Using Six Sigma to Assess Quality in the Jordanian Health Care Sector

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Abstract
This study applied Six Sigma methodology to selected hospitals in Jordan to evaluate their performance, compare the results, and suggest methods to improve the hospitals’ operations and reduce medical errors. Four hospitals were selected from both the public and private sectors. By using a series of interviews, archival reviews and a questionnaire, the study found that the studied public hospitals outperformed their private counterparts with some variations in the type of medication errors. Several recommendations were made to improve the processes followed, which could raise the value of the Six Sigma coefficient. This study provides an example of how applying knowledge management techniques can have a strong effect on improving customer service and reducing costs.

Keywords: Six Sigma, Quality, Healthcare, Medication Errors, Knowledge Management

1. Introduction
Six Sigma is a relatively new methodology for quality that provides a systematic way of improving business processes based on customer needs and factual analysis of company processes with an emphasis on defects prevention rather than defects detection.

Six Sigma involves a set of quality and management strategies and tools which have been used by many companies to achieve accuracy, speed, and at the same time reduce costs. It can be used by organizations to enable them to remain competitive and effective when facing the pressures from an increasingly global marketplace, where satisfying customers and making profits are a continuous challenge. Yuksel (2012) noted that minimizing defects will ensure that customers’ satisfaction increase and costs decrease.

It is an extension of other quality initiatives such as Deming’s Statistical Quality Control, Total Quality Management (TQM), statistical process control and Balanced Scorecard.

Six Sigma complements and expands on Total Quality Management (TQM). While many of the objectives of Six Sigma are similar to those of TQM (e.g. customer orientation and focus, team-based activity, comprehensive education, and problem solving methodology), Six Sigma aims are more aggressive and its methods are better defined. There are also elements in Six Sigma that distinguish it from TQM: It requires clear financial gains within limited time frames; employees involved receive a rigorous training program; and it is top-down driven (Chen et al., 2008). Therefore, it is TQM with strong customer focus, additional data analysis plus financial results and project management (Kwak and Anbari, 2006). Second, Six Sigma provides a well-defined target for quality that the process defects rate should not be more than 3.4 defects per million opportunities. Thirdly: Six Sigma is mostly a business result-oriented model compared to the return on investment orientation of TQM (Bertels, 2003).
Six Sigma contributes to knowledge management (KM) within organizations. The latter can be defined as “the process that creates or locates knowledge and manages the dissemination and use knowledge within and between organizations.” (Darroch, 2003). So knowledge management is concerned with the representation and processing of knowledge by humans, machines, organizations, and societies. Six Sigma programs create knowledge within an organization as it helps improve business processes based on customer needs and factual analysis of company processes.

Six Sigma is suitable for health care because many health care processes require a near zero tolerance for mistakes (Revere, 2003). Krajewski et al. (2010) indicated that in health care, management could incorporate Six Sigma with the current total quality management effects so that minimal disruption occurs in the organization.

This is of specific importance to the Jordanian health care system which served over 4 million patients in 2008 (Diab, 2012). In 2012, there were 30 public hospitals and 60 private hospitals in Jordan spread all over the country. The budget allocated to health care was about 24.5% of the total national budget. The number of workers working in the private healthcare system is unreported, but it was around 26,000 in the public sector in 2008 (Civil Service Bureau, 2008). There were no published figures on the contribution of the health care sector to the GDP, but Jordan has been promoting itself as a regional center for medical services offering quality services at regional affordable prices. All activities that aim to improve the medical process and reduce medication errors are likely to bring a great benefit to the Jordanian population and to the economy.

**Study Objectives**

The aim of this study is to apply Six Sigma in the healthcare sector, specifically, to some hospitals in Jordan, compare the results, and suggest methods to improve the hospitals’ operations. Applying this method to hospitals in Jordan has been a challenging issue in general; especially that it has not been used in Jordanian hospitals before. Applying Six Sigma is expected to contribute to knowledge management efforts within hospitals, which is likely to reduce medication errors and improve the services offered. Specific objectives include:

1. Identify suitable variables / factors to measure the medication errors and thus the levels of Six Sigma in some Jordanian hospitals.
2. Evaluate the Six Sigma values for some hospitals, compare the results, and identify which area (prescribing, dispensing, or administrating) is the largest contributor to the overall number of medication errors.
3. Make relevant recommendations to reduce medication errors in the studied hospitals.

**2. Literature Review**

The concept of Six Sigma was initially developed by Mikel Harry at Motorola in 1987 to improve the performance of key processes, productivity, quality of its products, and reduce costs (Revere, 2003).

Motorola initially used this technique to reduce the number of defects for each of its processes to one-tenth of the previous levels of performance. Eventually, the technique helped Motorola improve its manufacturing capability and reduced customers’ complaints about its product quality. As a result, the net income of Motorola jumped from $2.3 billion in 1978 to $8.3 billion (Han & Lee, 2002). The approach has since been adopted by many world-class companies such as General Electric, Sony, Nokia, General Motors (GM), Dow Chemical, IBM and other companies in the US, Asia and Europe (Antony, 2004).

Technically, Six Sigma is a disciplined data-driven approach and a methodology to eliminate defects in any process, product, or service that relies on the assumption that the output of every process should fall within acceptable limits (Carregan and Kujawa, 2006).

The term Six Sigma process comes from the notion that if one has six standard deviations between the process mean and the nearest specification limit, then no item will fail to meet specifications. This is why Six Sigma aims to have processes where the mean is at least 6σ away from the nearest specification limit. In such a case, the process is considered capable if there were no more than 3.4 defects per million opportunities for a process that is normally distributed.

However, Six Sigma is not just another quality initiative as it emphasizes the need to start with processes and defects from a customers’ point of
view, and outlines a management organization for effectively implementing change (Chang and Wang, 2008; Chkravorty, 2009).

There have been many definitions of Six Sigma in Literature. Harry and Schroeder (2000) defined Six Sigma as “a disciplined method of using extremely rigorous data gathering and statistical analysis to pinpoint sources of errors and ways to eliminate them”. Snee (2000) indicated that Six Sigma should be a strategic approach that works across all processes, products, company functions and industries. Han et al. (2000) described Six Sigma as a disciplined and statistically based approach for improving product and process quality. Chowdhury (2001) indicated that Six Sigma represented a management philosophy that taught employers how to improve the way they do business, scientifically and fundamentally, and how to maintain their new performance level. It gave discipline, structure and a foundation for solid decision-making based on simple statistics. Pande et al. (2002) added that it was uniquely driven by a close understanding of customers’ needs, disciplined use of facts, data, statistical analysis and diligent attention in managing, improving and reinventing business processes. Linderman et al. (2003) believed that Six Sigma cared to reduce customer defined defects.

Six Sigma can be implemented through one of the two key methodologies inspired by Deming’s Plan-Do-Check-Act cycle (Cheng, 2008). These are the DMAIC (Define, Measure, Analyze, Improve and Control) for improving an existing business process; and DMADV (Define, Measure, Analyze, Design and Verify) for creating a new product or a process design.

In implementing Six Sigma, Breyfogle (2003) and Pyzdek (2003) argued that it required time, commitment and education, and was also affected by both methods and psychological variables (Choo et al., 2007). Additional keys for its successful implementation included: a) sufficient education to employees in the “why” and “How-to” of quality concept and what it means to customers, both internal and external; b) good project planning, measurement of financial results, and sufficient executive support as it provides sufficient resources and reflects commitment.

There are many applications of Six Sigma in various fields. Goh et al. (2003) investigated the application of Six Sigma in the financial service industry and found that firms that utilized Six Sigma outperformed comparable institutions in performance, financial ratios and stock prices. Salaheldin and Abdelwahab (2009) studied the process of Six Sigma implementation by banks in Qatar. Findings indicated that implementing quality control tools in general and Six Sigma in particular, required certain tools and techniques that were found to be unsuitable or were difficult to implement in the banking industry of Qatar. The findings confirmed that there was hardly any difference among the different managerial levels in perceiving and evaluating the benefits and the successful factors of the quality control tools implemented in the banking sector.

Prabhushankar et al. (2009) used Six Sigma on a sample of 25 Indian automotive companies. Using a multitude of data, they noticed an increase in profitability and an improvement in quality.

Chang and Wang (2008) applied Six Sigma methodology and proposed a continuous improvement model on different phases of collaborative planning, together with forecasting and replenishment (CPFR), which is a processing tool that improves supply chain management (SCM). They aimed to demonstrate how to improve the performance of collaborative forecasts using the Six Sigma methodology. The results showed that the proposed improvement model could effectively improve the accuracy of collaborative forecasts. They also argued that the most important obligation would be the sharing of information and the building of trust among trading partners involved in collaborative forecasting.

A descriptive survey was undertaken in Netherlands, UK and USA. They found that successful Six Sigma implementation should build upon a number of quality management prerequisites such as an existing quality culture and a certain level of quality maturity. Secondly, the sustainability of Six Sigma in the long term depended on many factors such as top management commitment, being able to show successful projects, high investment in training, high investment in management time, and involvement of key players in the organization.
Six Sigma was also used in the health care industry. As a process performance improvement methodology that seeks a nonexistent error rate, Six Sigma is ripe in the healthcare industry because many healthcare processes require a near-zero tolerance for mistakes (Antony, 2004; Antony and Banuelas, 2002).

Six Sigma projects in health care industry were focused on direct care delivery, administrative support and financial administration (Goh et al. 2003). More specifically, it can be executed in the following health care processes: Improving patient satisfaction, improving bed availability across various departments in hospitals, reducing the number of medications errors and related wound problems (Revere and Black, 2003).

The multiple steps in the medication chain, from when the drug is prescribed to when a patient receives the drug, leads to significant scope for error. Significant improvements can be achieved from the prevention of medication errors, resulting in reduced patient morbidity, length of hospital stay, and healthcare costs. Medication errors may also be classified according to where they occur in the medication use cycle, i.e. at the stage of prescribing, dispensing, or administration of a drug.

Revere (2003) integrated Six Sigma with TQM to provide an example of Six Sigma measurements’ scheme. To compute Six Sigma levels, Revere (2003) identified and measured two ratios: Medication error and opportunities for medication errors. These errors included three categories: prescription errors, dispensing errors, and administrating errors.

Revere (2003) concluded that integrating Six Sigma and TQM programs could improve the quality without significantly increasing costs. Additionally, Six Sigma data could be used to identify improvement opportunities, benchmark with peer hospitals, and objectively monitor and assess hospital performance.

The studies showed the importance of Six Sigma in improving the relevant processes thus providing better services and products.

### 3. Research Methodology

This study employed an applied research methodology to test the outlined research problems in four hospitals; two public hospitals (i.e. King Abdullah II and Prince Basma) and two private hospitals (i.e. Ibn- al Nafees and the Specialist). The four hospitals are located in the city of Irbid, in the northern part of Jordan.

The needed data was partially derived from structured interviews with the directors of related hospital departments and from the archival records and medical files in each hospital. The questions revolved around two main departments; the internal medicine and surgery departments in each hospital, being the ones with the largest volume of operations. In addition, a questionnaire directed to caregivers in the respective hospitals was used to determine more details about the nature of the medication errors, and to support/validate the results collected in the interviews.

Ten semi-structured interviews were carried out for each hospital for a total of 40 interviews made. The interviews normally started with few open questions and ended with specific questions to collect the required data for calculating medication errors for each hospital.

The used questionnaire consisted of 33 developed questions using a five-point Likert scale. The questionnaire consisted of two sections. Section one included the demographic characteristics of the respondent (e.g. age, hospital name, specialty, and job experience), while section two consisted of three sets of questions each dealing with one type of medication error; namely, prescription, dispensing and administration errors.

The prescription errors section included eight questions; the dispensing errors included 14 questions and the administration errors section included 11 questions.

Questions about prescription errors questioned doctor’s knowledge of updated medicine research, proper patient’s diagnosis, correct dosage calculation, knowledge of patient’s medical history, drug sensitivity, and the clarity of doctor’s handwriting in drug prescription. Questions about dispensing errors included pharmacist role, medication storage conditions at pharmacies, stock management, and actions are done by a pharmacist when in doubt. Questions about administration
errors included doctor’s abiding by the medicine administration instructions, medicine’s integrity, education to the patients of the medicine’s correct usage and potential side effects.

To compute the hospital's Sigma level for a given process, the following equations, derived from literature (Revere, 2003) were used:

\[ MER_i = \frac{ME_i}{NOE_i} \quad \text{Equation 1} \]

where:

\[ MER_i = \text{Medication Error Ratio in the case of (i)} \]
\[ ME_i = \text{Number of Medication Errors in the case of (i)} \]
\[ NOE_i = \text{Number of Opportunities for errors in the case of (i)} \]
\[ i = \text{Denotes prescription, dispensing or administering error} \]

with

\[ NOE_{\text{Prescription}} = PE \times NO \times NA \quad \text{Equation 2} \]

where:

\[ NOE_{\text{Prescription}} = \text{Number of opportunities for Administration errors} \]
\[ PE = \text{Potential prescription errors} \]
\[ NO = \text{Average number of prescriptions received per patient} \]
\[ NA = \text{Number of patients admissions per year} \]

and

\[ NOE_{\text{dispensing}} = PE \times NO \times NA \times ALS \quad \text{Equation 3} \]

where:

\[ NOE_{\text{dispensing}} = \text{Number of opportunities for dispensing errors} \]
\[ PE = \text{Potential dispensing errors} \]
\[ NO = \text{Number of orders per day} \]
\[ NA = \text{Number of patients admissions per year} \]
\[ ALS = \text{Average length of stay} \]

and

\[ NOE_{\text{administration}} = PE \times NO \times ALS \times NA \quad \text{Equation 4} \]

where:

\[ NOE_{\text{administration}} = \text{Number of opportunities for Administration errors} \]
\[ PE = \text{Potential Administration errors} \]
\[ NO = \text{Average number of orders received per day} \]
\[ ALS = \text{Average length of stay} \]
\[ NA = \text{Number of patients admissions} \]

Potential errors include the types of errors categorized under prescription, dispensing or administration errors as follows:

- **Prescribing errors** may be defined as the incorrect drug selection for the patient. Such errors can include the miscalculation of dose, drug knowledge deficit, poor oral and written communication (Franklin et al., 2003).

- **Dispensing errors** occur at any stage of the dispensing process, from the receipt of the prescription in the pharmacy to the supply of a dispensed medicine to the patient. Dispensing errors include selection of the wrong strength or product. This occurs primarily with drugs that have a similar name or appearance; it includes misinterpretation of orders, name confusion, poor labeling, and poor packaging and design (Han and Maxwell, 2006).

- **Administration errors** occur when a discrepancy occurs between the drug received by the patient and the drug therapy intended by the prescriber. This could happen in terms of timing, dose or route of administration. Drug administration errors also include errors of omission where the drug is not administered for a variety of reasons (Phillips et al., 2001).

The number of medication errors was converted to the applied Sigma level using the Six Sigma conversion table developed by Pande et al. (2000). The Statistical Package for Social Sciences (SPSS version 19) was utilized to analyze the data collected from the questionnaire.

4. Results and Discussion

4.1 The Interviews

Using the information collected from 40 interviews, the error rate for each type of medical error in the four hospitals was computed and converted into the number of medication errors per million opportunities (e.g. defects per million) and was then transformed into a Six Sigma ratio using the conversion table developed by Pande et al. (2000).

The results listed in Table 1 show that prescription errors were highest at Ibn Nafees’s internal medicine (1.75) and lowest in King Abdallah’s Surgery department. For dispensing errors, the largest number of errors occurred in Princess Basma’s surgery department (2.5) and the lowest in Specialty hospital’s surgery department (3.625). As for administration error, the best results occurred equally at King Abdallah and Specialty’s Surgery departments (3.375) and the highest errors occurred at Princess Basma’s internal medicine.
department (2.25). Rankings among various departments and hospitals can be deduced from Table 1.

The private hospitals had higher error rates and thus lower Sigma values compared to public hospitals in prescription errors in the two departments, but showed lower rates in administration errors. As for dispensing errors, the public hospitals outperformed private hospitals in internal medicine (3.187 vs. 3.0625) but underperformed in surgery (3.3145 vs. 2.875).

The largest source of error in private hospitals came from prescription errors in the internal medicine department of Ibn Nafees (1.75). In public hospitals, the largest error was administration errors in the internal medicine department at Princess Basma (2.25).

The least errors in private hospitals came from dispensing errors at the surgery department in the Specialty hospital. In public hospitals, it was the dispensing errors at King Abdallah’s internal medicine department (3.5). In internal medicine, the two public hospitals outperformed the private on average (2.98 vs. 2.56) but underperformed in Surgery (2.88 vs. 2.98).

As for the overall results, the best performer was King Abdallah hospital (3.17) followed by the Specialty hospital (2.85) followed equally by Ibn Nafees and Princess Basma (2.69). Results also showed that public hospitals outperformed private hospitals having less medical errors with an average Sigma of 2.93 and 2.77 for the public and private hospitals, respectively. This may indicate a better level of staff professionalism and larger support from the government to public hospitals.

4.2 Analysis of the Survey

A questionnaire was developed to validate the results obtained from the semi-structured interviews. Of the 70 questionnaires distributed to caregivers in the respective hospitals, 58 valid questionnaires were returned which represent a response rate of 82.8%. The profile of the respondents is shown in Table 2.

### Table 1

Medication Errors for Surgery and Internal Medicine Departments

<table>
<thead>
<tr>
<th>Hospital</th>
<th>Prescription Errors</th>
<th>Dispensing Errors</th>
<th>Administration Errors</th>
<th>Overall Hospital</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Internal Medicine</td>
<td>Surgery</td>
<td>Internal Medicine</td>
<td>Surgery</td>
</tr>
<tr>
<td></td>
<td>Error Rate (ppm)</td>
<td>Sigma Value</td>
<td>Error Rate (ppm)</td>
<td>Sigma Value</td>
</tr>
<tr>
<td>Princess Basma</td>
<td>58.56</td>
<td>3.125</td>
<td>123.51</td>
<td>2.5</td>
</tr>
<tr>
<td>King Abdallah</td>
<td>58.46</td>
<td>3.125</td>
<td>96.13</td>
<td>2.75</td>
</tr>
<tr>
<td>Ibn Al Nafees</td>
<td>395.569</td>
<td>1.75</td>
<td>181.535</td>
<td>2.375</td>
</tr>
<tr>
<td>Specialty</td>
<td>335.120</td>
<td>1.875</td>
<td>186.57</td>
<td>2.375</td>
</tr>
<tr>
<td>Public Average</td>
<td>3.125</td>
<td>2.625</td>
<td>3.1875</td>
<td>2.875</td>
</tr>
<tr>
<td>Private Average</td>
<td>1.8125</td>
<td>2.375</td>
<td>3.0625</td>
<td>3.3125</td>
</tr>
</tbody>
</table>
The data was tested for reliability using Alpha Cronbach’s coefficient. The results showed a strong reliability as figures exceeded 80% (Sekaran, 2003) for the three dimensions (82, 87 and 92% for prescription, dispensing and administration errors, respectively) indicating that the measuring instrument is expected to give the same numeric value when the measurement is repeated on the same object. Thus, the internal consistency of the measures used in this study can be considered reliable.

Table 2 shows that 70% of the respondents worked in public hospitals. It also showed that around 85% of the respondents were above 33 years and that 77% had four or more years of experience with the majority of them (75%) specialized in either pharmacy or medicine. This shows that the sample interviewed had sufficient experience and education to provide reasonably reliable answers.

The answers in the three error-related sections were averaged for the three types of errors for each hospital, and were classified according to the following scale: mean answers below 2.5 were considered a “weak practice”; mean answers between 2.51 and 3.50 were considered a “moderate practice”; and mean answers above 3.51 were considered a “strong practice. The average responses for each error in the respective hospital are shown in Table 3.

Averaging the three types of errors shows that Princess Basma Hospital had the weakest result (2.34) while King Abdullah Hospital showed the highest result (3.04). This conclusion is similar to the results concluded from the interviews as shown in Table 2.

### Table 2
Profile of Respondents (n=59)

<table>
<thead>
<tr>
<th>Variable &amp; Group</th>
<th>Frequency</th>
<th>In Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working Place</td>
<td></td>
<td></td>
</tr>
<tr>
<td>King Abdullah II</td>
<td>21</td>
<td>35.6</td>
</tr>
<tr>
<td>Princes Basma</td>
<td>20</td>
<td>33.9</td>
</tr>
<tr>
<td>Specialty</td>
<td>8</td>
<td>13.6</td>
</tr>
<tr>
<td>Ibn-Al Nafees</td>
<td>10</td>
<td>16.9</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>less than 26 years</td>
<td>1</td>
<td>1.7</td>
</tr>
<tr>
<td>27-32 years</td>
<td>8</td>
<td>13.6</td>
</tr>
<tr>
<td>33- 38 years</td>
<td>19</td>
<td>32.2</td>
</tr>
<tr>
<td>39 – More</td>
<td>31</td>
<td>52.5</td>
</tr>
<tr>
<td>Experience</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 1 years</td>
<td>1</td>
<td>1.7</td>
</tr>
<tr>
<td>1-3 years</td>
<td>13</td>
<td>22</td>
</tr>
<tr>
<td>7-Apr</td>
<td>22</td>
<td>37.3</td>
</tr>
<tr>
<td>More than 8 years</td>
<td>23</td>
<td>39</td>
</tr>
<tr>
<td>Specialization</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medicine</td>
<td>23</td>
<td>39</td>
</tr>
<tr>
<td>Pharmacy</td>
<td>21</td>
<td>35.6</td>
</tr>
<tr>
<td>Administration</td>
<td>15</td>
<td>25.4</td>
</tr>
</tbody>
</table>

### Table 3
Summary of the Questionnaire for the Three Errors in the Hospitals

<table>
<thead>
<tr>
<th></th>
<th>King Abdullah University</th>
<th>Princess Basma</th>
<th>Ibn Nafees</th>
<th>Specialty</th>
<th>Average of All Hospitals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>level *</td>
<td>Mean</td>
<td>level</td>
<td>Mean</td>
</tr>
<tr>
<td>Mean of Prescription errors</td>
<td>3.07</td>
<td>M</td>
<td>2.19</td>
<td>W</td>
<td>2.58</td>
</tr>
<tr>
<td>Mean of Dispensing errors</td>
<td>2.93</td>
<td>M</td>
<td>2.24</td>
<td>W</td>
<td>2.39</td>
</tr>
<tr>
<td>Mean of Administering errors</td>
<td>3.11</td>
<td>M</td>
<td>2.60</td>
<td>M</td>
<td>2.74</td>
</tr>
<tr>
<td>Overall Hospital Mean</td>
<td>3.04</td>
<td>M</td>
<td>2.34</td>
<td>W</td>
<td>2.57</td>
</tr>
</tbody>
</table>

Average Public Hospitals: 2.69  Average Private Hospitals: 2.695

*: M: Moderate, S: Strong, W: Weak
Table 3 also shows that three types of errors (i.e. prescription, dispensing and administration) were highest in Princess Basma hospital and least in King Abdullah Hospital. This result is similar to that obtained from the interviews (Table 2) except that the highest prescription errors occurred in Ibn al Nafees Hospital.

In ranking the overall performance of hospitals, King Abdullah Hospital, came first in the two methods (i.e. interviews and questionnaire) followed by Specialty Hospital. Ibn al Nafees and Princess Basma had equal rankings in the interviews, but Ibn Al Nafees outperformed Princess Basma in the questionnaire.

On average, the performance of public hospitals was equal to that of the private hospitals according to the questionnaire, while the interviews showed that public hospitals outperformed private ones. The results for each hospital can also be compared to the mean of the four hospitals.

5. Conclusions and Recommendations

5.1 Conclusions

Using Six Sigma has helped identify the sources and levels of medication errors at four hospitals in Jordan, a process that is likely to reflect positively on the quality of health of service offered to recipients.

Enhancing the quality of health care is a major objective in all health researchers; and the use of Six Sigma contributes to the finding, sharing, collaborating, and developing of the knowledge of the stakeholders, and hence the quality of care. For this purpose, the adoption of knowledge management (KM) techniques including Six Sigma becomes essential.

Healthcare presents a special challenge to the use of KM, given the system complexity, impact of medical errors, and increased health care cost.

An ultimate aim in KM is to transform hospitals into a learning organization able to generate new knowledge, create knowledge systems, and base organizational actions on knowledge (Driver, 2001).

5.2 Recommendations to Reduce Medication Errors

Based on the interviews and questionnaire about the processes followed at the studied hospitals, the following recommendations can be made to reduce medication errors and improve Six Sigma values.

a) Prescribing errors: these errors could be reduced by incorporating what is called e-prescribing, using electronic mechanisms for prescribing orders, which may reduce the risk of prescribing errors resulting from illegible handwriting, although it can in turn lead to further problems such as incorrect drug selection. Computerized physician order entry systems eliminate the need for transcription of orders by nursing staff and for interpretation of orders by pharmacy staff and have been shown to have a significant effect on reducing medication error.

b) Dispensing errors: these can reduced by keeping interruptions in the dispensing procedure to a minimum and maintaining the workload of the pharmacist at a safe and manageable level, and improve the area of prescription errors by incorporating what is called e-prescribing discussed above.

c) Administering errors: these can be reduced by ensuring that the caregiver offers sufficient information to the patient or his family members, and ensures that the information was well understood. Other useful factors include the provision of continuous education programs to enhance nursing competencies in devices used for medication administration, and to be involved in ongoing error-tracking systems and pharmacy programs.

d) Other recommendations that can be followed by caregivers include:

– Consider issuing medical identities that are connected with a centralized Electronic Health Record database, so once health records are computerized; it is likely to facilitate reaching the right information about a patient at the right time.

– Consider the provision of electronic devices to all caregivers in order to record every step in the medical patients’ treatment. These devices allow (1) the decrease, if not elimination, of adverse drug effects and medical errors caused by human oversight, and (2) the decrease of
health care costs resulting from medical errors, giving a hand to health care financial resources management (3) medication orders to be clearly written and accurately transcribed (4) information entered into the patients' medical record signed and dated by the person taking the order(5) keep care givers with updated periodicals to keep up with new drugs research (6) connect care professionals with the pharmacists to assure that orders are clear, complete, regular, and legible. These devices can be connected to the Electronic Health Record database.

– Provide an opportunity for continuing education. In health care, continuous education is essential; some professionals cannot continue practicing unless they undergo a yearly continuous education course in order to update their knowledge. In this context, knowledge-based Health virtual communications can play a major role by providing a platform for e-education and knowledge exchange between peers.

– Provide a mobile knowledge management platform where limited mobile health care can be provided for off location patients. This can provide an advantage for both patients and caregivers (Hubert, 2006; Moreno and Isern, 2002; Siau and Shen, 2006).

– Allow for medical socialization among caregivers where discussions can thrive among employees and doctors about hospital processes and different patient’s cases, resulting in improved exchange of experiences.

– Provide continuous on the job training in various processes.

– Avoid abbreviations of drug names.

– Use generic medication names rather than trade names.

– Spell out dosage units rather than using abbreviations.

– Re-check calculations for the ordered dosage and ensure that the dose ordered falls within accepted limits.

– Allow prompt support to reconfirm confusing medication orders.

– Re-check drug compatibility with existing medication list and check for current allergy history.

– Keep interruptions in the dispensing procedure to a minimum and maintaining the workload of the pharmacist at a safe and manageable level.

– Encourage blame-free error reporting. Ensure that all staff members understand this method of reporting.

– Confirm patient identity before administration of each dose.

– Be familiar with medication ordering and dispensing systems.

– Verify drug orders before medication administration.

– Produce an ongoing error-tracking system.

– Ensure that all staff members understand the method of reporting orders.

– Ensure that dosing intervals are followed as prescribed. Ask questions to ensure understanding of medication administration. When possible, bring all current medications to the hospital for confirmation and review.

– Ensure that patient identity has been checked before medication administration.

– Ask questions about the purpose of each medication used to ensure that the right medication was prescribed.

References


Civil Service Board (2008), Preliminary Study of Healthcare Services at the Jordanian Ministry of Health, Department Of Information and Development, Amman, Jordan


