STUDYING ATTITUDE OF PATIENTS IN HOSPITALS TO SIGMA LEVEL OF THE PROVIDED SERVICES FOR IMPROVEMENT OF QUALITY AND EFFECTIVENESS (CASE STUDY OF 22 BAHMAN HOSPITAL OF NEISHABOUR CITY)

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ABSTRACT

Modern organizations seek to fulfill needs of customers and create value for them in the field of business competition. Creation of value for customer requires creation of value in the organization. Different barriers and problems can be removed in organizations, quality can be increased and costs can be reduced with logical problem-solving tools. One of the logical problem-solving tools is Six Sigma which is based on scientific principles and solves problems in structured manner. Considering nature of hospital services and difficulty of quality assessment by the patients, irreparable consequences in case of error in treatment of patients and endangerment of patients’ safety, heavy expenses for patients and hospital, it seems necessary to use a logical problem-solving tool in this organization. Quality of therapeutic services can be increased and therapeutic costs and errors and mortality of patients can be reduced considerably with help of Six Sigma. This research is an applied research which has been conducted in 2012 in 22 Bahman Hospital in Neishabour. In this research, information has been collected through distribution of questionnaire among patients and surveying opinions of the top managers of the hospital. To analyze data, SPSS software has been used to determine Sigma level and statistical tests.

KEYWORDS: Hospital Of Organization, Six Sigma, Improvement Of Service Quality, Customer’s Satisfaction

The current field of business gives a new image of organization. With this attitude, organization is a set of process which aim to create value in customer and creation of value for customer requires creation of value for organization. Among these competitions, hospitals and therapeutic organizations have not been safe. Type of dimensions and nature of problems and barriers which business organization faces, increase of profitability, effectiveness, productivity in all operations of the organization and access to needs and expectations of customers require managers of organizations to use logical problem solving tools use for removal of barriers (Sohrab Por Frooshan et al., Lean Thinking, Entrance Gate to land of Sigma). In today’s business competitive space, one can be no longer successful only with zero defect thinking and some operational strategies. For an organization, more defects mean higher cost and lower quality and reduction of value created for customers and consequently, loss of competitiveness level and market share (Chowdhury, Subir, 2004, 46). Inattention of organizations’ manager to implementation of logical model and definite problem-solving method will cause lack of concentration on requirements of the clients and customer satisfaction. This case will lead to reduction of productivity and failure to improve work process and increase of costs.

Problem statement

Many companies have to use managerial approaches and different techniques for increase of quality such as \(6\sigma, TQC , QC , TQM\). \(6\sigma\) is regarded as one of the new approaches for promotion of quality, reduction of wastes and earning income which has attracted attention of experts and managers of different companies all over the world. This approach has been based on confirmed scientific principles which can solve problems in structured method by passing a cycle composed of stages of definition, measurement, analysis, improvement and control. Consequentialism and limited time for completion of the improvement projects are of the evident specifications of this approach (Rasool Noor Alsana, 2004). Special nature of medical services and no specialty of customers for evaluation of these services cause very serious consequences and heavy expenses for the consumers even with one mistake in treatment of patients on the one hand and repetitive mistakes of the hospitals which cause more than 500000 defects in one million positions such as deficiencies of diagnosis and clinical treatment of patients necessitate this research (Farkhondeh Asadi, Role of Six Sigma in improvement of medical – therapeutic services). Since determination of Six Sigma level is the new statement of quality management, it has been almost used in manufacturing organizations. This research uses \(6\sigma\) for improvement of quality of service.

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plants. But servicing companies finally had tendency to utilize importance of scientific centers in engineering role and scientific-commercial centers in financial management (Anthony, 2006). 

SIGNIFICANCE OF RESEARCH

Medical minorities are a large network of complexities and conflicts because they provide privileges, services and technology but they have some defects such as inefficiency and limitation of resources for provision of services to patients. In 1998, Therapeutic Institute declared that 98000 people died in year due to therapeutic errors and this statistics attracts our attention to improvement of quality (Lazarus and Neely, 2003). Almost 2 million dollars is paid every year due to defective therapeutic services (Taglo et al., 2007). The presence of defect and limitations in therapeutic centers and heavy expenses and mortalities resulting from these defects necessitate performance of this servicing organization. Most efforts in the past and in some parts have been directed to the imposed quality instead of optimization of medical care system. Sigma methodology is an optimization tool which focuses on improvement and provision of services. One of the strong and perfect mythologies is improvement of performance which changes provision of services in medical care centers. Six Sigma methodology ends to reduction of deviation, more safety of cares, mortality and prevalence of lower diseases, better response to needs and receipt of higher value of resources. Today, Six Sigma projects in medical care industry focus on direction of provision of services, executive support and financial management (Anthony, 2006).

REVIEW OF LITERATURE

Jiju Antony (2008) in a paper entitled “the role of academic institutions for the future development of six sigma” studied distinguished technical and engineering role and scientific-commercial centers in future improvement of six sigma. Finding of this research mentions some limitations of six sigma and tries to utilize importance of scientific centers in research fields of six sigma. Levi Suvial (2003) in a paper entitled “Six sigma in medical cares” mentions that Sic Sigma was first executed successfully by Motorola and General Electric Companies to provide an improvement strategic process in the manufacturing plants. But servicing companies finally had tendency toward this method for performance of local and customer focus processes. This research refers to application of Six Sigma in health care institutes and also its implementation challenges in this field. Jorge Orthoit (2000) in a paper entitled “Total quality management in European medical cares” mentions that TQM has been used in many industries but its application in medical care industry has been limited up to now. He also mentions that hospitals and medical centers which have applied this method were more successful and their problems were reduced. This research defines TQM and mentions some examples of its applications and the achieved successes. Ki Anis (1999) in a paper entitled Factors effecting application of quality in Ireland health cares “mentions that hospitals and medical care centers seek to find ways for ensuring effectiveness and efficiency of their organization. TQM is introduced as a way for internal management of organization to improve all dimensions of services which are important for customers which caused some solutions for the challenges which most medical care organizations face.

Jamshid Salehi Sadghiani et al. (2008) in a paper entitled “Continual improvement mechanisms through combined six sigma” mentions concept of six sigma in recent years as a continual strategy which can lead to sustainable competitive advantage. Considering theoretical fundamentals of six sigma, six sigma has its own advantages and disadvantages and necessary conditions for success like other continual strategies. In this paper, nature of six sigma has been criticized and studied and its success factors and challenges have been presented. It refers to the fact that six sigma and other continual improvement strategies can be combined based on three principles of synergy acquisition, use of complementary characteristics of continual improvement strategies and saving cost and time of execution. Farkhondeh Asadi (2007) in a paper entitled “role of six sigma in improvement of medical – therapeutic services “has injected six sigma and central components and also refers to competitive conditions of medical care institutes in today’s business conditions and domain of application and effect of six sigma and executive steps of six sigma project in improvement of quality of health care institutes. These studies mention important points for success of managers in execution of six sigma projects. Sohrab Porfrooshan et al. (2011) in a paper entitled “Lean Thinking, Entrance Gate to land of Sigma” mentioned that lean thinking is an attitude which increases productivity and creates continual value and minimizes costs and wastes. In this regard, entrance gate of sigma land can be used for removing defects and errors through fast methods such...
as concepts and techniques of lean thinking because final increase of sigma rate is necessary for reducing defects and wastes. It has been mentioned that transition from lower sigma to higher sigma diverts attention of organization improvement projects to processes. In this paper, six sigma methodology and limitations of its execution are mentioned.

Main goal of research:

Determination of sigma level of the services provided in the hospital for improvement of quality of hospital services and satisfaction of the clients

Sub goals of research:

Determination of sigma level of the special privileges in hospital
Determination of sigma level of waiting time for receiving drug and services in hospital
Determination of sigma level of courtesy of personnel in hospital
Determination of sigma level of cost of services provided in hospital
Determination of sigma level of services quality in hospital

Research sub questions

What is sigma level of the special privileges in hospital?
What is sigma level of waiting time for receiving drug and services in hospital?
What is sigma level of courtesy of personnel in hospital?
What is sigma level of cost of services provided in hospital?
What is sigma level of services quality in hospital?

OPERATIONAL DEFINITION OF VARIABLES

In this study, economy and its cost mean that patients pay for treatment, physicians, drug and services. Waiting time has been defined as waiting time for visiting physician, waiting time for performing administrative procedures and waiting time for receiving drug.

Special privileges are related to silence of hospital environment, welfare equipment provided to patient, description of patient’s condition by the physician and cleanness of hospital environment. Courtesy means observance of ethical dignities by the morning and night shift nurses, service and security personnel at time of providing services and also good morals and friendly conduct of physicians when seeing patient. Quality means specialist of the physician, experimental and practical skills of physician, performance of diagnostic actions by hospital, medical and specialized equipment and technology.

RESEARCH METHOD

Research method is regular search process for specifying an indefinite position (Bazargan et al., 1999). In other words, research method is a special and systematic form which always seeks to find fact. Researches are divided into two types considering goal and method which they follow.

A- Applied research
B- Fundamental research

In terms of goal, the applied research seeks to achieve a practical goal. In case this type of research is conducted correctly, it will obtain useful information about planning, design and development and practical methods for executive activity. Although fundamental research may have practical application, its main goal is to expand knowledge and awareness. Goal of this research is to acquire new knowledge irrespective of their values for social changes. In this type of research, emphasis is on study of internal relationship between variables not study of human’s ability to affect interaction of variables.

Another difference between applied and fundamental researches is their time and space domain. Findings of the applied research highly relate to time and space while this doesn’t hold true for the fundamental research. Goal of the applied research is to solve problem and finally achieve information for making decision and fulfilling needs and solving immediate problems. In case goal of the fundamental research is to test hypothesis and find generality and research continues until researcher rejects or accepts generality considering the collected information.

Considering the mentioned cases, the present research is an applied research which aims to determine sigma level of hospital services for improvement of quality of services to provide high quality services by studying causes of the services which have low sigma level and improving them and reduce heavy expenses and undesirable consequences of therapeutic mistakes.
RESEARCH DOMAINS

Time domain

This research is conducted to determine sigma level of hospital services provided by 22 Bahman Hospital to improve quality of services in the first half of 1391(2012).

Space domain:

Space domain of this research is 22 Bahman Hospital in Neishabour City.

Subject:

Subject of this research is to determine sigma level of hospital services provided by 22 Bahman Hospital to improve quality of hospital services.

Information Collection Instruments

Review of the sources relating to the studied subject includes identification, study and valuation of research and the reported scientific observations and views which are related to subject of the research. Goal of this research is to acquire complete information about subject of the research. Research sources are divided into the secondary sources and original sources.

1- Secondary sources

These sources include books, papers and publications in which researcher didn’t have direct participation and have been prepared based on results of other researches. These sources present knowledge about the subject matter and mention literature of the research and its history.

The secondary sources used in this research include books, publications, papers and written and digital statistics in the field of medical care, six sigma, improvement of quality in services and also study of the theses written in the fields relating to subject of the research.

2- Original sources

Original sources include the sources in which occurrence of a phenomenon is reported by a person in which he/she has participated or a person who has witnessed it (Delavar, Ali, 2001). In this research, the following methods have been used to achieve the original information:

1- Formulating questionnaire and presenting it to the patients who have referred to 22 Bahman Hospital for treatment to achieve their viewpoints about the research subject.

2- Interviewing with top managers of the hospital for determination of the studied factors.

In this research, the questionnaire has been used as the main information collection instrument. The sources for formulation of the questionnaire in this research include library studies and scientific papers and also interview with top managers of the hospital for determination of the studied factors.

VALIDITY

Validity means that the measurement instrument can measure the desired characteristics not another characteristic (Hooman, 1997). Person judges about validity of variables (Fardan, Kerlinger, Hassan Pasha Sharifi and Jafar Najafi Zand, 1997). To validate the questionnaire of this research, the formulated questionnaire was given to some high level managers, the personnel who had direct relationship with patients in hospital and some patients and views and suggestions of the managers and validity of the questions were studied. Then, the modified questionnaire was given to the esteemed advisors and supervisors and final questionnaire was formulated considering their viewpoints and guidance and the necessary changes and corrections.

Reliability

Reliability means the trust in results of a test of tests which are obtained from its successive applications (Ganji, 1999). A test is reliable when its repeated performance gives equal result under fixed conditions (Calton and Moser, Kazem Izadi, 1989). To study reliability of this research, Cronbach's Coefficient Alpha has been used. This method is applied for calculation of internal consistency of measurement instruments such as questionnaire (Bazargan et al., 1999).

Table 1: Reliability Statistics

<table>
<thead>
<tr>
<th>Cronbach’s Alpha</th>
<th>N of Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>77%</td>
<td>56</td>
</tr>
</tbody>
</table>

Considering the obtained coefficient in this test (Table 1) which is larger than 0.7, reliability of the questionnaire is confirmed.

RESEARCH METHOD

This research has been conducted in 22 Bahman Hospital of Neishabour City. Governmental hospital was selected because people from all social levels refer to it. Different social classes can be achieved in this way and expectations of different
classes of society relating to the hospital can be studied.

In this research, both classes of patients were studied. The outpatients are not included in this research. After specifying sample size, researcher referred to the hospital in odd days during a week to achieve patients randomly and obtain their views.

**Statistical population**

Statistical population includes a set of people or units which have the mimion common traits (Bazargan et al., 1999). Population means all real or hypothetical members to whom we are interested to generalize research findings (Delavar, Ali, 2001). In this research, common trait of people is their reference to hospital for treatment whether this reference is done for the first time or continually. In this regard, statistical population of this research includes all people who have referred to the hospital for performing therapeutic services such as surgery and dialysis.

In this research, statistical population includes all people who referred to hospital in a month. Since the number of patients is different in different months, 4 months of Farvardin, Ordibehesht, Khordad and Tir were considered and its mean has been calculated.

Formula(1)

\[ \bar{n} = \frac{\sum_{i=1}^{n}}{n} \]

With Formula (1), 4 mentioned months have been averaged.

\[ \bar{n} = \frac{4}{\sum_{i=1}^{n}} \]

\[ \bar{n} = \frac{1001}{n} = 250 \]

Now, size of the sample referring to 22 Bahman Hospital in one month has been estimated in Table 2.

**Table 2: Patients referring to the hospital in 4 months**

<table>
<thead>
<tr>
<th>Dialysis</th>
<th>Number of patients for surgery</th>
<th>Month of reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>65</td>
<td>168</td>
<td>Farvardin 1391(March 2012)</td>
</tr>
<tr>
<td>48</td>
<td>195</td>
<td>Ordibehesht 1391(May 2012)</td>
</tr>
<tr>
<td>56</td>
<td>258</td>
<td>Khordad 1391(June 2012)</td>
</tr>
<tr>
<td>37</td>
<td>174</td>
<td>Tir 1391(July 2012)</td>
</tr>
</tbody>
</table>

**Statistical sample**

Since all members of the population cannot execute the research in most cases, the research should be limited to a small size of population. This sample should represent the population to which the researcher intends to generalize research findings (Delavar, Ali, 2001). Sampling means selection of some people, events and objects from a defined population as representative of that population (the same). As mentioned before, it was possible to gain access to patients randomly by referring to the hospital in odd days. Sampling method in this research is random sampling.

**Determination of sample size**

In this research, Formula (2) has been used to calculate sample size considering the population size.

Formula(2)

\[ n0 = \frac{s^2 \cdot 1 - a}{d^2 \cdot \bar{y}^2} \]

To calculate variance in the above formula, it is necessary to use a pretest. In this research, pretest size is 25. Sampling error has been considered 0.5.

Since there are two classes of question in the questionnaire, n0 is calculated for both importance and satisfaction. n0 is 69 for importance and 83 for
satisfaction.

Formula (3)

\[
\hat{n} = \frac{n_0}{1 + \frac{n_0}{N}}
\]

With Formula (3), sample size can be obtained. In the questionnaire, importance of the factor from the patients’ viewpoint and satisfaction with the factor have been studied. These two criteria are independent of each other. For both values, \(n_0\) and \(n\) have been calculated. Based on importance of the factor, sample size was obtained 69 and based on satisfaction with the factor, sample size was obtained 110. To reduce error in sampling, sample size was selected based on satisfaction with the factor. Therefore, sample size was considered equivalent to 110 persons considering confidence level of 95% and standard error of 0.05 (Ali Amidi, P. 55-62).

**Statistical techniques of research**

After completing and collecting the questionnaires, data will be extracted and classified. Then, the results are presented in two sections of frequency distribution and statistical tests. To analyze data, indices of descriptive statistics, Cronbach’s Coefficient Alpha, determination of sigma level, Mann–Whitney test, Kruskal–Wallis one-way analysis of variance and standard signed–rank test are used. It is necessary to note that SPSS software has been applied for analysis of data.

Studying effect of descriptive variables on critical specifications

Gender is effective on importance and satisfaction with some critical specifications. For example, gender is effective on satisfaction with courtesy and performance of night shift nurses. Men are more satisfied with courtesy and performance of the night shift nurses than women. Age is also effective on some critical specifications. The highest satisfaction with courtesy and performance of patients-related services personnel in age range of 20-30. Education is also effective on importance and satisfaction with some critical specifications such as importance of the diagnostic actions performed by hospital and satisfaction with welfare equipment for patient. The patient with associate and bachelor’s degree regarded diagnostic actions very important and patients with high school degree below were more satisfied with welfare equipment than other patients with other education levels.

Now, effects of monthly income on critical specifications are mentioned. Importance of diagnostic actions for the patients with income level of Rls. 4-6 million is higher than that for other patients. These patients have been the most satisfied with costs of hospital.

Patients with monthly income of below Rls. 2 million were more satisfied with silence and cleanliness of hospital environment.

**Studying effect of types of treatment on importance of critical specifications**

As mentioned in the previous chapters, patients in this hospital were divided into two classes of dialysis and surgery. Critical specifications such as courtesy and performance of night nurses, waiting time for receiving drug, welfare equipment are more important for the patients who undergo surgery than those for dialysis patients.

**Six sigma proposed model**

In this study, sigma level of the considered indices was determined by determining critical specifications and studying view of the patients about these specifications. Since sigma levels relating to the indices in this hospital are not high and acceptable, this organization is suggested to enter DMAIC cycle, define the problem, identify customers and their needs and demands in the first step, collect information about the problem in the second step and quantify them and study the information and find the main cause in the third step, implement the solutions for the main causes in the fourth step to reduce the main causes and their effects on performance of hospital and prevent from return to its past organizational culture, repetition of errors and wasting in the last step. This step can be effective for organization and increase of quality of its services because sig sigma tries to realize total quality in the real sense as a philosophy and tries to found an organization in the highest global class level by developing quality beyond expectation of customers (Fathollah et al., 2004).

The following model is a proposed model for hospital to enter DMAIC cycle and consider suitable DFSS for services of organization.
Figure 1: six sigma prosed model

As Figure 1 shows, factors such as personnel, sig sigma team training, support of team by top management, diagnostic actions and quality perceived by patient are effective on efficient and effective design and for achieving continual improvement to enter DMAIC and DFSS cycle.

All of these factors are centered on satisfaction of patient.

The hospital is suggested to consider critical specifications which have low quality and are regarded as hospital sub-indices for which sigma level was determined and first focus on them to increase their quality to the desirable level. This problem will; have considerable effect on promotion of sigma level of the mentioned indices because satisfaction of the patients increases and the counted defects are reduced with increasing quality of services.

It means that specialty and practical skills and observance of ethical principles by physicians of the hospital, courtesy and performance of the personnel in services section and nurses, diagnostic actions in hospital, welfare equipment for patient, cleaness and silence of hospital environment were desirable for the patients and have positive effect on sigma level of the indices and the hospital should try to focus on other specifications.

Since two classes of patients are hospitalized in this hospital and they undergo two types of dialysis and surgery, it is necessary to study their needs and demands separately to fulfill need of both classes concurrently.

The patients who are in surgery section require other critical specifications. Specifications of courtesy and performance of nigh shift nurses and waiting time for receiving drug are of high importance for these patients.

The hospital is suggested to transfer more sociable and skilled nurses to surgery sections in night shift to be more patient against restlessness of patients and solve their problems more immediately.

For these patients, receipt of drug and waiting time are of high importance. The hospital is suggested to found surgery sections of this organizational culture. It is necessary to note that quality of services of this hospital is low for the patients.

The hospital can achieve the following benefits by implementing six sigma methodology:

Efficient decision of managers which results from reliance on data and avoidance of personal judgment and emotions significantly reduces costs relating to false guidance and incorrect solutions for the problems.

Increasing understanding of needs and expectations of customers particularly about critical specifications of the services which have the highest effect on satisfaction and loyalty of customers.

Increasing awareness with problem solving techniques and tools which lead to high job satisfaction of personnel.

Increasing changeability in performance of services which causes high compatibility of the services and makes them predictable.

Culture of organization will move from passive to active thinking.

**Improving culture of teamwork in organization**

Top managers of the hospital should be aware that satisfaction of patients will increase by providing proper and high quality services. Since patients were
satisfied with physicians of the hospital, managers of the hospital should focus on other indices. Satisfaction of patients attracts other patients to this center. In this way, recommendation of friends and relatives for referring to the hospital can be increased.

Some facts which result from performance in low sigma level are mentioned as follows:

If an unsatisfied customer faces a problem which is not so serious, he/she will mention it for more than 10 persons.

When problem of that patient is solved satisfactorily, he/she will inform other 5 persons again. 31% of the customers who have experienced their problem in receipt of services will not mention their complaint. Only 9% communicate with the organization again. It is very desirable for the organization to keep the customers glad and satisfied. It has been proved that 5% increase of customers retention will increase profit by more than 25%.

Goal of six sigma is to help patients and processes manufacture the products and provide defect free services. Here zero defect is not considered. In six sigma, it is assumed that there is potential for defect but six sigma in performance level of 99%/997 determines goal for the performance so that there is almost no defect in many processes and products.

Studying descriptive variables

In this research, a governmental hospital has been selected to gain access to all social levels. In terms of descriptive variable of gender, 57.5% of the people referring to this hospital who are hospitalized for treatment in wards are female considering tables of Chapter 4 and 51.9% of the people are in age range of above 50 years. In terms of education, 85.8% of the patient hold high school degree below and income level of 60.4% of the people is below Rls. 2000000 per month. 68.9% of the patients reside in city and 73.6% come from Khorasan Razavi Province and 65.1% of the people referred to this hospital for the first time in 2009. Considering the above results, it is clear that most people who refer to this hospital are from low levels of society.

Studying recommendation of others

97.2% of the patients in this hospital were not familiar with the physician which caused provision of services to most patients in equal level. 87.7% of the patients were not recommended by their friends and relatives to select this hospital which indicates low satisfaction with therapeutic services of this hospital. 74.5% of the patients have used recommendation of other physicians and specialists to refer to this hospital which indicates the presence of specialized and skilled physicians and acceptable therapeutic services in the hospital from the viewpoint of other physicians.

Studying determination of critical specifications

As mentioned above, the first step for determination of sigma level is determination of critical specifications. Among the desired factors in the questionnaire, 17 factors which have been highly important for the patients have been introduced as the critical specifications. These factors include specialty of physician, specialty and practical skills and observance of ethical principles by physician, courtesy and performance of the personnel in services section and morning shift nurses, courtesy and performance of the night shift nurses, courtesy and performance of security section, diagnostic actions in hospital, equipment available in the hospital, waiting time for visiting with physician, waiting time for receiving drug , waiting time for performing administrative procedures , cleanness of the hospital , silence of hospital environment , welfare equipment for patient, elaboration of patient’s condition by the physician, cost of hospital . With help of these specifications, the hospital can find needs and demands of patients and fulfill them.

Factors: reputation of physician, information at the beginning of entrance to hospital, food quality, suitable parking lot, determined hours for visiting and welfare equipment for the patient’s companion were not included in class of critical specifications due to their low importance for the patients.

Studying order of critical specifications in terms of frequency of the people satisfied with these specifications

This research includes 17 critical specifications and view of the patients about satisfaction and importance of these specifications has been studied. Considering the number and frequency of the satisfied patients, order of these specifications is as follows:

Specialty of physician, practical experiences and skills of physician, observance of ethical principles by physician, cleanness of the hospital environment, silence of the hospital environment, welfare equipment of the patient, diagnostic actions performed by the hospital, courtesy and performance of the personnel in service section, courtesy and performance of the morning shift nurses, waiting time for visiting the physician, courtesy and performance of the night shift
nurses, waiting time for receiving drug, elaboration of the patient’s condition by the physician, equipment available in the hospital, waiting time for performing administrative procedures and courtesy and performance of the security section, cost of hospital.

For satisfaction with silence and cleanness, P values of test were smaller than the test significance level and null hypothesis is not accepted and income level has no equal effect on these factors.

Table 3: Mean rank of satisfaction with silence

<table>
<thead>
<tr>
<th>Mean rank</th>
<th>Number</th>
<th>Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>56.96</td>
<td>65</td>
<td>Below Rial 2 million</td>
</tr>
<tr>
<td>52.64</td>
<td>38</td>
<td>Between Rial 2 and 4 million</td>
</tr>
<tr>
<td>24.9</td>
<td>4</td>
<td>Between Rial 4 and 6 million</td>
</tr>
<tr>
<td>6</td>
<td>3</td>
<td>Above Rial 6 million</td>
</tr>
<tr>
<td></td>
<td>110</td>
<td>Total</td>
</tr>
</tbody>
</table>

Considering Table 3, people with monthly income of below Rs. 2000000 were the most satisfied with silence of the hospital environment.

Table 4: Mean rank of satisfaction with cleanness

<table>
<thead>
<tr>
<th>Mean rank</th>
<th>Number</th>
<th>Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>56.59</td>
<td>65</td>
<td>Below Rial 2 million</td>
</tr>
<tr>
<td>51.36</td>
<td>38</td>
<td>Between Rial 2 and 4 million</td>
</tr>
<tr>
<td>36.2</td>
<td>4</td>
<td>Between Rial 4 and 6 million</td>
</tr>
<tr>
<td>19.5</td>
<td>3</td>
<td>Above Rial 6 million</td>
</tr>
<tr>
<td></td>
<td>110</td>
<td>Total</td>
</tr>
</tbody>
</table>

Table 4 shows that the people with monthly income of below Rs. 2000000 are the most satisfied with cleanness of hospital. It should be noted that these people constitute the highest group of the patients.

Quality or lack of quality of the critical specifications is studied based on satisfaction of respondents. To perform this case, signed –rank statistical test and SPSS software are used. As mentioned before, codes 1, 2 and 3 indicate dissatisfaction and codes 4 and 5 indicate satisfaction of the patients. Therefore, if median of the specifications is higher than or equal to 4, satisfaction with these specifications will be shown. Since data doesn’t follow normal distribution and is nonparametric, median instead of mean is used. Therefore, statistical hypotheses are mentioned as follows:

- Median of satisfaction with specifications is larger than or equal to 4: H₀
- Median of satisfaction with specifications is smaller than 4: H₁

The following Table is output of the software of which analysis is mentioned.
Table 5: Software output table

<table>
<thead>
<tr>
<th>Median of specification</th>
<th>P value of test</th>
<th>Above 4</th>
<th>Equal to 4</th>
<th>Below 4</th>
<th>Number</th>
<th>Critical specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>1</td>
<td>60</td>
<td>45</td>
<td>5</td>
<td>110</td>
<td>Specialty of physician</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>65</td>
<td>29</td>
<td>6</td>
<td>110</td>
<td>Ethics of physician</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>66</td>
<td>40</td>
<td>4</td>
<td>110</td>
<td>Skill and experience of physician</td>
</tr>
<tr>
<td>4</td>
<td>0/1074</td>
<td>29</td>
<td>43</td>
<td>39</td>
<td>110</td>
<td>Night shift nurses</td>
</tr>
<tr>
<td>4</td>
<td>0/8854</td>
<td>4</td>
<td>51</td>
<td>25</td>
<td>110</td>
<td>Morning shift nurses</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>5</td>
<td>41</td>
<td>64</td>
<td>110</td>
<td>Courtesy and performance of service section</td>
</tr>
<tr>
<td>4</td>
<td>0/9907</td>
<td>33</td>
<td>58</td>
<td>19</td>
<td>110</td>
<td>Courtesy and performance of services</td>
</tr>
<tr>
<td>4</td>
<td>0/7142</td>
<td>17</td>
<td>79</td>
<td>14</td>
<td>110</td>
<td>Diagnostic actions</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>6</td>
<td>43</td>
<td>61</td>
<td>110</td>
<td>Specialized equipment</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>17</td>
<td>44</td>
<td>49</td>
<td>110</td>
<td>Information of physician</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>11</td>
<td>37</td>
<td>62</td>
<td>110</td>
<td>Performing administrative procedures</td>
</tr>
<tr>
<td>4</td>
<td>0/0088</td>
<td>24</td>
<td>43</td>
<td>43</td>
<td>110</td>
<td>Waiting time for receiving drug</td>
</tr>
<tr>
<td>4</td>
<td>0/0225</td>
<td>21</td>
<td>52</td>
<td>37</td>
<td>110</td>
<td>Waiting time for visiting physician</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>10</td>
<td>36</td>
<td>64</td>
<td>110</td>
<td>Cost</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>76</td>
<td>25</td>
<td>9</td>
<td>110</td>
<td>Silence of environment</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>77</td>
<td>24</td>
<td>9</td>
<td>110</td>
<td>Cleanness of environment</td>
</tr>
<tr>
<td>4</td>
<td>0/5881</td>
<td>11</td>
<td>89</td>
<td>12</td>
<td>110</td>
<td>Welfare equipment of the environment</td>
</tr>
</tbody>
</table>

Considering Table 5, null hypothesis about critical specifications of which P value is smaller than significance level is not accepted and critical specifications of which P value is larger than significance level is accepted.

Critical specifications: Courtesy and performance of service section, specialized and medical equipment, information and clarification of physician about the patient’s condition, waiting time for administrative procedures, waiting time for receiving drug, waiting time for visiting physician and hospital costs have the critical value of below significance level of 0.5. Therefore, the null hypothesis is not accepted which indicates undesirable quality of providing the said services.

Critical specifications: specialty of physician, observance of ethical principles by physicians, experimental and practical skills of physician, Courtesy and performance of morning shift nurses, Courtesy and performance of the personnel in service section, performance of diagnostic actions by hospital, silence of the hospital environment, cleanness of hospital environment and welfare equipment for the patient have test P value of above significance level and null
hypothesis for them has been accepted and this indicates desirable quality of provision of the said services.

As mentioned before, the patients who refer to this hospital are included in two major groups of dialysis and surgery. Now, we study if these two major and different groups have different needs. In other words, is inclusion of patients in two different groups cause difference in importance of critical specifications? Or is its effect equal?

Table 6: Mann–Whitney Test Statistics

<table>
<thead>
<tr>
<th>Importance of courtesy and performance of security section</th>
<th>Importance of courtesy and performance of morning shift nurses</th>
<th>Importance of courtesy and performance of night shift nurses</th>
<th>Importance of physician’s ethics</th>
<th>Importance of physician’s specialty</th>
<th>Mann–Whitney Test Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1178</td>
<td>1265</td>
<td>1234</td>
<td>972</td>
<td>1373</td>
<td>1348</td>
</tr>
<tr>
<td>2452</td>
<td>254</td>
<td>2509</td>
<td>2247</td>
<td>2648</td>
<td>2623</td>
</tr>
<tr>
<td>-1/604</td>
<td>-0/958</td>
<td>-1/272</td>
<td>-3/069</td>
<td>-0/263</td>
<td>-0/518</td>
</tr>
<tr>
<td>0/109</td>
<td>0/338</td>
<td>0/203</td>
<td>0/002</td>
<td>0/793</td>
<td>0/605</td>
</tr>
</tbody>
</table>

Table 7- Rank Means of importance of courtesy and performance of the night shift nurses

<table>
<thead>
<tr>
<th>Sum of ranks</th>
<th>Rank Mean</th>
<th>Number</th>
<th>Types of treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>2247</td>
<td>44/94</td>
<td>54</td>
<td>Dialysis</td>
</tr>
<tr>
<td>3424</td>
<td>61/14</td>
<td>56</td>
<td>Surgery</td>
</tr>
</tbody>
</table>

Table 7 shows that this factor is more important for the patients who undergo surgery because its rank mean is larger.
Table 8: Mann–Whitney Test Statistics

<table>
<thead>
<tr>
<th>Cost</th>
<th>Importance of waiting time for visiting physician</th>
<th>Importance of waiting time for receiving drug</th>
<th>Importance of waiting time for administrative procedures</th>
<th>Importance of physician’s information</th>
<th>Importance of medical equipment</th>
<th>Importance of diagnostic actions</th>
<th>Grouped variable: types of treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1354</td>
<td>1172</td>
<td>765</td>
<td>1230</td>
<td>1248</td>
<td>1312</td>
<td>1266</td>
<td>Mann–Whitney Test Statistic</td>
</tr>
<tr>
<td>2950</td>
<td>2446</td>
<td>2040</td>
<td>2506</td>
<td>2844</td>
<td>2587</td>
<td>2542</td>
<td>Wilcoxon signed-rank test Statistic</td>
</tr>
<tr>
<td>-0.882</td>
<td>-1/644</td>
<td>-4/351</td>
<td>-1/294</td>
<td>-1/101</td>
<td>-0/64</td>
<td>-1/032</td>
<td>Z value</td>
</tr>
<tr>
<td>0.378</td>
<td>0/1</td>
<td>0</td>
<td>0/196</td>
<td>0/271</td>
<td>0/522</td>
<td>0/302</td>
<td>P value</td>
</tr>
</tbody>
</table>

Based on Table 8, P values of test for importance of diagnostic actions, medical equipment, physician’s information about patient’s condition, waiting time for performing administrative procedures, waiting time for visiting the physician and cost are larger than significance level of the test and the null hypothesis regarding them is accepted. Therefore, the said specifications are equally important for both classes of patients and there is no significant difference.

P values of test for importance of waiting time for receiving drug is smaller than significance level which causes rejection of the null hypothesis. It means that types of treatment have no equal effect on importance of this factor.

Table 9: Rank means of types of treatment regarding waiting time for receiving medicine

<table>
<thead>
<tr>
<th>Sum of ranks</th>
<th>Rank mean</th>
<th>Number</th>
<th>Types of treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>2040</td>
<td>408</td>
<td>54</td>
<td>Dialysis</td>
</tr>
<tr>
<td>3631</td>
<td>6484</td>
<td>56</td>
<td>Surgery</td>
</tr>
</tbody>
</table>

Table 9 shows that this factor is more important for the patients who have undergone surgery.

Table 10: Mann–Whitney Test Statistics

<table>
<thead>
<tr>
<th>Importance of welfare equipment for the patient</th>
<th>Importance of cleanliness</th>
<th>Importance of silence</th>
<th>Grouped variable: types of treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1113</td>
<td>1310</td>
<td>1285</td>
<td>Mann–Whitney Test Statistic</td>
</tr>
<tr>
<td>2388</td>
<td>2585</td>
<td>2560</td>
<td>Wilcoxon signed-rank test Statistic</td>
</tr>
<tr>
<td>-2/26</td>
<td>-1/324</td>
<td>-1/818</td>
<td>Z value</td>
</tr>
<tr>
<td>0/024</td>
<td>0/185</td>
<td>0/069</td>
<td>P value</td>
</tr>
</tbody>
</table>

Considering Table 10, P value of test for importance of silence and cleanliness of environment is higher than significance level of the test and the null hypothesis for equal effect of types of disease on importance of the above specifications is accepted. But P value of the test for importance of the welfare equipment is smaller than the significance level and the null hypothesis is not accepted. Therefore, types of
treatment have no equal effect on importance of the above factors and importance of the said factors has significant difference for two classes of the patient.

Table 11: Rank means of types of treatment regarding welfare equipment of patient

<table>
<thead>
<tr>
<th>Sum of ranks</th>
<th>Rank mean</th>
<th>Number</th>
<th>Types of treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>2388</td>
<td>47/76</td>
<td>54</td>
<td>Dialysis</td>
</tr>
<tr>
<td>3283</td>
<td>58/62</td>
<td>56</td>
<td>Surgery</td>
</tr>
<tr>
<td></td>
<td></td>
<td>110</td>
<td>Total</td>
</tr>
</tbody>
</table>

Table 11 shows that the welfare equipment which the hospital gives to the patients is more important for the patients undergoing surgery than for the dialysis patients.

Response of main question

Main goal in this research is to determine sigma level of the services provided in the hospital. The sigma level of all services provided in the hospital is 3.34. It means that the hospital has lost 32241 out of 1000000 opportunities for provision of high quality and suitable services. Response of the main question is 3.34.

Response of the sub questions

Sub goals of this research is to determine sigma of the indices of cost, courtesy of personnel, quality of services, special privileges and reputation and waiting time.

- Sigma level of the special privileges of the hospital is 3.4. In other words, the hospital has lost 28537 out of 1000000 opportunities for provision of special and different services from other hospitals and reaching high reputation and being recommended by the friends and other physicians. Response of the first sub question is 3.4.

- Sigma level of the waiting time is 3.37. The hospital has lost 30503 out of 1000000 opportunities for provision of services in the shortest time. In other words, it has provided 30503 services in the longer time and with long waiting time for patients. Response of the second sub question is 3.37.

- Sigma level of courtesy of personnel and physicians is 3.45. The hospital has lost 25094 out of 1000000 opportunities for provision of services with proper and customer-focus conduct. In other words, it has provided 25094 services to the patients with proper conduct of the hospital’s personnel which led to dissatisfaction of patients. Therefore, response of the third sub question is 3.45.

- Sigma level of the cost is 3.04. It means that the hospital has lost 61320 out of 1000000 opportunities for provision of services with proper cost. In these cases, it couldn’t fulfill satisfaction of patients. Response of the fourth sub question is 3.04.

- Sigma level of the cost is 3.6. The hospital has lost 17452 out of 1000000 opportunities for provision of high quality and satisfaction of patients and this caused dissatisfaction of patients. Response of the fifth sub question is 3.6.

- Studying quality of critical specifications in hospital

Critical specifications: courtesy and performance of the security section, specialized and medical equipment, information and clarification of physician about the patient’s condition, waiting time for performing administrative procedures, waiting time for receiving drug, waiting time for visiting physician, costs of hospital, unacceptable quality from viewpoint of patients.

But critical specifications such as specialty of physician, observance of ethical principles by physician, experimental and practical skills of physician, courtesy and performance of the night shift nurses, courtesy and performance of the morning shift nurses, courtesy and performance of the personnel in services section, performing diagnostic actions by hospital, silence of hospital environment, cleanness of hospital environment and welfare equipment provided to patient had acceptable quality from viewpoint of the patients and the hospital has provided these services in suitable level.

Studying effect of descriptive variables on critical specifications

Gender is effective on importance and satisfaction with some critical specifications. For
example, gender is effective on satisfaction with courtesy and performance of the night shift nurses. Men are more satisfied with courtesy and performance of the night shift nurses than women are.

Age is also effective on some critical specifications. The highest satisfaction with courtesy and performance of services personnel relates to patients in age range of 20-30.

Education is effective on importance and satisfaction with some critical specifications such as importance of diagnostic actions taken by the hospital and satisfaction with welfare equipment for the patient. The patients with associate’s and bachelor’s degree regarded diagnostic actions highly important and patients with high school degree below were more satisfied with welfare equipment than other patients with other education levels.

Now, we mention effects of monthly income on critical specifications. Importance of diagnostic actions for the patients with income level of Rials 4-6 million is higher than that for other patients. These patients have been the most satisfied with costs of hospital. Patients with monthly income of below Rials 2 million were more satisfied with silence and cleanliness of hospital environment.

**Studying effect of types of treatment on importance of critical specifications**

As mentioned in the previous chapters, patients in this hospital were divided into two classes of dialysis and surgery. Critical specifications such as courtesy and performance of night nurses, waiting time for receiving drug, welfare equipment are more important for the patients who undergo surgery than those for dialysis patients.

**CONCLUSION AND RECOMMENDATION**

Goal of six sigma is to help patients and processes manufacture the products and provide defect free services. Here zero defect is not considered. In six sigma, it is assumed that there is potential for defect but six sigma in performance level of 99%/997 determines goal for the performance so that there is almost no defect in many processes and products.

The hospital can achieve the following benefits by implementing six sigma methodology:

Efficient decision of managers which results from reliance on data and avoidance of personal judgment and emotions significantly reduces costs relating to false guidance and incorrect solutions for the problems.

Increasing understanding of needs and expectations of customers particularly about critical specifications of the services which have the highest effect on satisfaction and loyalty of customers. Increasing awareness with problem solving techniques and tools which lead to high job satisfaction of personnel.

Increasing changeability in performance of services which causes high compatibility of the services and makes them predictable.

Culture of organization will move from passive to active thinking.

Improving culture of teamwork in organization.

Top managers of the hospital should be aware that satisfaction of patients will increase by providing proper and high quality services. Since patients were satisfied with physicians of the hospital, managers of the hospital should focus on other indices. Satisfaction of patients attracts other patients to this center. In this way, recommendation of friends and relatives for referring to the hospital can be increased.

Some facts which result from performance in low sigma level are mentioned as follows:

If an unsatisfied customer faces a problem which is not so serious, he/she will mention it for more than 10 persons.

When problem of that patient is solved satisfactorily, he/she will inform other 5 persons again. 31% of the customers who have experienced their problem in receipt of services will not mention their complaint. Only 9% communicate with the organization again. It is very desirable for the organization to keep the customers glad and satisfied. It has been proved that 5% increase of customers retention will increase profit by more than 25%.

Therefore, it is recommended that:

- A skilled nursing expert should train her inferiors including inexperienced nurses and nurse’s aide.
- Physician should give patient and his/her companions necessary information such as accurate explanation of the disease diagnosis, term of hospitalization in hospital, and the treatments which should be done and cost.
- Head of the hospital should have careful supervision on wars through supervisors of the
wards. Head of the hospital is the first power of the hospital. His careful supervision will increase quality of treatment.

- Ethical charter should be installed in wards and visible to inform the patients with all of their rights.

- Ethical committee of the hospital should execute more powerful encouragement and punishment system for the personnel which creates motivation and increases efficiency of the personnel.

- At the end, at least one skilled employee should be present beside the inexperienced employee in each shift. Because it has been recently observed that the presence of inexperienced personnel and nursing students and the nurses who have no necessary experience beside each other in important wards such as surgery, dialysis and intensive cares reduces quality and increases mortality.

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