

ORIGINAL PAPER

Conceptual Model of Clinical Governance Information System for Statistical Indicators by Using UML in Two Sample Hospitals

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ABSTRACT

Objective: The purpose of this study was investigating situation and presenting a conceptual model for clinical governance information system by using UML in two sample hospitals. **Background:** However, use of information is one of the fundamental components of clinical governance; but unfortunately, it does not pay much attention to information management. **Material and Methods:** A cross sectional study was conducted in October 2012- May 2013. Data were gathered through questionnaires and interviews in two sample hospitals. Face and content validity of the questionnaire has been confirmed by experts. Data were collected from a pilot hospital and reforms were carried out and Final questionnaire was prepared. Data were analyzed by descriptive statistics and SPSS 16 software. **Results:** With the scenario derived from questionnaires, UML diagrams are presented by using Rational Rose 7 software. The results showed that 32.14 percent Indicators of the hospitals were calculated. Database was not designed and 100 percent of the hospital's clinical governance was required to create a database. **Conclusion:** Clinical governance unit of hospitals to perform its mission, do not have access to all the needed indicators. Defining of Processes and drawing of models and creating of database are essential for designing of information systems.

Key words: Clinical governance, Unified Modeling Language (UML), Statistical indicator, Information system.

1. INTRODUCTION

Clinical governance is a framework in which the organizations are held responsible for constantly improvement of care standards. This matter will be flourished by creating an environment whose focus is excellence in clinical services(1). Clinical governance is an integrated and systematic approach to ensure that services are held accountable for providing the healthcare with high quality (2). Seven focuses of clinical governance prepared by the members of clinical governance team of national health services in 1999, include: 1) using the information 2) risk management 3) clinical effectiveness 4) management of the personnel 5)continuous professional and personal training and development 6) clinical audit 7) participation of service user (1). Using the information is one of fundamental components of clinical governance (1-5). It is due to the fact that clinical governance requires good information to investigate the quality and performance of the services (6). Information management system is a system which provides information support for decision making in organizations at every level (7). Information management has been clearly linked to all components of clinical governance (8, 9). Information management is usually

designed as a cycle to be a linear process and involve the following processes: 1) conceptualization 2) data collection 3) designing a database 4) the procedure of transferring the received data to a file for subsequent revisions (entering the data) 5) Processing and analyzing the data 6) reporting and presenting the results 7) using the information (10).

Generally, Information Management presents the functions considered in clinical governance using statistical indicators, which are introduced in data collection section. It is due to the fact that indicators are the information that can a) be widely used for decision making on the quality management of patient care b) measure the effectiveness of medical health institutions c) indicate the performance of a hospital in various fields, and consequently d) make the goals of clinical governance be achieved (11). The results obtained from a study done by Taheri in social security hospitals of Tehran indicated that the supervisors of statistic department have problems in processing the data and have a poor performance in analyzing the data (12). The results of other studies also showed that the hospital officials have a relatively little knowledge of the statistical indicators and only 55 percent of calculated indicators are used and just

Indicators	Done		Not done	
	Frequency	Percentage	Frequency	Percentage
Percentage of all patients departing the emergency department within four 6 of arrival	2	100	0	0
Percentage of all patients departing the emergency department within 12 hours of arrival	1	50	1	50
Percentage of unsuccessful CPR in the emergency department	2	100	0	0
The ratio of early successful CPR to all CPRs done	1	50	1	50
The ratio of secondary successful CPR to all CPRs done	0	0	2	100
Percentage of leaving the emergency department upon personal responsibility*	1	50	1	50
The percentage of leaving other wards upon personal satisfaction*	1	50	1	50
Average time of triage per level of triage	0	0	2	100
The ratio of hospital infections	1	50	1	50
The number of consultations conducted to all consultations required	0	0	2	100
Time of consultations inside the hospital	0	0	2	100
Time of consultations outside the hospital	0	0	2	100
The ratio of the number of pressure ulcer cases to all admitted patients	0	0	2	100
The ratio of the number of nursing errors (medical, falling out of bed) to all admitted patients	0	0	2	100
Average waiting time of presence of CPR team after announcing CPR code	0	0	2	100
The average time of presence of patient from admission to transferring to the emergency department / discharge / death	0	0	2	100
The ratio of admission to the division of wards or specialty	1	50	1	50
Percentage of needle stick	1	50	1	50
The average waiting time for doing immediate radiography from doctor's order to receiving the result	0	0	2	100
Percentage of patients transferred to department within less than 12 hours (emergency discharge department)	0	0	2	100
Percentage of falling out of bed	0	0	2	100
The amount of insurance deductions	2	100	0	0
Patients' satisfaction with hospital services (in emergency department)	0	0	2	100
Patients' satisfaction with hospital services (except emergency department)	0	0	2	100
The amount of personnel's' satisfaction based on questionnaire	0	0	2	100
The amount of holding hospital committees according to instruction	0	0	2	100
The ratio of dialysis patients to dialysis beds	0	0	2	100
amount of maternal morbidity and near miss due to childbirth complications	0	0	2	100
Mortality after surgery	0	0	2	100
The ratio of staff nurse to job injuries(physical, mental and emotional) due to profession	0	0	2	100
The ratio of active bed to statistic bed	1	50	1	50
The ratio of medical staff to beds in emergency department	0	0	2	100
The rate of stillbirths	1	50	1	50
Mortality rate of newborns	2	100	0	0
Mortality rate of babies in the first 59 months of life	1	50	1	50
maternal mortality due to pregnancy and delivery complications	0	0	2	100
The ratio of surgeries done to operating table	1	50	1	50
Bed turnover interval	2	100	0	0
The rate of caesarian deliveries	1	50	1	50
Occupancy active bed rate	2	100	0	0
The average length of stay in hospital	2	100	0	0
The ratio of the deceased to all hospitalized patients	1	50	1	50
Overall	27	32.14	42	50

Table 1. Frequency distribution and state percentage of calculating indicators in 2 sample hospitals. * In another hospital the statistics of the emergency department and ward have not been presented separatel. **In another hospital just frequency is presented. *** In another hospital the statistics in this respect have been zero

about half of these are true indicators. Many statistical indicators needed for clinical governance are not calculated and presented in hospitals (14, 15). Only 35 percent of hospital indicators are calculated (16). Therefore, it seems that the processes related to the way of presenting the information require using the information management system for implementing the clinical governance whose prelude is designing a database using a conceptual modeling created by UML in each hospital. Hence, hospitals need to study their processes again and depict their models

to achieve the goals of clinical governance. For modeling all stages and constituent components of the process, software running is shown graphically to be imaginable for everyone. Given the complexity of the system, a variety of models is created to contain the data collected and summarized and also can show different levels of details.

The present study was aimed at presenting a conceptual model for information management based on clinical governance in two sample hospitals.

Status	No		Yes	
	%	frequency	%	frequency
Designing a database	100	2	0	0
Announcing the requirement for creating a database	0	0	100	2
Interpreting and analyzing the data	50	1	50	1
Reporting the results	0	0	100	2

Table 2. Frequency distribution of the state of existing database in 2 sample hospitals

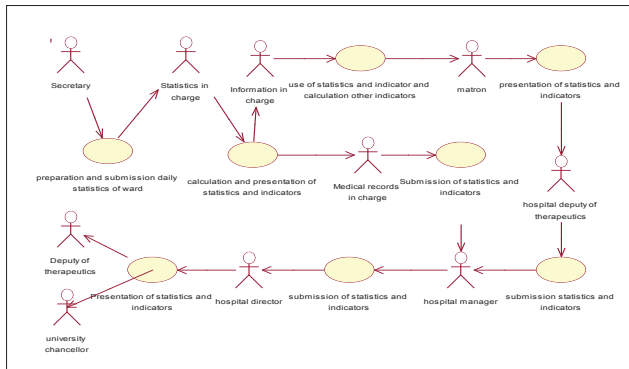


Diagram 1. Use case diagram in the shahid beheshti hospital

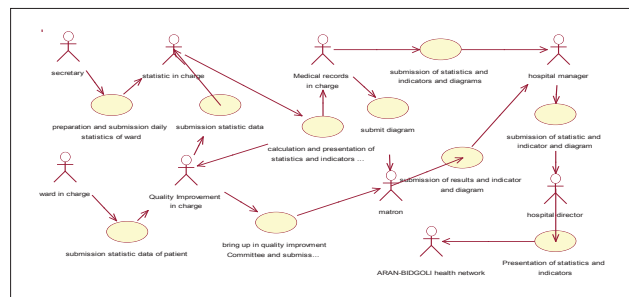


Diagram 2. Use case diagram in the Seyyedoshohada hospital

2. MATERIAL AND METHODS

The present study is a cross sectional study which investigates the existing processes. The population of the study was clinical governance units in two sample hospitals in Kashan in October 2012- May 2013 in two sample hospitals (including Shahid Beheshti and Seyyedoshohada hospital). The status of presenting the statistical indicators was collected through checklists. Data related to the scenario of current processes (the order of stages) in each hospital were collected through the questionnaire made by the researcher. Face and content validity of the questionnaire has been confirmed by experts. First data were collected in pilot way and the reforms were done based on data obtained and the final questionnaire was written. Data related to data collection processes were obtained through the interviews of the researcher with the supervisor of clinical governance unit and data presenting units. (Such as: statistic supervisor of medical record department, the secretary of the department and the supervisor of the ward in hospital). In each hospital the data obtained were

confirmed by observation. Data were analyzed using SPSS 16 software and descriptive statistics. Moreover, through data and scenario derived from the questionnaire, the models were presented using UML. UML diagrams were presented using Rational Rose 7. UML were collected based on the definitions bellow.

UML: Unified Modeling Language provides the standards for drawing a diagram and as a unified language is used for modeling all systems. Most of the elements of a UML are graphical. That is, they include lines, squares, rhombus and other shapes. Graphical elements of UML are just the graphical show of the things that need to be modeled. Graphical view helps people realize models or parts of the models.

UML diagrams: Out of different kinds of UML diagrams, Activity diagram and Use Case diagram can be named. Activity diagram explains different activities of a user (or system), the person who does each activity, and the sequence of activities. Use Case Diagram shows which actions occur in existing system and explains the behavior of a system from the perspective of a user. By using the diagram, the needs of system can be collected from the viewpoint of the users.

3. RESULTS

The results of the study, according to Table 1, indicated that 32.4 percent of the indicators were calculated in hospitals. According to Table 2, database was designed in none of the clinical governance units of the hospitals which were the population of the study (zero percent). In all clinical governance units of the hospitals, data were analyzed and interpreted and 100 percent of clinical governance units of the hospitals announced that they need a database.

Generally, in the sample hospitals, the statistics for 3 indicators (3.57 percent) were zero, for 6 indicators (7.14 percent) were presented overall for emergency department and ward (were not presented separately for the emergency department and ward) and for 2 indicators (2.38 percent) just the frequency was presented and no indicators were calculated for that.

The scenario of information system of clinical governance for presenting the statistical indicators in Shahid Beheshti Hospital: daily statistics were prepared and sent to statistic department by the secretary of each department. The statistic supervisor in each medical record department, calculated the monthly statistics such as the statistics and indicators of the rate of stillbirths, mortality rate of the newborns in the first 29 days of life, mortality rate of the babies in the first 59 months of life, bed turnover interval, the rate of cesarean deliveries performed, occupancy active bed rate, average length of hospitalized patient's stay in hospitals, the ratio of the deceased persons to overall admission. Then these statistics were given to the supervisor of the data in clinical governance department to calculate other indicators and send them to the matron. The indicators were as the following: The percentage of patients departing emer-

gency department within 6 hours, the percentage of patients departing the emergency department within 12 hours, the percentage of unsuccessful CPR in the emergency department and other wards, the percentage of leaving the emergency department or other wards(except emergency department) upon personal personality, the rate of hospital infections, the ratio of successful CPR to all CPRs done, the ratio of admission to wards division, percentage of needle stick, the ratio of surgeries done to operating tables. Then the matron sends the indicators to medical deputy of hospital and they send them to the manager of hospital. The manager sends all of the statistics and indicators obtained from clinical governance and medical record departments to the president of hospital. Then these statistics are sent to medical deputy and the dean of university by president of hospital. Diagram 1 indicates the use case diagram in the hospital. (See also diagram 3 in supplementary file)

The scenario of information system of clinical governance for presenting the statistical indicators in Seyyedshohada Hospital: The secretary of each department prepares daily statistic and sends them to statistic department. Statistic supervisor calculates monthly statistic and indicators such as: bed turnover interval, occupancy active bed rate, average length of patient's stay in hospital, mortality rate of the newborns in the first 29 days of life, mortality rate of the babies in the first 59 months of life, , the percentage of unsuccessful CPR in the emergency department and other wards .Then they present them to the supervisor of medical record department every month. The supervisor of medical records sends them to the manager of the hospital and the manager sends them to the president of hospital. Then the president of hospital sends them to the health network of Aran va Bidgol(all through automation). Then, a print from all diagrams is sent to the supervisor of clinical governance department (matron). Then the matron sends them to hospital management. Also, the departments send the statistics of leaving upon personal responsibility and patients' satisfaction with hospital services to the supervisor of quality improvement in clinical governance department. The supervisor of quality improvement calculates the frequency and presents it to the statistic supervisor. Statistic supervisor calculates the indicator overall and sends it to the supervisor of quality improvement. Then the overall statistic is presented to quality improvement committee and is sent to the supervisor of clinical governance (matron) and the manager of hospital respectively. Diagram 2 indicates use case diagram in the hospital. (See also diagram 4 in supplementary file)

4. DISCUSSION

Given the fact that in the hospitals which were the population of the study, there was no scientific and academic model concerning the medical records, statistics and indicators, at the beginning of the study, an investigation was done to determine the status of

calculating the indicators. In next step, the models were designed in forms of UML diagrams (UML diagram by using Rational Rose 7).

Databases prevent data uncertainty because unorganized data make the process of doing the tasks slow and long or cause many important points to be ignored. The presence of instruction and databases can be a good help for doing the tasks considering that arranging the data in form of a database increases the speed and accuracy. As a result, paying attention to the structure of conceptual model presented in the article provides a proper platform for designing a database using UML which is usually used for designing databases. The diagrams not only can contribute to discussing and analyzing the workflow design in relation to statistical indicators but also can be a sample for modernizing other functional capabilities of hospital. Given Table 1 only 25.79 percent of the indicators were calculated in the hospitals. 2.77 percent in cases like leaving upon personal responsibility, the rate of hospital infections, the ratio of consultations conducted to all consultations conducted, the percentage of needle stick, and the rate of stillbirths instead of calculating the indicator just the number of them was mentioned. Given the scenarios, it can be found out that enough attention has not been paid to the focus of using the information in clinical governance, whose important part is related to calculating and using the indicators, so it demands more attention from officials and process owners.

5. CONCLUSION

In practice, some indicators are not calculated or some of them are calculated but are not used. Defining the processes, drawing the necessary models, and creating databases are necessary for designing the information systems considering that clinical governance department of hospitals, for doing their missions, does not have access to all indicators needed.

Suggestions: It is suggested that hospitals, for calculating their indicators needed, define their processes and draw their models.

Acknowledgements

The present paper is the result of a master thesis. Research Deputy of Kashan University of Medical Sciences is highly appreciated for their financial support for carrying out the present study (Project No.9209). Also, all those who have helped us in this study are sincerely appreciated. The authors declare that have no conflict of interest.

CONFLICT OF INTEREST: NONE DECLARED

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Acta Informatica Medica - New Issue Available

Friday, 31 January 2014

The first issue of the Journal of the Academy of Medical Sciences of Bosnia and Herzegovina, the bimonthly published Acta Informatika Medica 1(22), 2014 is available. The current issue covers relevant topics such as the history of the European Federation for Medical Informatics as well as the history of Medical Informatics in General. It also contains a tribute to Morris F. Collen a true pioneer in medical informatics. For more information on the Journal and the current issue please refer to the Website of the Journal: Acta Informatica Medica Website or Pubmed

MIE2014 - Submission Deadline Extended

Wednesday, 29 January 2014

The 25th European Medical Informatics Conference - MIE2014 - will take place in Istanbul from August 31st to September 3rd, 2014. **The deadline for submissions was extended to 07.02.2014.** The conference addresses, but is not limited to, the following categories and themes:

Methodology (qualitative and quantitative)

- ▶ Information and Knowledge Representation
- ▶ Information and Knowledge Processing
- ▶ Empirical Research Methodologies

Applications (systems, goals, problems, policies)

- ▶ Improved healthcare through health informatics (theme of the conference)
- ▶ Health-care service delivery
- ▶ Policy, financing and stewardship
- ▶ Research and education
- ▶ Specific topics

For further information please visit the website at: www.mie2014.org

STC 2014 - Budapest, 26-29th of April 2014

Friday, 25 October 2013

ICIMTH 2014 ATHENS

The **International Conference on Informatics, Management, and Technology in Healthcare** supported by the European Federation for Medical Informatics will take place from **10-13 July in Athens.** For more information about the conference topics and the program please refer to the [Conference Website](http://www.icimth.org)

MIE 2014 ISTANBUL

The 25th International Congress of the European Federation for Medical Informatics will be held in **Istanbul, Turkey** from the