitals with 500 beds or more was the least, $66 million.

The total cost per admission was $2,412. In the tertiary hospital, the single admission was the lowest with $2,477, and unplanned readmission was the highest with $3,389. In general hospitals with 500 beds or more, single admission was the lowest with $2,108 and planned readmission was $2,770. In the tertiary hospitals, the cost per admission was the highest in the case of unplanned readmission. In the general hospitals with 500 beds or more, the cost per admission was the highest in planned readmission [Table 3].

Table 3: Cost of admissions

Size of Hospital	Type of admits		No. of admits	%	Cost of admits	Cost per admits
Total			1,585,857	100.0	3,825	2,412
Tertiary hospitals	Sub total		916,251	57.8	2,369	2,585
	Single admit		792,274	50.0	1,962	2,477
	Readmits	Sub total	123,977	7.8	407	3,280
		planned	37,838	2.4	115	3,031
		unplanned	86,139	5.4	292	3,389
General hospitals (500 beds+)	Sub total		669,606	42.2	1,456	2,175
	Single admit		587,914	37.1	1,239	2,108
	Readmits	Total	81,692	5.2	217	2,657
		planned	23,732	1.5	66	2,770
		unplanned	57,960	3.7	151	2,610

Currency: $ 1 = 1, 200 won

Risk-adjusted unplanned readmission rate and coefficient of variance: Using the hierarchical logistic regression method, the risk was corrected for each of the five cohorts, surgical, medical, cardiovascular, cardiorespiratory, and nervous. The risk-adjusted standardized unplanned readmission rate was estimated by calculating the weighted average score for each cohort.

Risk-adjusted standardized readmission rate of tertiary hospitals was 6.4% whereas that of general hospitals with 500 beds or more was 5.7%. The variation of unplanned readmission rates of tertiary hospitals was higher compared to others. CV, an indicator for variation of medical institutions, was 17.5 in general hospitals with 500 beds or more whereas that of tertiary hospitals was 32.8. While there was no large variation in medical fees, the variation of risk-adjusted unplanned readmission rates as a marker of hospital care quality was large in tertiary hospitals [table 4].

Table 4: Risk-adjusted unplanned readmission rate

Category	Total	Tertiary	General hospitals, 500 beds or more
No. of Hospitals	94	43	51
Average(%)	6.0	6.4	5.7
STD	1.5	2.1	1.0
CV	24.5	32.8	17.5

Risk-adjusted unplanned readmission cost and coefficient of variance: The cost per admission of unplanned readmission was $3,175 in the tertiary hospitals, $3,195 in the general hospitals with 500 beds or more. The standard deviations (STD) by institutions were 919 in the tertiary hospital, which was small and about 1/5 of that in general hospitals with 500 beds or more. The CV of risk-adjusted unplanned readmission cost in the general hospitals with 500 beds or more was about 4.5 times larger than the tertiary hospitals.

The cost per admission was similar each other. However, the STD and the CV of the cost per risk-adjusted unplanned readmission in general hospitals with 500 beds or more were much larger than the tertiary hospitals [Table 5].

Table 5: Risk-adjusted unplanned readmission cost

Category	Total	Tertiary	General hospitals, 500 beds or more
No. of Hospital	94	43	51
Cost per admits($)	3,186	3,175	3,195
STD($)	2,701	919	4,204
CV	84.6	28.9	131.6

Distribution of hospitals for risk-adjusted unplanned readmission rate: Hospitals were classified into two groups by the average of risk-adjusted unplanned readmission rate (6.0%). Hospitals with less than average were 23 (53.5%) institutions in tertiary hospitals and 30 (58.8%) institutions in general hospitals with 500 beds or more among the total 94 hospitals [Table 6].

Table 6: Distribution of hospitals by risk-adjusted unplanned readmission rate

Category	Total	Tertiary Hospitals	General Hospital more 500 beds
No. of Hospitals	Total	43(100.0%)	51(100.0%)
	Lower than the average	20(46.5%)	21(41.2%)
	Higher than the average	23(53.5%)	30(58.8%)

Discussion

In this study, cancer which cause frequent admission for treatment were excluded. Because readmission of cancer may not by insufficient quality of previous inpatient care or a series of procedures in the course of treatment. Some researches excluded cancer cases or cancer surgery in studying unplanned readmission. Further researches need to be conducted to find whether cancer cases are adequate to be included in studying readmission or not. This study was based on CMS of US standards however, it was recommended to establish criteria which could classify planned and unplanned readmission for Korean patients.

In Korea, patients throng into tertiary hospitals in large city such as Seoul. The tertiary hospitals are equipped with personnel, facilities, and equipment, thus the cost of medical care is higher than other level of hospitals. Quality of medical care was evaluated based on unplanned readmission rate with general hospitals with 500 beds or more with presumption that they maintain similar readmission rate with tertiary hospitals.

There was no significant difference in readmission rates between the two groups, but the variation of readmission rates was greater in the tertiary hospitals. The result implied that the tertiary hospitals had the same additional medical fee rate, but the variation in quality of care was large. STD and the CV of the cost per admission in the general hospitals 500 beds or more were larger than those of the tertiary hospitals. The variation in quality of medical care in readmission rate was stable in general hospitals with 500 beds or more, but unstable in medical cost. Further analysis was needed on the factors affecting the variation in the cost of medical care for the hospitalized in general hospitals.

One of unique characteristics of medical system of Korea was a tendency of tertiary hospitals being concentrated in mega cities. As tertiary hospitals tend to shorten length of hospital stay, hospitalization and discharge cases are being dispersed to local hospitals. We used U.S. CMS criteria for this study to categorize planned and unplanned admissions. The criteria that are more suitable for Korean situation should be developed.

Improvement of patient satisfaction, timely and proper discharge, encouragement of use of outpatient care after discharge, follow up care, proper care in the initial hospitalization, and national level intervention[14,15] are required to reduce readmissions.

Conclusion

The unplanned readmission rate of tertiary hospitals was higher than that of general hospitals. Despite the fact that 5%p more of medical fees for tertiary hospitals is applied, it can be assumed that the quality of medical services of general hospitals was better than that of tertiary ones.

The CV of unplanned readmission rate was higher in tertiary hospitals than in general hospitals with more than 500 beds, but the CV in cost was smaller in tertiary hospitals.

The variation of unplanned readmission rates for tertiary hospitals was the highest, suggesting that there was a significant difference of medical care quality among tertiary hospitals despite the fact that the same additional rate of medical fees was applied for all range of tertiary hospital services.

The STD and the CV of unplanned readmission cost in general hospitals over 500 beds are large, which means that there is a large disparity in costs among institutions of this hospital level.

Further study on the gap of medical costs in general hospitals will be necessary because there may be differences in the medical costs of each general hospitals depending on the application of too many examinations or non-coverage item in health insurance system.

It is also necessary to review the hospital level adjustment for the institutions with higher readmission rate among the tertiary hospital and for the institutions with less readmission rate among general hospitals over 500 beds.

These findings suggest the significance of monitoring quality of hospital care through variation of unplanned readmission rate of medical institutions. Appropriate interventions to reduce readmissions by improving quality of medical care are required.

Ethical Clearance: Not required

Source of Funding: Self

Conflict of Interest: The authors declare no conflict of interest.

REFERENCES

1. National Health Act, Regulations on Designation Criteria of the tertiary hospitals, Section 2. National Law Informationch Center in Korea, (2017).
2. Ministry of Health Welfare, National Health Insurance, List of Insured and Non Insured Services and Relative Value Score of Reimbursement, Notice of MOHW, No. 2018-50, (2018).
3. N. I. Goldfield, E. C. McCullough, J. S. Hughes, A. M. Tang, B. Eastman, L. K. Rawlins, R. F. Averill, "Identifying Potentially Preventable Readmissions", *Health care financing review*, (2008).
4. Centers for Medicare & Medicaid Services(CMS), *Hospital-wide all-cause unplanned readmission measure(final technical report)*, CMS&YNHHSC/CORE, (2012).
5. E. Y. Choi, M. S. Ock, S. I. Lee, "Is the Risk-Standardized Readmission Rate Appropriate for a Generic Quality Indicator of Hospital Care?", *Health Policy and Management*, (2016).
6. Health Insurance Review & Assesment Service(HIRA), *Study of readmission model categorize and standard development*, HIRA & Dankuk University, (2016).
7. Health Insurance Review & Assesment Service(HIRA), *Year of 2014 statistics of medical fee*. HIRA, (2015).
8. Centers for Medicare & Medicaid Services(CMS), *2014 Measure Updates and Specifications Report Hospital-Wide All-Cause Unplanned Readmission – Version 3.0*, CMS&YNHHSC/CORE, (2014).
9. M. S. Shin, W. J. Lee, "Estimation of cost by unnecessary readmission of the tertiary hospitals", *Korea convergency society*, (2017).
10. M. S. Shin, *Factors on Readmissions -Primary Admissions in the General Hospital, Readmissions in the Hospitals Using Health Insurance Claims data-*, Doctoral dissertation. Gachon University, (2018).
11. AHRQ CCS list, Retrieved from http://hcup-us.ahrq.gov/toolssoftware/ccs10/ccs10.jsp, (2013).

12. Health Insurance Review & Assesment Service(HIRA), *Korea Diagnosis Related Group(KDRG) ver. 4.2*, HIRA, (2018).
13. H. Quan, B. Li, C. M. Couris et al., "Updating and Validating the Charlson Comorbidity Index and Score for Risk Adjustment in Hospital Discharge Abstracts Using Data from 6 Countries", *AM J Epidemiol*, (2011).
14. J. Y. Moon, "An empirical study of the Strategy Development and Deployment effects on the Hospital Management and Hospital Performance", *Journal of the Korea Convergence Society*, (2015).
15. S. F. Jencks, M. V. Williams, and E. A. Coleman, "Rehospitalizations among Patients in the Medicare Fee-for-Service Program", *The New England Journal of Medicine*, (2009).