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Effect of Information Technology on ED's Performance Indicators

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Abstract

Background: Information Technology (IT) had innovations in the health sector that could facilitate the performance of the health service providers. Because of its sensitivity the emergency department should be organized appropriately and the process of service provision in this department should be precisely defined and determined to provide better services to patients with effective management. Hospitals performance indicators as well as are the most important tools to show the function of this department, which should be examined regularly and during the specified period. The aim of this study was, first, to identify the emergency department performance indicators and second, to determine the impact of IT on these indicators.

Method: This study was unsystematic-review study. The literature was searched of libraries, books, conference proceedings, data bank, and also search engines available at Google, Google scholar. In our searches, we employed the following keywords and their combinations: indicator, performance, evaluation, emergency and IT in the searching areas of title, keywords, abstract, and full text. In this study, more than 100 articles and reports were collected and 34 of them were selected based on their relevancy.

Results: According to the survey, it was observed that some of the indicators mentioned in the articles were common. A number of indicators include waiting time, Length of triage, Length of Visit, ED Length of Stay, ED admissions, Number of Tests and Images Ordered, ED Mortality and Percentage of unsuccessful CPR. Also the literature review showed that health information systems could have an impact on increasing the efficiency of the emergency department.

Conclusion: Checking the performance indicators are one of the most important duties of the emergency department and hospital manager that can help them to evaluate the emergency department and followed its status in terms of planning or scientific researches. These indicators are also used to predict the trend of works in the emergency departments.

Keywords: Emergency department; Information technology; Indicator; Evaluation; Performance

Introduction

The Emergency Department (ED) is the heart of the hospital. Regular workflows in this department can save many lives. Without active emergency and properly performance any hospital can be regarded as an ideal treatment center. And with such shortfalls other hospital services would be affected by the large defect [1]. The ED is the key point of the hospital and the relationship between hospital and community. Quick care, efficiency and effectiveness of this department can save the lives of many people and reduce the severity of disease [2]. The ED is the key point of the hospital and the relationship between hospital and community. Quick care, efficiency and effectiveness of this department can save the lives of many people and reduce the severity of disease. 75% of hospital admissions are referred to the emergency department so attention to the current processes of emergency and management of this department is very important [3]. In emergency department activities is facing with Stress and certain complexities. Dissatisfaction from the services is more visible than everywhere, especially in both pre-hospital emergency and hospital emergency room [4]. In about of the patients satisfaction factors in emergency in their research showed that among the patient dissatisfaction factors in emergency that include the physical environment, staffing, equipment and management factors, patrons expressed equipment and medical equipment as the first factor of their dissatisfaction. And accordingly to this emergency managers can use with medical equipment and new technologies in order to create the basic steps to take patient satisfaction [5]. Current age is called information age and information technology (IT) explosion affect all of the life and business aspects [6]. In fact,

the first distinction between developed and developing countries, are the production, application and utilization of information [7-9]. Nowadays, with the development of hospital information systems in healthcare centers, the use of software, hardware and new methods in order to increase the speed and quality of health care services is growing [10]. The advantages of using these technologies is extent that not only reduce errors and increase the speed and accuracy of providing health services to the patients, But also reduces costs through coordination of services and improve the quality of health care [11]. The ED is an exceptional environment, where visits are unscheduled, patients undifferentiated, and care decentralized. Workflows vary from ED to ED and even patient to patient. It is clear that the Health Information Technology (HIT) presents ongoing opportunities to improve the quality of emergency care, promote patient safety, reduce medical errors, and enhance the efficiency of emergency departments [12]. So by considering the critical role of the ED in health care to avoid duplication, improve quality and care, and reduce costs it is worthy this department and other related provisions of service units to be

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assessed [13]. Nowadays, various tools and methods used to measure performance in organizations. And if done correctly and consistently, be able to develop of executive organization accountability and Increase public confidence in the performance and efficiency and effectiveness of public and private sector. One of the distinguishing and helpful features of performance assessment is that it should have quantitative aspect and calculate the outcomes of assessment in computable values. Actually the performance assessment is a process that deals to measure, valuation and judgment about performance during a certain period. Indicators are valuable tools and fixed quantity that describe a target population. Indicators clear the organization path to reach its goals [14]. Hospital performance indicators are the most important tool to represent the hospital performance that should be examined regularly and during the specified period. Indicators determined are one of the most important duties of the hospital department heads.

The key performance indicators, evaluate the system in a way that responds to the basic questions posed by the most significant stakeholders, such as healthcare policy makers, patients and employees. These indicators can describe the emergency services and furthermore, these KPIs are a tool that can be easily understood by researchers, physicians, ED managers [15].

The aim of this study was, first, to identify the emergency department performance indicators and second, to determine the impact of IT on these indicators.

Methods

This study was unsystematic reviewed which was divided into three phases that include search, assessment, and selection of related resources. The searches were done through libraries, books, conference proceedings, data banks, and also search engines available at Google, Google scholar and with regard to the issue of the emergency department performance indicators and the impact of IT on these parameters. In our searches, we employed the following keywords and their combinations: indicator, evaluation, performance, emergency, HIS, and IT in the searching areas of titles, abstracts and full texts. In this study, more than 100 articles and reports were collected and 34 of them were selected based on their relevancy. The criteria for the selection of the articles included 1) Articles related to the evaluation of the performance of the emergency. 2) Articles that not only related to evaluation of the performance of the emergency, but also deal with the impact of IT on these indicators. After selecting the articles we determined them for identifying performance indicators of emergency department. Then we also investigated the impact of technology use in the emergency department in the papers deal with IT.

Results

All emergency department performance indicators that have mentioned in selected articles have listed in the following Table 1. According to the survey, it was observed that some of the indicators mentioned in the articles were common. A number of indicators include waiting time, Length of triage, Length of Visit, ED Length of Stay, ED admissions, Number of Tests and Images Ordered, ED Mortality and Percentage of unsuccessful CPR. The main purpose of the emergency department is emergency medical services. Therefore, Medical condition of patients must be clear within the short time. In other words long-term Staying in emergency room decrease the possibility of providing services to other patients requiring emergency medical care and this leads to patient dissatisfaction and losses due to disasters [16]. Parish stated that emergency department is introduced the heart of the healthcare' systems, and the most important priority of

the ministry of health is improvement the condition and organization of it, Their study results showed that total number of patients through two month was 6517, the median lengths of triage was 8 minutes, the average lengths of first doctor visit was 6 minutes, Percent Discharge Against Medical Advise (DAMA) was 8.16 percent from the total visitor, the 56.71 percent of patients decided within 6 hours and 60.65 percent decided within 12 hours and the percentage of unsuccessful Cardio Pulmonary Resuscitation (CPR) was 22.72. Finally they offered solutions such as audit the level of triage trains, constant monitoring of the performance of emergency personnel and transfer the laboratory to the nearby emergency department [17]. The best known metric for the measurement of the performance of emergency is Length of Stay (LOS), as it refers to the time period spent by the patient in the ED. The LOS is a descent indicator for crowding in the system. A KPI that is very useful for patients that require immediate medical treatment is "the time to first treatment"(TTFT) or waiting time, used to count the time interval between the arrival in the ED and the first treatment by a physician [15].

The impact of IT on the ED through the performance indicators

One goal of this study was to determine the impact of IT on emergency performance indicators. The results of some of the papers on this subject were followed:

Yamaha et al. argued that in Japan to reduce Ambulance arrival time to health care centers used a system that reduced the time to send patient for 37 minutes in 2010 [18]. These systems intended tablets for emergency staff on-site ambulance and target hospital personnel to share the Information of available hospitals through the network. How it works will be that, after the emergency personnel arrived to the patient's bedside, enter the name of the patient and his disease and searched based on the symptoms and available specialists to find the appropriate hospital. Finally uses of this communication system caused In addition to the reference time reduce to 34 minutes, in a year there are about 400 thousand dollars in savings [18].

Bell et al. performed a quasi-experimental study to compare the completeness of ED discharge instructions before and after introduction of an electronic discharge instruction module by scoring compliance with the Centers for Medicare and Medicaid Services (CMS) Outpatient Measure 19 (OP-19). According to their study the electronic discharge instructions had a 97.3% overall OP-19 compliance, while the paper-based discharge instructions had overall compliance of 46.7%. The largest improvement was in documentation of major procedures and tests performed: only 60% of the paper-based discharge instructions satisfied this criterion, compared to 100% of the electronic discharge instructions. There was a modest difference in medication documentation with 92.7% for paper-based and 100% for electronic formats. There were no statistically significant differences in documentation of patient care instructions and diagnosis between paper-based and electronic formats. They concluded that IT can improve the completeness of ED patient discharge instructions and emergency performances [19].

Mohan et al. in 2009 conducted a retrospective study to determine whether implementation of the Cerner First Net electronic medical record system was associated with any change in ED performance [20]. First Net (Cerner), an EMR system, has been introduced in emergency departments (EDs) around New South Wales since 2007. This system replaced the Emergency Department Information System (EDIS) which was previously used in most NSW EDs. In this system all medical documentation became electronic, including doctors'

Title	Author, Year, Reference number	Performance indicators of ED
HIT Adoption in the ED	Selck & Decker [23]	• Time to See a Physician • Length of Visit • Number of Medications Prescribed • Number of Tests Ordered • Number of Images Ordered
Effect of an electronic medical record information system on emergency	Mohan et al. [20]	• Waiting time • Treatment time • Total time for patients discharged from the ED; • Proportion of patients who did not wait to be seen by a doctor (DNW rate) • Proportion of ambulance offload waiting times
ACT Auditor-General's Office Performance Audit Report	Australian Capital Territory Auditor General Office. [24]	• Emergency Department waiting times • Emergency Department length of stay
The Development of Indicators to Measure the Quality of Clinical Care in Emergency Departments Following a Modified-Delphi Approach	Lindsay et al. [25]	• Mortality • Morbidity • Admissions • Return to ED • Return to Primary care • ED Length of Stay • Diagnostic Testing • ED Resource Use
Emergency Department Operation In Top-Performing Safety-Net Hospitals	Anthony et al. [26]	• Registration • ED LOS (Overall, hours) • ED admissions
Use of Health IT to Manage Frequently Presenting Emergency Department Patients	Stokes-Buzzelli et al. [21]	• Total ED Charges • The number of lab studies ordered • Average Number of ED visits • ED Length of Stay (Minutes) • Total Emergency Department Contact Time (TED)
Ontario Hospital Strategic Plan: 2013 – 2016	Ontario Hospital Association [27]	• Patient Experience in Emergency Room • Wait Times in Emergency Room
Improving the Performance of ED: A Survey from an Operations Management Perspective	Jouini et al. [15]	• Length of Stay (LOS) • Time to First Treatment (TTFT) • Left without being seen (LWBS) • Ambulance Diversion (AD) • Fairness
Evaluation of ED Performance – a systematic review on recommended performance and quality-in-care measures	Sorup et al. [28]	• Morbidity/mortality • LWBS (Left Without Being Seen) • Bed occupancy rate • Number of laboratory studies • Number of plain radiographic studies • ED admission transfer rate • LOS (Length of Stay), • total Ambulance off-loading time • Arrival -- Init. Triage • Triage -- Init. Treatment • Arrival -- Init. Treatment • X-ray ordered -- X-ray taken
ED Key Performance Indicators	Carol-Anne Lever [29]	• Time to treatment • Patients seen and discharged within 4 hours of presentation • Patients seen, treated and admitted to an inpatient bed from the ED • LOS greater than 24 hours in the emergency department:
A national system for monitoring the performance of hospitals in Ethiopia	McNatt et al. [30]	• ED attendees • ED patients triaged within 5 minutes of arrival at ED • ED attendances with stay longer than 24 hours • Emergency referrals, as a proportion of all referrals made • ED mortality
The indices provided by the Ministry of Health and Medical Education In Shahid Madani emergency department and strategies to improve it	Parish et al. [17]	• Total number of patients • The median lengths of triage • The average lengths of first doctor visit • Percent DAMA • Patients decided within 6 hours • Patients decided within 12 hours • Percentage of unsuccessful CPR
Evaluation of ED department activity	Baratlou et al. [31]	• Patients decided within 6 hours • Patients discharged from the emergency department within 31 hours • Percentage of unsuccessful CPR • Leave with personal responsibility • Average lengths of triage
Performance Evaluation of Emergency Medicine in Al-Zahra hospital in 1389	Mousavi et al. [32]	• Patient's waiting time to See a Physician first • The DAMA • Average length of stay
The speed of service in Kerman ED of Bahonar Hospital in 2000	Zohour and Pilevarzade [33]	• Average time between accidents to arriving Physician's office • The time between patient arrivals to the Physicians room to start examinations • The time between Lab test request to results taken • The time between radiology request to results taken • The time between CT scan request to results taken • Delay time for first consultation • The delay time between the start of the examination to make a diagnosis • Waiting time in the operation room of emergency

Table 1: Performance indicators of ED.

examination notes, nursing progress notes, patient observations, and electronic ordering of pathology and radiology investigations. The result of their study on the emergency patient's trough the 6 months showed that there were increases in the waiting time for all patients (median, 40min v 78min) and total time (median, 214min v 280min) for patients discharged from the ED. There were increases in the proportion of patients who did not wait to be seen by a doctor (DNW rate) (8.3% v 15.6%) and the proportion of ambulance offload time longer than 30 minutes (10.5% v 13.3%). According to their study, they stated that we found a reduction in performance with respect to ED KPIs after implementation of the First Net system. So Implementation of the First Net electronic medical record system was associated with deterioration in ED KPIs [20].

In Figure 1 the indicators are divided into four categories and the emergency and the impact of IT on these indicators has shown.

Buzzelli et al. performed the retrospective study between June 2005 and July 2007 to determine the effectiveness of use the Health Information Technologies (HIT) and the Electronic Medical Record (EMR) in ED that complicated frequently presenting patient population. According to this study that the ED charges decreased by 24% from $64,721 to $49,208. The number of lab studies ordered decreased by 28% from 1847 to 1328. The average number of ED visits/patient decreased by 25% from 67.4 to 50.5. The Total Emergency Department Contact Time (TEDCT) decreased by 39% from 443.7 hours to 270.6 hours. They argued that the effective and efficient management of frequently presenting emergency department (ED) patients are challenges for many EDs. Frequently presenting ED patients have higher incidences of chronic medical conditions, higher overall mortality rates, incur higher healthcare costs more frequently than the overall ED population. According to their study, they stated that, the use of HIT and the EMR to identify patients and store easily accessible care plans significantly reduced ED charges, labs ordered, number of ED visits, and the TEDCT [21].

Selck and Decker performed the study to describe the trend in HIT systems adoption in hospital EDs and its effect on ED efficiency and resource use. Their results showed that the percent of ED visits that took place in an ED with at least a basic health IT or an advanced IT system increased from 25.2 and 3.1 percent in 2007 to 69.1 and 30.6 percent in 2010, respectively. Waiting times were reduced by 6.0 minutes in advanced IT-equipped EDs, and the number of tests ordered increased by 9 percent. According to their study, they argued that health information technology adoption in the ED is associated with a nontrivial and persistent reduction in waiting times. When taken in combination with the reduced waiting times and the lack of a detectable increase in the average length of visit, our findings suggest that advanced health IT systems may have an effect on increasing ED efficiency [16].

Finnell et al. stated that According to the American Medical Association electronically health exchange can save time and costs for both physicians and patients. The institute also states that share health information could well be reduced diagnostic testing and the costs associated with it and also cause the correct prescription and investigation [22].

Discussion

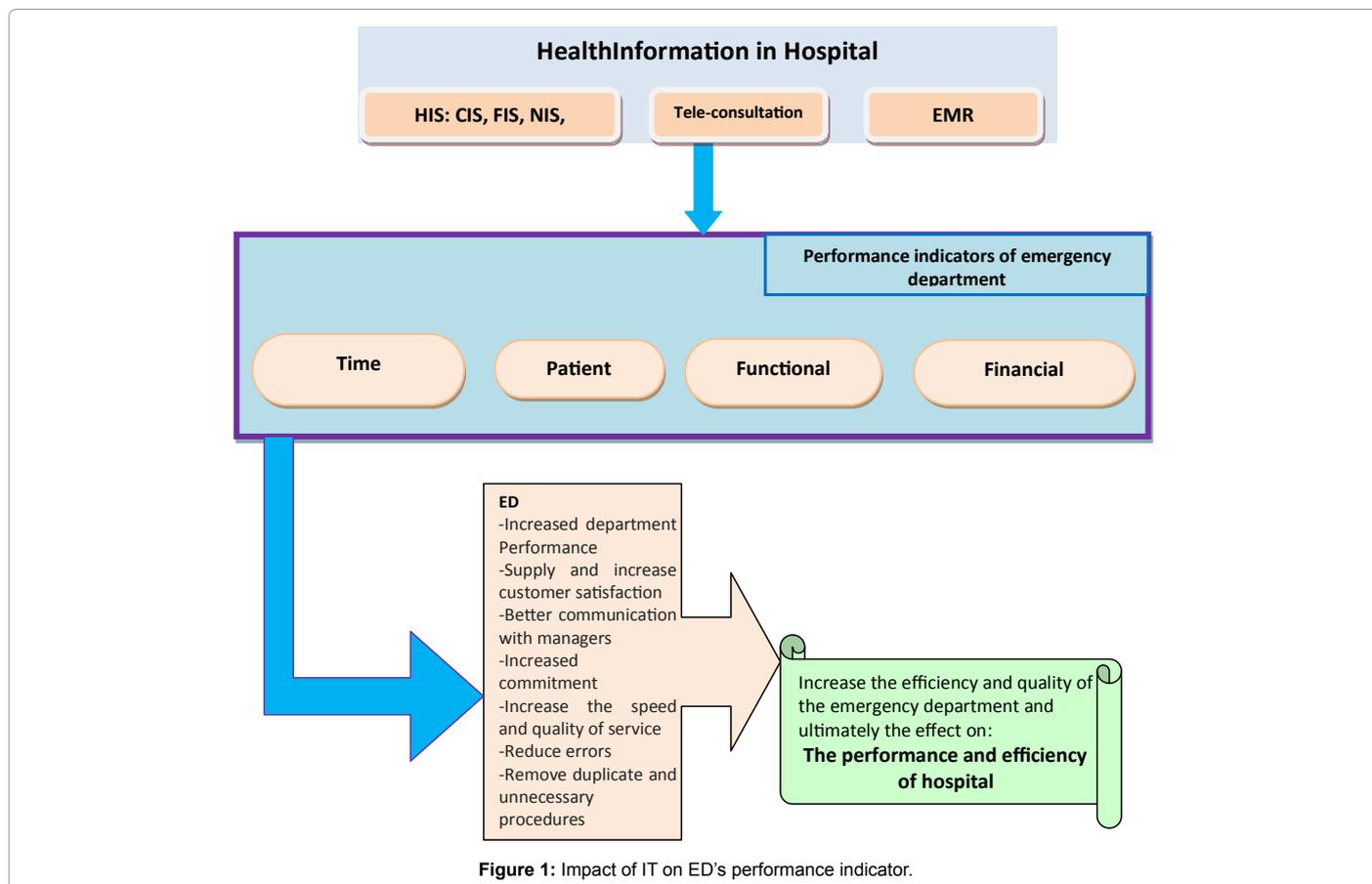The ED is a crucial component of a hospital for treatment the

Figure 1: Impact of IT on ED's performance indicator.

ill and injured patients. Emergency medical providers have been tasked with handling huge increases in patient load, and making sure patients who are admitted have a smooth transition into the hospital. Monitoring and evaluation of the emergency performance are the most important processes of this department. Developing the Quantitative Standards and specify the range of valid and meaningful indicators for any treatment in an emergency is the most important activity of this main process [23-28]. Today, emergencies faced with a large volume of patients and health IT has a key role in the management of patients. Using IT can be useful to improve the performance evaluation results [29-34].

Conclusion

A number of indicators include waiting time, Length of triage, Length of Visit, ED Length of Stay, ED admissions, Number of Tests and Images Ordered, ED Mortality and Percentage of unsuccessful CPR. Checking the performance indicators is one of the most important duties of the emergency department and hospital manager that can help them to evaluate the emergency department and followed its status in terms of planning or scientific researches. These indicators are also used to predict the trend of works in the emergency departments.

Support and Source of Funds

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