

Depiction of Trends in Administrative Healthcare Data from Hospital Information System

Leila R Kalankesh^{1,2}, Faramarz Pourasghar¹, Mohammad Asghari Jafarabadi³, Negar Khanehdan¹

¹School of Management and Medical Informatics, Tabriz University of Medical Sciences

²Health Services Management Research Center, Tabriz University of Medical Sciences

³School of Health, Tabriz University of Medical Sciences

Corresponding author: Dr Leila R Kalankesh, PhD, School of Management and Medical Informatics, Tabriz University of Medical Sciences, Iran, Email: lrkalankesh@tbzmed.ac.ir

ABSTRACT

Background: administrative healthcare data are among main components of hospital information system. Such data can be analyzed and deployed for a variety of purposes. The principal aim of this research was to depict trends of administrative healthcare data from HIS in a general hospital from March 2011 to March 2014. **Methods:** data set used for this research was extracted from the SQL database of the hospital information system in Razi general hospital located in Marand. The data were saved as CSV (Comma Separated Values) in order to facilitate data cleaning and analysis. The variables of data set included patient's age, gender, final diagnosis, final diagnosis code based on ICD-10 classification system, date of hospitalization, date of discharge, LOS (Length of Stay), ward, and survival status of the patient. Data were analyzed and visualized after applying appropriate cleansing and preparing techniques. **Results:** morbidity showed a constant trend over three years. Pregnancy, childbirth and the puerperium were the leading category of final diagnosis (about 32.8%). The diseases of the circulatory system were the second class accounting for 13 percent of the hospitalization cases. The diseases of the digestive system had the third rank (10%). Patients aged between 14 and 44 constituted a higher proportion of total cases. Diseases of the circulatory system was the most common class of diseases among elderly patients (age ≥ 65). The highest rate of mortality was observed among patients with final diagnosis of the circulatory system diseases followed by those with diseases of the respiratory system, and neoplasms. Mortality rate for the ICU and the CCU patients were 62% and 33% respectively. The longest average of LOS (7.3 days) was observed among patients hospitalized in the ICU while patients in the Obstetrics and Gynecology ward had the shortest average of LOS (2.4 days). Multiple regression analysis revealed that LOS was correlated with variables of surgery, gender, and type of payment, ward, the class of final diagnosis and age. **Conclusion:** this study presents trends in administrative health care data residing in hospital information system of a general public hospital. Patterns in morbidity, mortality and length of stay can inform decision making in health care management. Mining trends in administrative healthcare data can add value to the health care management.

Keywords: Pattern, Administrative healthcare data, Hospital Information System

1. INTRODUCTION

Information systems can provide essential evidence required for decision making in health care system (1). Administrative healthcare data are among main components of hospital information system. They are deployed for billing, registering, and managing healthcare system (2). Administrative healthcare data are invaluable as they are inexpensive and they cover large populations (3). Data residing in hospital information system can be analyzed and deployed for a variety of purposes (4, 5). Exploring such data can reveal patterns hidden in them. These trends can reveal the dynamics of diseases in a given community and accordingly health care demands of the population (6, 7). It can also highlight domains requiring change or improvement

and can be used for improving management of healthcare in resource-limited system toward tackling the priorities (8). The objective of this paper was to depict trends of administrative healthcare data from HIS in Razi general hospital (located in Marand city) over 3 years (March 2011 to March 2014).

2. METHODS

Data set used for this research was extracted from the SQL database of the hospital information system in Razi general hospital located in Marand (the second big city of East Azerbaijan Province with population of 239,209). Razi is a general and public hospital with 160 licensed beds and 120 active beds. Data of all patients (n=33505) hospitalized between 21 March

2011 and 20 March 2014 were included in the study. The data extracted from the database were saved as CSV (Comma Separated Values) in order to facilitate data cleaning and analysis. The variables of data set included patients' age, gender, final diagnosis, final diagnosis code based on ICD-10 classification system, date of hospitalization, date of discharge, LOS (Length of Stay), ward, and survival status of the patient. Records had been anonymized and the pseudo- identification number had been assigned to each records before releasing data to the researchers. To analyze and visualize data, the Rapid Miner and Excel were employed. Data cleansing and preparation techniques were applied on the data before analysis.

Main categories of diseases in ICD-10 classification system are presented in Table 1.

Title	Blocks	Chapter
Certain infectious and parasitic diseases	A00-B99	1
Neoplasms	C00-D48	2
Diseases of the blood and blood-forming organs and certain disorders involving the immune system	D50-D89	3
Endocrine, nutritional and metabolic diseases	E00-E90	4
Mental and behavioral disorders	F00-F99	5
Diseases of the nervous system	G00-G99	6
Diseases of the eye and adnex	H00-H59	7
Diseases of the ear and mastoid process	H60-H95	8
Diseases of the circulatory system	I00-I99	9
Diseases of the respiratory system	J00-J99	10
Diseases of the digestive system	K00-K93	11
Diseases of the skin and subcutaneous tissue	L00-L99	12
Diseases of the musculoskeletal system and connective tissue	M00-M99	13
Diseases of the genitourinary system	N00-N99	14
Pregnancy, childbirth and the puerperium	O00-O99	15
Certain conditions originating in the perinatal period	P00-P96	16
Congenital malformations, deformations and chromosomal abnormalities	Q00-Q99	17
Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere specified	R00-R99	18
Injury, poisoning and certain other consequences of external causes	S00-T98	19
External causes of morbidity and mortality	V01-Y98	20
Factors influencing health status and contact with health services	Z00-Z99	21

Table 1. Main categories of ICD-10 classification system

3. RESULTS

A total of 36505 patients were hospitalized in Razi general hospital from 21 March 2011 to 20 March 2014. About 64 % of patients were female and 36% of them were male. Mean of age among women and men were 34.4(SD=21.8) and 35.7(SD=27.6) respectively. About 14.9% of the hospitalization occurred in non-working days (weekend and holidays) and 85.1 % of patients were hospitalized in working days. Patterns observed for morbidity, mortality and length of stay are presented as follows.

3.1. Morbidity pattern

3.1.1. Temporal Trend

As it can be seen from figure 1, the morbidity showed a constant trend over three years. Pregnancy, childbirth and the puerperium (classified in chapter 15 of ICD-10), were the leading cause of hospitalization (about 32.8 %). Diseases of the circulatory system (categorized in chapter 9 of ICD-10) were the second most common category accounting for 13 percent of the hospitalization cases. The digestive system illnesses (chapter 11 of the ICD-10) had the third rank (10%).

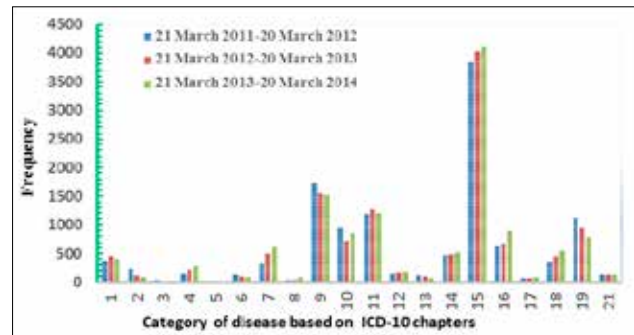


Figure 1. Temporal trend of morbidity in the hospital by class of disease

3.1.2. Type of admitting ward

The Obstetrics and Gynecology ward admitted the largest percentage of patients (34%). Twenty five percent of patients were hospitalized in Men's ward. Women ward admitted about 21 percent of the patients. About 11.2 % of hospitalization occurred in Pediatrics ward and 6.1% of the admissions took place in Neonatal ward. Only 1.6 % of patients were hospitalized in the CCU and the ICU admitted 1.2 % of all patients.

3.1.3. Age specific trend

Figure 2 depicts age trend of morbidity over 3 years (from March 2011 to March 2014). Overall patients aged between 14 and 44 constituted a higher proportion of total cases. As it is evident from the graph, diseases of the circulatory system (classified in Chapter 9 of ICD-10) were found to be the most common class of diseases among elderly patients (age ≥65). Hospitalization due to "pregnancy, childbirth and the puerperium", "diseases of the digestive system", and "injury, poisoning and certain other consequences of external causes" were more common among the patients aged between 15 and 44 than among other age groups.

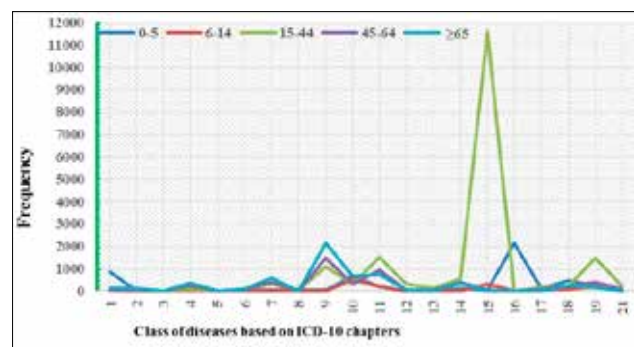


Figure 2. Age specific trend of morbidity by category of diseases based on ICD-10

3.2. Mortality pattern

3.2.1. Mortality trend and final diagnosis

Figure 3 shows mortality trend among patients in terms of final diagnosis. The highest rate of mortality was observed

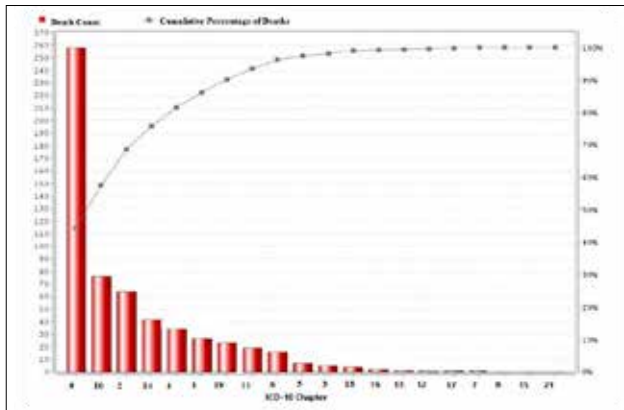


Figure 3. Mortality trend by class of final diagnosis (based on ICD-10 chapter)

among patients with final diagnosis of the circulatory system diseases followed by those with diseases of the respiratory system, neoplasms, diseases of the genitourinary system, endocrine, nutritional and metabolic diseases, and certain infectious and parasitic diseases.

3.2.2. Mortality trend and hospital ward

Exploring more details on the death cases revealed that about 48 % of all deaths occurred among patients hospitalized in the ICU and 27% of them in the CCU. The Men's ward and Women's unit constituted about 9.5 % and 9% of death cases respectively. The Pediatrics (0.3%) and Neonatal (0.5%) wards had the lowest proportion of total death cases.

Mortality rate for the ICU patients was 62%. The CCU patients had mortality rate of 33%. The lowest rate of mortality was observed among patients of Neonatal ward (0.001%) followed by those hospitalized in Pediatrics ward (0.048%), Men's ward (0.59%) and Women ward (0.68%).

3.3. Trends in length of stay

Length of hospital stay ranged from 1 to 73. Average of LOS (ALOS) for all wards was 3.28 days. The longest average of LOS (7.3 days) was observed among patients hospitalized in the ICU (with standard deviation of 8.5) while the obstetrics and gynecology ward had the shortest average of LOS (2.4 days) with SD of 0.65. ALOS and SD for CCU, Women, Men, Pediatrics, and Neonatal wards were "4.1±3.99", "4.1±2.9", "3.6±2.45", "3.4±1.84", and "3.23 days±1.26" respectively.

The longest ALOS was observed among patients with final diagnosis from the class of "endocrine, nutritional and metabolic diseases (5.19±3.66 days). Patients diagnosed with diseases of the eye and adnexa had the shortest ALOS (1.74 ± 0.7 days).

Multiple regression analysis revealed that LOS was dependent (statistically significant, p-value<0.05) on the variables of surgery (coefficient=-1.31), gender (coefficient=1.09), and type of payment (coefficient=0.19), ward (coefficient=0.16), the class of final diagnosis (coefficient=0.03), and age (coefficient=0.024). The predictive equation of the regression had R² of 0.68.

4. DISCUSSION

This paper presents trends observed in administrative health care data from hospital information system in a general hospital.

Temporal profile of morbidity implies a constant trend over the period of study. No transition might have happened in the population health of the region or their demands over this period of time. Overall pattern of morbidity observed in our study

is consistent with the fact that the non-communicable diseases are more prevalent than other categories of diseases in Iran (9, 10). This trend is also similar with findings of a study from Nigeria in which the non-communicable diseases constituted the majority of inpatient admissions to hospital (11).

High Proportion of hospitalization due to "Pregnancy, childbirth and the puerperium condition" is in accordance with the ratio of female to male (1.76) observed in our study.

"Pregnancy, childbirth and the puerperium condition" was the most common class of diagnosis among women aged between 15 and 44 years old. It is not surprising as this range of age is considered as the childbearing years (12).

The number of circulatory system diseases appears to increase with an increase in patient's age. This is in accordance with the fact that aging has significant impacts on the cardiovascular system (13).

Injury, poisoning and certain other consequences of external causes had a peak in patients aged between 15 and 44 too. WHO has reported that about 60 % of the total number of DALYs lost worldwide happens among those aged between 15-55 years as a result of road traffic injury (14).

According to our finding, patients hospitalized with final diagnosis of the circulatory system illnesses and diseases of the respiratory system lost their life more than other categories of patients. This is in line with the fact sheet released by WHO in which ischemic heart disease, stroke and respiratory diseases have been reported as the leading causes of death (15). This is also comparable with the statistics presented by Mehrdad (16), and Saadat and his colleague (17) in which the cardiovascular disease has been reported as the most important cause of death and neoplasms as the third one among Iranians. While these two reports have referred to the accidents as the second common cause of death among Iranians, diseases of the respiratory had the second rank of mortality cause in our findings.

Average length of stay observed in this study (3.28) is less than the mean (4.78 days) reported for the teaching hospital affiliated to Tehran University of Medical Sciences (18) and also less than the average (4.5 days) observed among American general hospitals (19) and American short stay non-federal hospitals (20). ALOS observed for the ICU ward in our study is higher than the value reported for the general hospital of Heraklion in Greece (4.5 days) (21) and the Neuroscience ICU (5.82 days), Surgical ICU (6.37), Medical ICU (3.08), CCU (1.23) wards of a tertiary care hospital in India (22).

Findings obtained from multiple regression analysis revealed that LOS were significantly correlated with the variables of surgery, gender, payment type, ward type, final diagnosis and age. Brandt investigated a predictive capacity of independent variables at admission time on dependent variable of LOS and found that physician specialty had the highest predictive power and gender had the poorest predictive capacity (23). However in our study the variables surgery and gender had the highest correlation with LOS.

Huntley and colleagues reported the correlation of age and admitting diagnosis variables with LOS in an acute psychiatric hospital (24).

This study was limited to the selection of administrative health care data as all desired administrative healthcare data were not available to the researchers. For instance exploring prescribing pattern was one of our aims; however these data

were not released to the researchers despite their willingness.

Developing research databases from hospital Information systems, particularly administrative healthcare data by medical universities appears to be inevitable if meaningful use of the data is to be achieved by researchers.

5. CONCLUSION

This study presents trends in administrative health care data collected in hospital information system of a general hospital. Patterns in morbidity, mortality and length of stay can inform decision making in health care management. Mining trends in other administrative data and clinical data can add even more value to the health care management. If meaningful use of data residing in hospital information system is to be realized in health care system, trends hidden in those data must be depicted and inform decision making in the system.

Acknowledgement

This paper has been prepared as a part of MSc thesis Project funded by School of Management and Medical Informatics at Tabriz University of Medical Sciences. Researchers acknowledge the cooperation of staff working in Medical Records and IT department of Razi hospital particularly Ms Mirzaei.

CONFLICT OF INTEREST: NONE DECLARED.

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