Improving Healthcare Services by Quality Function Deployment (QFD)

تحسين الخدمات الصحيه بالستخدام نشر تطبيق الجودة (QFD)

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الملخص

اكتسبت أدوات إدارة الجودة الشاملة (TQM) أهمية كبيرة نظرا لزيادة المنافسة في قطاع الرعاية الصحية. يحتاج نهج البيع إلى أن يقوم على ضمان الإدارة لهذا النهج، و لابد من تطبيقها على نطاق المستشفى بستخدام نهج منتظم لضمان التحسين المستمر للجودة. أظهرت الملاحظات من المستشفى التي تم اختيارها لهذا البحث أنها تكافح من أجل تلبية توقعات العملاء في بعض المناطق. نشر تطبيق الجودة (QFD) هو أسلوب منهجي لتصميم الخدمات أو المنتجات التي تعتمد على احتياجات العملاء. لذلك، يتم استخدام الأداة على نطاق واسع في جميع الصناعات تقريبا.

وتشرح هذه الورقة البحثية على الأسباب التي يتم فيها إستخدام نشر تطبيق الجودة (QFD) كأسلوب لتطوير نموذج الجودة الشاملة في الرعاية الصحية، بالستخدام مستشفى مختار لدراسة حالة الجودة. هذه الورقة البحثية تكتشف إمكانية استخدام نشر نطبيق الجودة (QFD) في خدمات الرعاية الصحية. وأظهرت الدراسة بعض القيود المفروضة على نظرية نشر نطبيق الجودة (QFD) التقليدية خارج الإنتاج الصناعي المادي ولكن أضهرت التعديلات امتدادا للنشر تطبيق الجودة (QFD) في خدمات الرعاية الصحية. واستنادا إلى النتائج، تم تطوير نموذج الجودة الشاملة للاسترشاد بها في إدارة الرعاية الصحية في التنمية الجودة الشاملة.

ABSTRACT

The tools of the Total Quality Management (TQM) have gained high importance due to increasing competitions in the healthcare industry. As a selling approach needs to be based on management assurance, this has to be applied hospital-wide with a systematic approach for the continuous quality improvement. The observations from the selected hospital for this research showed that it is struggling to meet customers' expectations in some areas. The quality function deployment (QFD) is a systematic technique for designing services or products that are based on the customers' needs. Therefore, the tool is widely used in almost all industries.

This research paper elaborates on the reasons the quality function deployment (QFD) is selected as a technique to develop a total quality healthcare model. With the help of a hospital-based case study, this research paper discovers the possibility of using the quality function deployment (QFD) in the healthcare service. The paper showed some limitations of the conventional quality function deployment (QFD) outside the physical industrial production and presented modifications as an extension of the quality function deployment (QFD) in the healthcare service. Based on the outcomes, a total quality model was developed to guide the healthcare management in their total quality development.

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CHAPTER ONE

INTRODUCTION

1.1. Research Problem

Governments provide various public services to their citizens, and a healthcare service is one of them. It is being an essential rather than luxury service, and the governments spend a huge amount of money on it. The principle behind providing a good health service to the people is to ensure a healthy society. A study shows that there is a chance of fast recovery of the patient if he/she is satisfied with the service the one receives (Rogers & Smith, 1999). One of the most important services the government of the UAE focuses on is improving its health services provided through the public and the private hospitals. According to the Prosperity Index, the United Arab Emirates (UAE) was ranked as (32nd) in (2012) while in (2015), its rank dropped down to (34th) (The 2015 Legatum Prosperity Index, 2016). That difference made the government to focuses more on the improvement of country's healthcare services. In (2016), Dubai government established the new vision to convince the people of the city to get a medical service before their tours. The program is aimed to ensure the improvement of their focus on healthcare (UAE Vision 2021, 2016).

1.2. Research Aims

The focus on healthcare defines the process of applying the quality function deployment (QFD) as a part of the general management of the healthcare system in the United Arab Emirates (UAE). The quality function deployment (QFD) is a procedure to determine customers' needs and evaluate, manage, and design a mechanism to enhance the current system (ReVelle, Moran, & Cox, 1998). The research will present a case study of applying the quality function deployment (QFD) model to enhance the healthcare processes and the customers' satisfaction at the private hospitals (Hospital A) in Dubai, compared to other hospitals of a region. The study will use an organized method based on hospital customer-surveys to assess their current satisfaction level and will identify detailed actions that can be done to improve the overall quality of hospital services.

The followings are the aims for this research:

- The first aim of this research is to introduce and understand the quality function deployment (QFD) application and the tools associated with its use in the real world, to help design and improve a product or a service.
- The second aim is to define the strategic and technical requirements through this method usage to help fulfil the customers' demands and the other steps in product planning.
- The third aim is to show how the quality function deployment (QFD) can be implemented and what are the benefits of using such method in the chosen scenario.

1.3. Research Methodology (Quality Function Deployment QFD)

The main objective of this research is to increase the hospitals' operational quality. To start the process, customers' needs should be identified to determine the improvement actions. An online survey will be conducted to determine the needs and wants of the customers. The research can be summarized in four steps (Bhattacharyya, 1998):

- Step 1: Define and prioritize customer needs;
- Step 2: Use the hospital reports and the survey to determine the customer satisfaction level.
- Step 3: Use the quality function deployment (QFD) to analyze and define the area that requires enhancement and design the improvement process (House of Quality Matrix).
- Step 4: Implement the analysis outcomes, and monitor the process.

1.4. Quality Function Deployment (QFD) Benefits

The quality function deployment (QFD) is driven by customers and focuses on their needs and requirements, which needs data collection from the competitors in the business. This practice helps to organize the resources and restructures them according to the information collected about the customers' experiences. The quality function deployment (QFD) helps to decrease the development and implementation time for the new product, which helps to minimize any design changes in the future. Other benefits of the quality function deployment (QFD) will also be introduced and demonstrated throughout this research (Bhattacharyya, 1998).

CHAPTER TWO

LITERATURE REVIEW

2.1. Definition

Six Sigma is one of the most famous quality methods used all over the world. It focuses on the customer needs for continuous improvement and development. It also helps in minimizing (3.4) defects per million in products and process designs. It is used to endorse excellence in companies' processes with strong target sets. Six Sigma method was invented by Bill Smith, an engineer at Motorola Company in (1984). It is based on the statistical methods to determine the standard deviation and is used to detect the amount of variation in any process. Six Sigma has five steps which are (1) Define, (2) Measure, (3) Analyze, (4) Improve and (5) Control (DMAIC). These steps are used for continuance improvement and focus on customer satisfaction to reduce the cost by decreasing the variation in the processes. The aims of the five steps (DMAIC) are to identify the problem, measure the service or the process performance, examine the process to determine the root causes, enhance the process or the service by removing the root causes, and then using the identified measures to improve the performance of the process (Pyzdek, 2003).

The basic element that helps any company to implement Six Sigma is the 'Voice of the Customers'. The company needs to understand what the customer wants and needs as a first step of the process. This will help to identify, structure, and arrange the customers' requirements. It will also allow the companies to understand the customers' expectations at the start of the project and act accordingly. The companies need to understand what quality means to the customers and how they define it. To do that, a data collection is required using methods, for example, surveys or interviews. This will help get the customer feedback, and the quality function deployment (QFD) will be used to measure the product requirements according to the customer needs. The companies need to promptly respond to the customers' needs to stay in business (Ficalora, Cohen, & Cohen, 2010).

2.2. Background

The quality function deployment (QFD) is widely used as it helps to determine the voice of the customers and interprets it into the technical requirements that should be fulfilled in the product or service design to achieve customer satisfaction. The quality function deployment (QFD) was developed by Yogi Akao in (1966) and was presented in Japan between (1960 and 1970). Later, it was used by Mitsubishi's Kobe shipyard in (1972). Since then, the quality function deployment (QFD) was introduced worldwide, especially in the manufacturing sector of the United States of America. The use of quality function deployment (QFD) was not limited to manufacturing, it has been used in all process designs, starting with customers' needs analysis, process design, product design, quality management, and other engineering areas (Hunt & Killen, 2004).

The quality function deployment (QFD) can be used in any service or business. It has been applied to improve many service features in the manufacturing and design industry, aviation sector, healthcare service, and many other businesses. The quality function deployment (QFD) helps to achieve customers' satisfaction by determining their exact requirements and needs to help the company survive in the competitive market. The advantages of using the quality function deployment (QFD) at any process is that it does not inspect the quantity and only focuses on the quality of the design, which will help to reduce the time of process development and will lower the cost of starting a design. It helps in fulfilling the customer requirements and can be used for future improvements in the design (Hunt & Killen, 2004).

The quality function deployment (QFD) is a process used to incorporate customers' requirements into the design of the products or the services. Understanding the customer requirements and needs are critical to the success of the design of the products. The customers' requirements and needs will be used to populate the quality table to ensure that these requirements are implemented at all design levels and are used to determine the company's requirements. Nowadays, the quality function deployment (QFD) is implemented in the strategic planning processes to focus on the voice of the customers to help achieve the company's goals and visions. The quality function deployment (QFD) is a process different than the other quality tools that helps to minimize the quality glitches. A cross-functional team

is responsible for implementing the quality function deployment (QFD) process within the organization (Forster Cornejo, 1998).

2.3. Quality Function Deployment (QFD) Methodology (House of Quality)

The house of quality (HoQ) is the first step towards planning the improvement process within quality function deployment (QFD). The house of quality (HoQ) is a systematic graphical method to demonstrate the design aspects organized in a matrix, which consist of rooms, a roof, and a basement. The house of quality (HoQ) matrix shows the summary of the product information. The real value of the house of quality (HoQ) is not the diagram itself, but the outcome of the brainstorming between the team members to construct the matrix to understand the design problem. The team needs to understand the problem and how that may affect the company and the customers. The information gathered should be related to the customers and the company's requirements. The house of quality (HoQ) consists of eight rooms: (1) Customer requirements, (2) Customer importance weight, (3) Engineering characteristics, (4) Correlation ratings matrix, (5) Benchmark satisfaction rating, (6) Benchmark performance, (7) New product or service target, and (8) Coupling matrix. As mentioned in the previous chapter (Chapter 1), the house of quality (HoQ) will be used to improve the healthcare services at the chosen hospital (Hospital A) (Hunt & Killen, 2004).

Following are the explanations of the rooms in the house of quality (HoQ) (Figure 2.1) (Hunt & Killen, 2004):

1. **Customer Requirements (Room 1)**

It illustrates the customers' needs and requirements that are put in rows and are organized according to their importance to the customers. The requirements should also be clear, and modified to work with the company's requirements. These requirements express the 'Voice of Customers (VoC)'.

2. **Customer Importance Weight (Room 2)**

This is next to the customer requirements column, a weighting column using values between (0) for less important to (100) for most important. The weighting is important to analyze how significant these requirements are in terms of the customers' needs.

3. **Engineering Characteristics (Room 3)**

It lies under the roof to list the quantitative performance limits and their related units. It is used to measure the level of customer satisfaction associated with every requirement.

4. **Correlation Rating Matrix (Room 4)**

It is a biggest and the most important room in the house, and consists of rows and columns that are used to show the amount of correlation between the customer and engineering requirements. Each cell has six of three correlation-rating numbers or symbols indicating the ranks. For positive correlation (1) is low, (3) is medium, and (9) is high, while for negative correlation (-1, -3 and -9) are the numbers used. If there is no correlation between the requirements, the cell will be left blank, but if there is no correlation between the customer requirements and the engineering requirements, it will lead to a wrong measurement of customers' satisfaction.

5. **Benchmark Satisfaction Rating (Room 5)**

This step compares the service or the product of the company with other competitors as a benchmark. The team members have to rate the current product or service according to the customer requirements. After that, the competitors' product or service is rated using the collected data about the product or the service provided by other companies.

6. **Benchmark Performance (Room 6)**

It is located underneath the correlation matrix and is used to show the performance of each benchmark product or service to designate the performance with respect to the engineering requirements.

7. New Product or Service Target (Room 7)

It used to determine the performance target and set the required goals for the new product or service.

8. Coupling Matrix (Room 8)

It is the triangle roof for the house of quality (HoQ) and is used to show the correlation between the engineering requirements with the rating numbers. For a positive correlation, (1) is a lower value, (3) is medium, and (9) is high while for a negative correlation (-1, -3 and -9) are the subsequent values. There will be some requirements that are not correlated and can be improved by focusing one requirement after another without affecting the other engineering requirements. The correlated requirements show that some concessions should be made. For instance, improvement applied to one requirement might violate the rules for the other one.

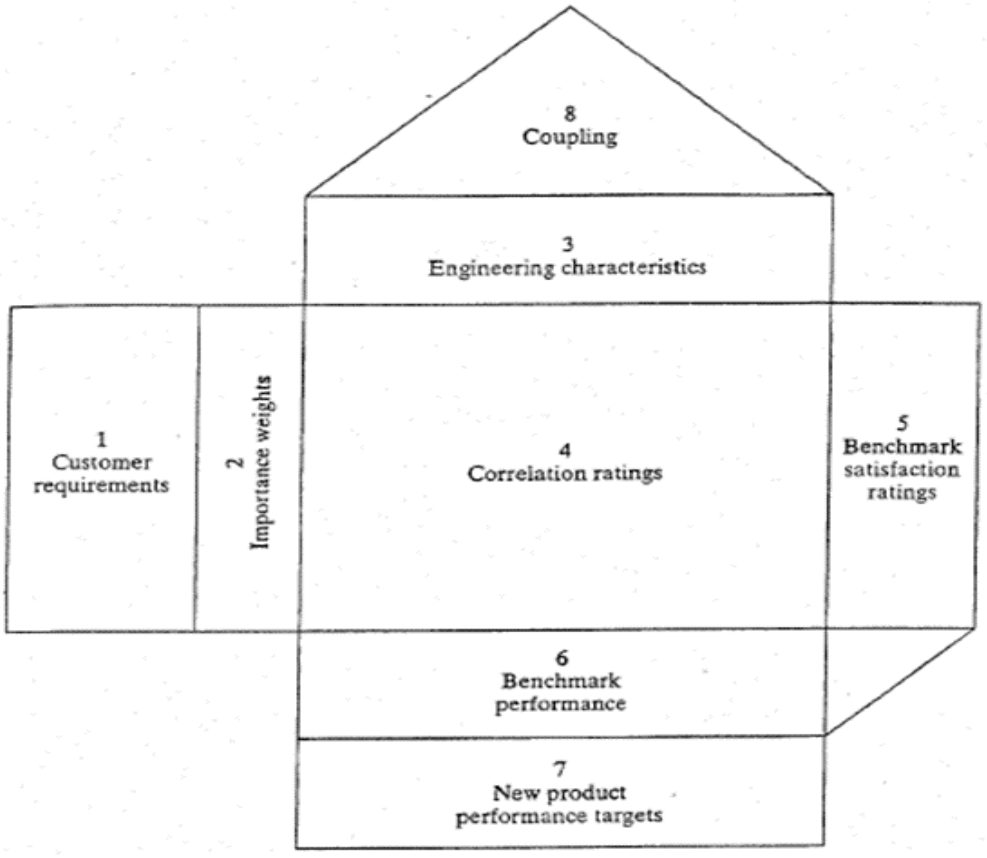


Figure 2.1 The house of quality (HoQ) model, (Hunt & Killen, 2004)

CHAPTER THREE

HOUSE OF QUALITY METHOD

3.1. Customer's Needs (Voice of Customers)

The identification of the customers' needs is the first step towards applying the quality function deployment (QFD) and focuses on defining, clarifying, and identifying the customer's demands. The customers' requirements are the drivers of the house of quality (HoQ) model. It will lay out the foundation to ensure that the process will be designed according to the customers' needs. A survey was conducted (Appendix A) and was designed to determine the needs of the customers and focused to gather information about the patients' demands at the selected hospital (Hospital A) (56) patients did take the survey in total (The survey conducted online using a healthcare survey templet from www.surveymonkey.com).

The survey context showed that the quality requirements are (1) Receiving fast and professional help, (2) Doctors communicate professionally with the patients, (3) Nursing staff communicate professionally with the patients, (4) Pain controlled with the right procedures, (5) Medicine using instructions explained clearly, (6) Clean rooms and facilities, (7) Quite facilities at night, and (8) Follow-up care at home recovery (Akao, 2004). The customers' requirements lay at the left side of the house of quality (HoQ) model (QFD Online - Free House of Quality (QFD) Templates for Excel, 2016), and the first four columns consist of (1) Demand quality, (2) Weight/importance, and (3) Maximum relationship value row. The weight/importance column will be filled with a number from (0 to 100) to show how important this requirement is (Figure 3.1). The most important factors with high weight is a fast and professional help, while the communication between the doctors and the nurses with the patients has the second priority. On the other hand, clean rooms and facilities are more important than the follow-up care (Akao, 2004).

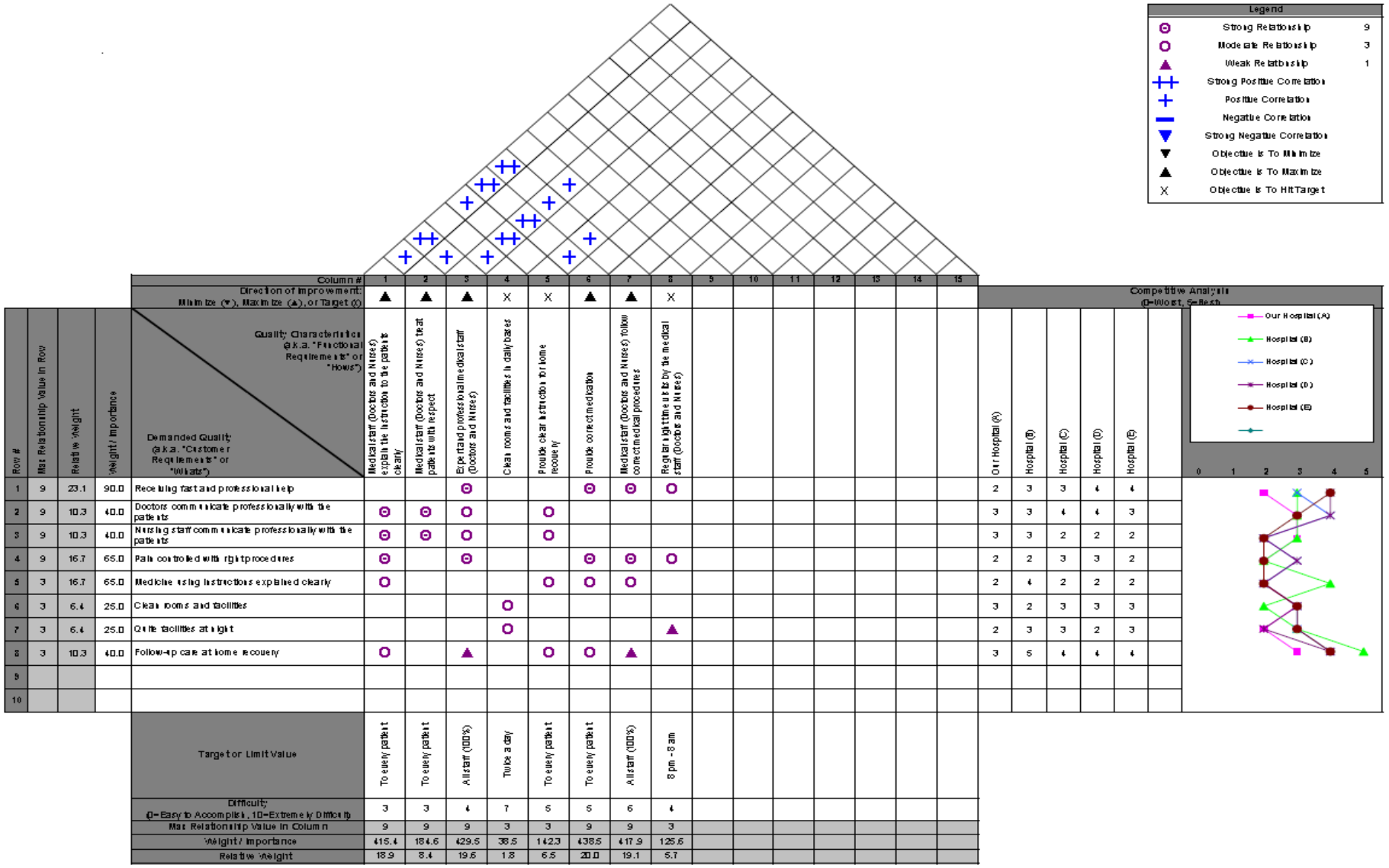


Figure 3.1 House of quality model for hospital A

The next column will be filled with relative weights, which will be affected by their importance to the patients. The comparative weight will affect the hospital procedures when they deal with the patients. The hospital management will give a high priority to control the pain with the right procedures against other requirements, keeping in mind the improvement of each requirement according to its importance to the patient (Figure 3.1) (Akao, 2004).

3.2. Technical Requirements (Voice of the Engineers)

The identification of the technical requirements is the second step to construct the house of quality (HoQ). These requirements will be designed on the basis of the customers' requirements to help the hospital design the right system to meet the customers' needs. The technical requirements are: (1) Medical staff (Doctors and Nurses) explain the instructions to the patients clearly, (2) Medical staff (Doctors and Nurses) treat the patients with respect, (3) Expert and professional medical staff (Doctors and Nurses), (4) Clean rooms and facilities in daily bases, (5) Provide clear instructions for home recovery, (6) Provide correct medication, (7) Medical staff (Doctors and Nurses) follow correct medical procedures, and (8) Regular night time visits by the medical staff (Doctors and Nurses) (Figure. 3.1) (Akao, 2004).

3.3. Competitive Analysis

The third step in designing the house of quality matrix is to focus on comparing the selected hospital with its four compotator hospitals (Hospital B, C, D and E). Nevertheless, an across-hospital comparison will also be conducted with respect to the customers' requirements as a reference. The hospitals will be ranked from (0 to 5), where (0) is being the lowest rank, and (5) is being the highest one. The selected hospital will be ranked using the patients' survey outcomes, which are used to determine the patients' requirements. The rating for the requirement will be done using the following system (0%-49%, 50%-59%, 60%-69%, 70%-79%, 80%-89%, 90%-100%), which is equivalent to (0, 1, 2, 3, 4, and 5) respectively. This step will help the management to understand how the patients see the hospital compared to other hospitals. It will help the hospitals to provide better services against their competitors by using them as a benchmark (Figure. 3.1) (Akao, 2004).

To analyze the survey outcomes (Appendix B), the eight patients' requirements will be ranked according to the benchmark. Some of the requirements got high scores for good feedback. However, these requirements also got a high percentage, which may cause damage in a long-term. These requirements will be prioritized according to this analysis. The following table (Table 3.1) shows patients' requirements with the estimated rank using the chart (Figure 3.2) from the survey outcomes (Akao, 2004).

Requirements Number	Patients Requirements	Questions	Very Poor	Poor	Fair	Good	Very Good	Competitive analysis rank	Weight
1	Receiving fast and professional help	10	0.0%	3.6%	35.7%	42.9%	17.9%	2	90
2	Doctors communicate professionally with the patients	4,5,6	0.0%	2.4%	16.7%	47.6%	33.3%	3	40
3	Nursing staff communicate professionally with the patients	1,2,3	0.0%	3.6%	16.1%	52.4%	28.0%	3	40
4	Pain controlled with right procedures	9,10	0.0%	3.6%	37.5%	43.8%	15.2%	2	65
5	Medicine using instructions explained clearly	3,6,12	1.2%	9.5%	26.8%	41.1%	21.4%	2	65
6	Clean rooms and facilities	7,11	0.0%	9.0%	17.0%	52.7%	21.4%	3	25
7	Quite facilities at night	8	1.8%	12.5%	35.7%	35.7%	14.3%	2	25
8	Follow-up care at home recovery	13	0.0%	10.7%	33.9%	46.4%	8.9%	3	40

Table 3.1 Patients requirements weights

Figure 3.2 Patients requirements survey analysis

The patients' requirements will be weighted in accordance with the competitive rank. The lowest rank will have the highest weight. The most important requirement of receiving fast and professional help (Requirement 1) will be weighted (90), while the second important requirement that is the pain controlled with right procedures and medicine-dosage instructions explained clearly (Requirements 4, 5) will be weighted (65). Other requirements including, communication of the hospital staff (Doctors and Nurses) with the patients and follow-up care at home recovery (Requirement 2, 3, 8) will be weighted (40). The last two requirements (Requirement 6, 7) will be weighted (25) (Figure. 3.1) (Akao, 2004).

3.4. Relationship Matrix

The relationship matrix is the fourth step in the house of quality (HoQ) (Figure. 3.1). It is used to show the relationship between the patients' requirements and the technical requirements, and how strongly they relate to each other. The relationship between them will be shown using symbols, illustrating a strong, moderate, and weak relationships, with a given value of (9, 3, and 1). The aim of this strategic step is to improve the service to fulfil the patients' demands. The competitive analysis between the hospitals showed the strengths and weaknesses of the selected hospital, which can help to show the areas that require improvements and the changes to compete. The relationship matrix has to align at least one patient's requirement with one from the technical requirements (Akao, 2004).

For example, the analysis for the patients and the technical requirements showed that the medical staff (Doctors and Nurses) explains the instruction to the patients clearly. Furthermore, if the staff treats the patients with respect, there is a better chance that the professional communication between the staff and the patients will be improved. The reason for this strong relationship is that the patients expect the medical staff to communicate clearly with them and to deal with any issues professionally. Medical staff (Doctors and Nurses) explains the instruction to the patients clearly, and a follow-up care at home also builds a moderate relationship. The matrix will be filled using the same method by defining a rational connection between the patients' requirements and technical requirements (Akao, 2004).

3.5. Technical Correlation Matrix

The technical correlation matrix step represents the roof of the house of quality (HoQ) (Figure. 3.1), and its uses to show the relationship between the technical requirements and the way they affect each other. The relationship is shown as a symbol. There are four symbols which represent strong positive correlation, positive correlation, negative correlation, and a strong negative correlation. For example, if there is a strong or strong positive relationship between two requirements, any changes have to be made by the management to ensure a positive impact. If there is a negative or strong negative relationship between two requirements, the management needs to make sure that there is no change in the requirements to avoid a negative impact on them (Akao, 2004).

The management has to implement the required changes if there is a negative correlation. Nevertheless, some changes may have a negative impact because the technical requirements have a strong relationship with each other. In this case, the management will not apply any changes to improve these requirements. The matrix (Figure. 3.1) shows that there are no negative or strong negative relationships between the technical requirements, which mean that no changes are needed to the requirements. If all the requirements have positive and strong positive correlation, these correlations are linked to each other and have the potential to affect each other to a major extent (Figure. 3.1). For example, the technical requirement experts, and professional medical staff (Doctors and Nurses) follow the correct medical procedures to ensure a strong positive correlation. Since the expert medical staff (Doctors and Nurses) will provide the correct medication with correct dosages, each one is expected to have a positive impact on each other. The use of correct medical procedures by the medical experts is a good example of a positive correlation between the requirements (Akao, 2004).

3.6. Technical Properties and Targets

The technical properties and targets identification is the final step is the designing of the house of quality (HoQ) matrix. It focuses on ranking the technical requirements by using the following methods: target or limit value difficulty, maximize the relationship value, weight / importance, and relative weight. The reason for using these methods in the management is to determine the most important problems to work on to gain a higher customer satisfaction. As a first step, the management has to set the target for each technical requirement. The management gives the most difficult requirement the high importance to achieving that goal. For example, the hospitals should achieve the ultimate patients' satisfaction by having an expert medical staff (Doctors and Nurses) to explain the instructions to every patient clearly and treat them with respect. The numbers showing the difficulty to achieve the target values are (0) Easy to Accomplish, (10) Extremely Difficult (Figure. 3.1) (Akao, 2004).

CHAPTER FOUR

HOUSE OF QUALITY ANALYSIS

The current house of quality (HoQ) shows the current position of the chosen hospital compared to other hospitals. To improve its position and increase patients' satisfaction, the current house of quality (HoQ) model requires some improvements. The design will give each quality characteristic a weight according to its importance to define the characteristics preferred by the patients. A relationship matrix showed the correlation between the patients' demands and the technical requirements that will also help in defining the required weights. It also showed the level of efforts put in the quality characteristics.

4.1. Step (1) Relative Weights Analysis for Technical Requirements

The weight will be selected according to the importance of the technical requirement to the hospital and will be given a numerical number. The most important technical requirement is 'expert and professional medical staff (Doctors and Nurses)'. Although the other requirements are also significant for the hospital, 'expert and professional medical staff (Doctors and Nurses)' is a major characteristic, which ensures the success of other requirements. This requirement will be used to determine the weights for other technical requirements. A relative weight will be determined using the weight/importance (Table. 4.1) (Bernal, Dornberger, Suvelza, & Byrnes, 2009).

Quality requirements	Weight/Importance	Relative Weight
Medical staff (Doctors and Nurses) explain the instruction to the patients clearly	60	13.0
Medical staff (Doctors and Nurses) treat patients with respect	50	10.9
Expert and professional medical staff (Doctors and Nurses)	100	21.7
Clean rooms and facilities in daily bases	30	6.5
Provide clear instruction for home recovery	50	10.9
Provide correct medication	75	16.3
Medical staff (Doctors and Nurses) follow correct medical procedures	75	16.3
Regular night time visits by the medical staff (Doctors and Nurses)	20	4.3
Total	460	100.0

Table 4.1 Quality requirements weight/importance and relative weight

4.2. Step (2) Relative Weights Analysis for Customers' Requirements

A relative weight for the quality characteristics will be used to calculate the relative weight of the customers' requirements. This will be done to determine a numerical relationship between the quality requirements and the customers' requirements, and it will be shown how important they are to each other. To determine the relative weights of the customers' requirements, the relative weight for the quality requirements will be multiplied with the weight/importance score for the customers' requirements (Table 4.2) (Bernal, Dornberger, Suvelza, & Byrnes, 2009).

Customers' requirments	Weight/Importance	Relative Weight
Receiving fast and professional help	90	1173.9
Doctors communicate professionally with the patients	40	434.8
Nursing staff communicate professionally with the patients	40	869.6
Pain controlled with right procedures	65	423.9
Medicine using instructions explained clearly	65	706.5
Clean rooms and facilities	25	407.6
Quite facilities at night	25	407.6
Follow-up care at home recovery	40	173.9
Total	390	4597.8

Table 4.2 Customers' requirements relative weights

A percentage score will be calculated using the relative weight of the customers' requirements (Table 4.3). This step is important to help conduct a comparative analysis between the information collected from the selected hospitals and other comparative hospitals (Bernal, Dornberger, Suvelza, & Byrnes, 2009).

Customers' requirments	Weight/Importance	Relative Weight	Percentage score
Receiving fast and professional help	90	1173.9	25.5
Doctors communicate professionally with the patients	40	434.8	9.5
Nursing staff communicate professionally with the patients	40	869.6	18.9
Pain controlled with right procedures	65	423.9	9.2
Medicine using instructions explained clearly	65	706.5	15.4
Clean rooms and facilities	25	407.6	8.9
Quite facilities at night	25	407.6	8.9
Follow-up care at home recovery	40	173.9	3.8
Total	**390**	**4598**	**100**

Table 4.3 Customers' requirements percentage score

In the table above (Table 4.3), the percentages show the importance of each customer's requirements that will help the hospital to give keen attention to them in order to improve their quality of services. For example, 'receiving fast and professional helps' has the highest percentage (25.5%). It indicates that the hospital needs to give more importance to this service to get patients' satisfaction. On the other hand, 'clean rooms and facilities and quite facilities at night' have the lowest percentage (8.9%) indicating that these two requirements are not as significant as 'receiving fast and professional help'. The percentages will help the selected hospital to get a better understanding of the patients' requirements. They will also be able to assess how much effort should be put in each requirement to increase customers' satisfaction (Bernal, Dornberger, Suvelza, & Byrnes, 2009).

4.3. Step (3) Competitive Analysis for Customers' Requirements

This step will determine the customers' requirement ratings within the selected hospital as a comparison to other competitor hospitals. In the house of quality (HoQ) matrix (Figure 3.1), the competitive analysis graph shows how well each customer requirement is doing and which area needs improvements. From (Figure 3.1), some of the customers' requirements have a value of (3) and above while others are below (3). These results coordinate with the competitive analysis graph. The tendency starts from the top of the graph between 2 and 4 and stays like this to the bottom of the graph to reach (5). A calculated average score will be compared with the percentage score of the last step (Table 4.4) (Bernal, Dornberger, Suvelza, & Byrnes, 2009).

Customers' requirments	Average score
Receiving fast and professional help	3.2
Doctors communicate professionally with the patients	3.4
Nursing staff communicate professionally with the patients	2.4
Pain controlled with right procedures	2.4
Medicine using instructions explained clearly	2.4
Clean rooms and facilities	2.8
Quite facilities at night	2.6
Follow-up care at home recovery	4
Total	23.2

Table 4.4 Customers' requirements average hospitals score

The table above (Table 4.4) illustrates that the hospital can work on many complexities and improves its average rating. Furthermore, the conducted survey can also help the hospital to improve its service quality compared to its competitors. The percentage score is a measurement tool to observe and decide what needs to be done, and it works as a standard to be followed. A high percentage means the more effort is needed to improve the requirement score. The management needs to decide which area requires improvement according to the percentage score. For example, the requirement of 'nursing staff communicate professionally with the patients' has a percentage of (18.9%) with (2.4) score. Therefore, the hospital management needs to decide how much resources should be allocated to this effort. If the management puts (18.9%) effort to improve the 'nursing staff's professional communication with the patients', it might get a satisfactory rating (Bernal, Dornberger, Suvelza, & Byrnes, 2009).

The percentage score will help the hospital to dedicate its efforts for the improvement of patients' satisfaction. If the average score needs improvement, the hospital management should perfect its efforts to achieve a high average. Quite the opposite, if the average score is high, it will be reasonable to reduce the efforts spent on one specific area and increase it in another one. While it is important to fulfil all customer requirements, it is also essential to get enough understanding of the customers' requirements before trying to improve their rating (Bernal, Dornberger, Suvelza, & Byrnes, 2009).

CHAPTER FIVE

DESIGN FOR QUALITY

The required analysis has been done in the last chapter (Chapter 4), and these results will be used to improve the healthcare service of the chosen hospital (Hospital A). The chosen hospital will be compared to a hospitals national average in the UAE instead of its competitor hospitals (Health Authority - Abu Dhabi, 2016). In the competitive analysis done through the house of quality (HoQ) matrix, the average value of the hospital is (4) (Figure 3.1). The current values of the chosen hospital (Hospital A) based on the survey's responses submitted by the hospital patients' reflect the patients' satisfaction. Nevertheless, there is another set of data that will help to determine the hospital average rank against the hospitals national average (Table 5.1).

Customers' requirments	Hospital A Avarage	Reginal Average	National Avarage
Patients who reported that they "Always" received help as soon as they wanted	67%	70%	81%
Patients who reported that their doctors "Always" communicated well	75%	81%	82%
Patients who reported that their nurses "Always" communicated well	78%	81%	80%
Patients who reported that their pain was "Always" well controlled	69%	72%	71%
Patients who reported that staff "Always" explained about medicines before giving it to them	69%	65%	65%
Patients who reported that their room and bathroom were "Always" clean	72%	75%	74%
Patients who reported that the area around their room was "Always" quiet at night	58%	60%	62%
Patients who reported that YES, they were given information about what to do during their recovery at home	89%	88%	86%

Table 5.1 Hospitals national average ("Health Authority - Abu Dhabi", 2016)

In the table above (Table 5.1), receiving fast and professional help has a national average of (81%) and the chosen hospital (Hospital A) has a value of (67%). In this case, a value of (3) was given to the hospital because it is less than the national average value. The second quality requirement of 'doctors' professional communication with the patients' has a national average of (82%) while the chosen hospital (Hospital A) has a percentage score of (75%). Therefore, a values of (3) will be given to the chosen hospital in a comparative analysis. 'Nursing staffs' professional communication with the patients' has a national average of (80%), and the chosen

hospital (Hospital A) has (78%). Again, a value of (3) will be given to this characteristic because of its score lower than the national average (Figure 5.1).

'Pain controlled with right procedures' has a national average of (71%), and the chosen hospital (Hospital A) has a percentage score of (69%) that leads the chosen hospital to get a value of (3). 'Medicine using instructions explained clearly' has a national average of (65%) and the chosen hospital (Hospital A) has a score of (69%). Therefore, it gets a value (2) in the comparative analysis because the hospital score is higher than the national average one. The national average for the 'clean rooms and facilities' is (72%) while for the chosen hospital (Hospital A), it is (74%). As there is no significant difference between the two scores, the hospital gets a value of (3) (Figure 5.1).

'Quite facilities at night' has a national average of (62%), and the chosen hospital (Hospital A) has a score of (58%) and gets a value of (3). The last customer requirement is 'follow-up care at home' that has a national average of (86%), and the chosen hospital (Hospital A) has a percentage of (89%). Due to the small difference between both values, a score of 3 will be given to the chosen hospital. From the table above (Table 5.1), it can be noticed that the selected hospital has only two customers' requirements with an average score that is higher than the national average one. These requirements are 'medicine using instructions explained clearly' and 'follow-up care at home after recovery' (Figure 5.1).

'Medicine using instructions explained clearly' has an average percentage of (69%) that is higher than the national average and has (15.4%) percentage score in the comparative analysis. Although this requirement has the third highest percentage, the Hospital has a good overall average in it and does not need to do much to improve this requirement. 'Follow-up care at home after recovery' has an average percentage of (89%) which is higher than the national average. With (3.8%) percentage score in the competitive analysis, this requirement has the lowest percentage in it and has a lower overall percentage in it. However, the customers still have a good satisfaction over this service. Therefore, the hospital is not required to make any changes in this requirement for the sake of improvement (Figure 5.1).

'Following customers' requirements' has the highest percentage. 'Receiving fast and professional help' has (25.5%). For other requirements, the percentage is as follows: 'nursing staff communicate professionally with the patients' (18.9%), 'doctors communicate

professionally with the patients' (9.5%), and 'pain controlled with right procedures' (9.2%). These customers' requirements have a sum of (63.1%), which indicates that the hospital management needs to put more efforts within these requirements. A percentage of (63.1%) is an indication of how much the hospital management needs to perfect these customers' requirements. Some requirements seem easy to improve compared to the others, such as 'pain controlled with right procedures' can be upgraded by having a standard procedure that the doctors and the nurses can follow. Moreover, having regular internal reviews can ensure that the staff is following the stated standards (Figure 5.1).

Following the customer requirement of 'receiving fast and professional help' has the highest percentage. This requirement has the most significant role in the improvement of other characteristics, and therefore, needs more attention of the hospital management. The professional communication of the medical staff (Doctors and nurses) with the patients can be enhanced with the help of training and regular reviews provided to the medical staff.

The other two requirements including 'clean rooms and facilities' and 'quite facilities at night' have the sum of (17.7%). They do not require a rigorous effort for improvement because of their trivial role in fulfilling the customers' satisfaction. The last two requirements, including 'medicine using instructions explained clearly' and 'follow-up care at home after recovery', will be excluded since they have a percentage higher than the national average one. These two customers' requirements can be improved faster than the other ones by increasing the cleaning frequency. Moreover, the hospital can change the visiting hours and minimize the number of the visitors to ensure quite facilities at night (Figure 5.1).

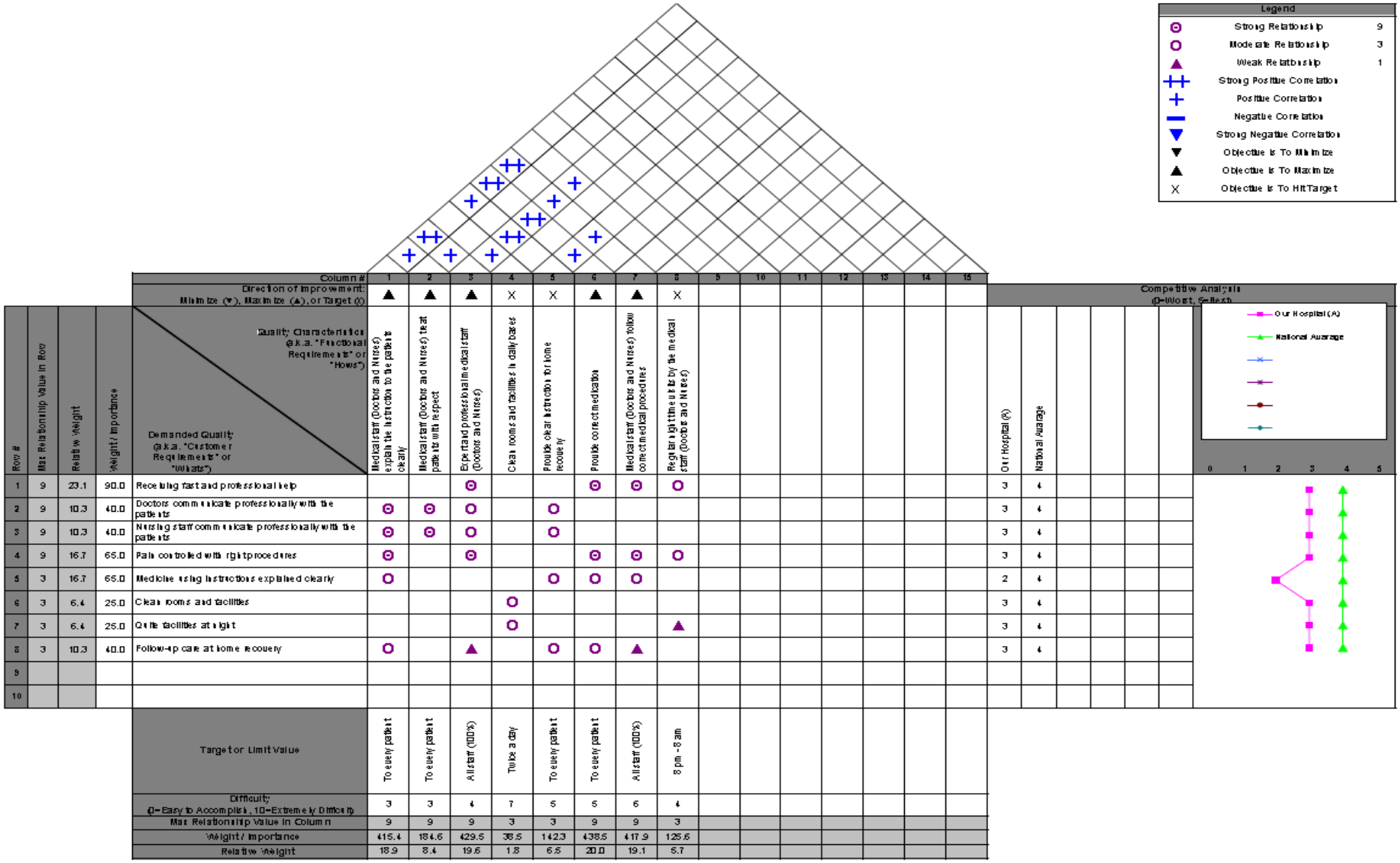


Figure 5.1 New house of quality model for hospital A

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6.1. Conclusion

Over the years, the total quality management proved its vibrant role in improving the companies' services or products. For the quality management, each company uses quality techniques that serve its organizational strategies. The quality functional deployment (QFD) is one of the most popular tools in the total quality management and proved to be useful in improving services or products for an ultimate customers' satisfaction. In the case study, the competitor hospitals are ahead of the chosen hospital in some areas, and the hospital management needs to focus on those areas to improve its customer satisfaction. The analysis started by gathering customers' feedback with the help of a survey about the current services provided by the hospital. These survey outcomes helped to fill the rooms in the house of quality (HoQ) and showed how the customers' feel about the hospital. The results will help the hospital management determine customer and technical requirements and priorities these requirements according to their importance to the customers.

The analysis continued by adding some weights of importance to the customers' and technical requirements, which helped the hospital management determine the areas that need an improvement. The final house of quality model helped explain to the hospital management the relations between different parts of the hospital and a direct association with how good the hospital responds to the patient's requirements. The results helped make few changes to the quality functional deployment (QFD) and the house of quality (HoQ) plan.

The percentage scoring system put light on the areas that are strong and helps in exploring the hospital services that can be made better. Although the percentage scores helped in allotting a required effort to attain a customer's satisfaction, it did not show the other parts of the hospitals can be managed. For example, it is obvious that funding is required to help improve the services with the help of staff training, but this information could not be gathered from the

survey results. A short-term plan has been initiated to help improve the areas that are necessary for the quality improvement.

6.2. Recommendations

The hospital management should work on necessary changes to improve its service. Chapter 5 distinguished a few vital steps to help the hospital design a proper plan in order to get to the required customers' satisfaction. The management needs to adopt the most important technical requirements that are achievable within their capability and strategy. At the moment, a suitable plan is to implement a systematic approach using a lean system. Additionally, a quality officer should be there to monitor the service quality and solve the quality issues.

The reason to adopt lean system is that it is time saving and can help reduce the predicament in attracting more patients. The new system will take at least two to three years to be fully implemented after the hospital management accepts and approve the new plan. This will happen due to the wide range of departments within the hospital and a large number of employees. The survey needs to be run for long period of time to measure the hospital performance, for example the survey can run at least for two months and the performance can be analyzed in weekly bases to determine when the hospital is performing well or bad. Finally, for the further improvement, the financial aspect should also be considered to enhance the quality plan.

The below table (Table 6.1) shows the steps that will help the hospital management to prove the technical requirements linked to the customers' requirements.

Importance	**Rational**	**Target/objective**	**Expected duration**
Systematic Method	To adopt a new system that has the likelihood to increase the efficiency and decrease time lost.	That will help to decrease the time to help the patient.	Two years.
Quality officer and team	A devoted officer's full time with quality experience. Employees from each departments in the hospital are required to assemble a quality team.	That will help to monitor the quality procedures within each department and over the hospital	To be decided within departments.
Customers' feedback	A feedback system with to the increase of customers' awareness of using it for future developments.	That will help the hospital management to monitor the hospital service based on the customer feedback.	Approximately one years.
Soft skills training (Communication)	Provide a suitable training to enhance the communication methods between the medical staff and the patients.	Thant will help the medical staff to communicate professionally with the patients.	Approximately one years.

Table 6.1 Priorities - implementation plan

References

Akao, Y. (2004). *Quality Function Deployment: Integrating Customer Requirements into Product Design*. Productivity Press.

Bernal, L., Dornberger, U., Suvelza, A., & Byrnes, T. (2009). Quality Function Deployment (QFD) for Services Handbook. *International SEPT Program*.

Bhattacharyya, S. (1998). The International Warwick Manufacturing Group. *Assembly Automation*, *18*(2). http://dx.doi.org/10.1108/aa.1998.03318baa.002

Ficalora, J., Cohen, L., & Cohen, L. (2010). *Quality function deployment and Six Sigma*. Upper Saddle River, NJ: Prentice Hall.

Forster Cornejo, E. (1998). *Application of quality function deployment in defense technology development*.

Health Authority - Abu Dhabi. (2016). *Haad.ae*. Retrieved 10 April 2016, from http://www.haad.ae/haad/

Hunt, R. & Killen, C. (2004). *Best practice quality function deployment (QFD)*. Bradford, England: Emerald Group Pub.

Pyzdek, T. (2003). *The Six Sigma handbook*. New York: McGraw-Hill.

QFD Online - Free House of Quality (QFD) Templates for Excel. (2016). *Qfdonline.com*. Retrieved 10 February 2016, from http://www.qfdonline.com/templates/

ReVelle, J., Moran, J., & Cox, C. (1998). *The QFD handbook*. New York: Wiley.

Rogers, G. & Smith, D. (1999). Methodology matters. Reporting comparative results from hospital patient surveys. *International Journal For Quality In Health Care*, *11*(3), 251-259. http://dx.doi.org/10.1093/intqhc/11.3.251

The 2015 Legatum Prosperity Index. (2016). *Prosperity Index 2015*. Retrieved 9 February 2016, from http://www.prosperity.com/#!/

UAE Vision 2021. (2016). *Vision2021.ae*. Retrieved 17 February 2016, from https://www.vision2021.ae/en

https://www.surveymonkey.com/r/CZ5WDJL

Appendix A

Patient Satisfaction Surveys (https://www.surveymonkey.com/r/CZ5WDJL).

During your visit to the hospital, your care was provided by Doctors, physicists' assistant and nurse practitioner. Please answer the following questions with that health care provider in mind:

1. During this stay at the hospital, how often did nurses treat you with courtesy and respect?

- Very Poor
- Poor
- Fair
- Good
- Very Good

2. During this stay at the hospital, how often did nurses listen carefully to you?

- Very Poor
- Poor
- Fair
- Good
- Very Good

3. During this stay at the hospital, how often did nurses explain things in a way you could understand?

- Very Poor
- Poor
- Fair
- Good
- Very Good

4. During this stay at the hospital, how often did doctors treat you with courtesy and respect?

- Very Poor
- Poor
- Fair
- Good
- Very Good

5. During this stay at the hospital, how often did doctors listen carefully to you?

- Very Poor
- Poor

- Fair
- Good
- Very Good

6. During this stay at the hospital, how often did doctors explain things in a way you could understand?

- Very Poor
- Poor
- Fair
- Good
- Very Good

7. During this stay at the hospital, how often were your room and bathroom kept clean?

- Very Poor
- Poor
- Fair
- Good
- Very Good

8. During your stay at the hospital, how often the hospital was kept quiet?

- Very Poor
- Poor
- Fair
- Good
- Very Good

9. During this stay at the hospital, how often was your pain well controlled?

- Very Poor
- Poor
- Fair
- Good
- Very Good

10. During this stay at the hospital, how often did the hospital staff do everything they could to help you with your pain?

- Very Poor
- Poor
- Fair
- Good
- Very Good

11. Before giving you any new medicine, how often did hospital staff at the hospital tell you what the medicine was for?

- Very Poor
- Poor
- Fair
- Good
- Very Good

12. Before giving you any new medicine, how often did hospital staff at the hospital describe possible side effects in a way you could understand?

- Very Poor
- Poor
- Fair
- Good
- Very Good

13. How well did your provider explain your follow-up care?

- Very Poor
- Poor
- Fair
- Good
- Very Good

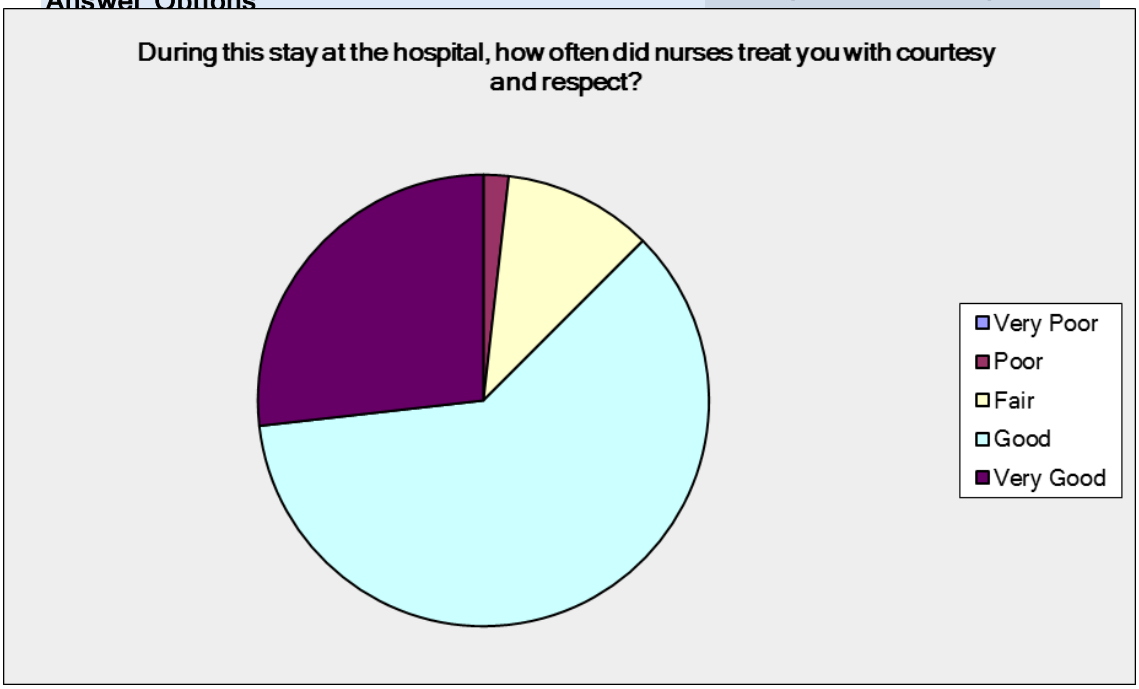
14. Comments (describe good or bad experience):

Appendix B

Question 1:

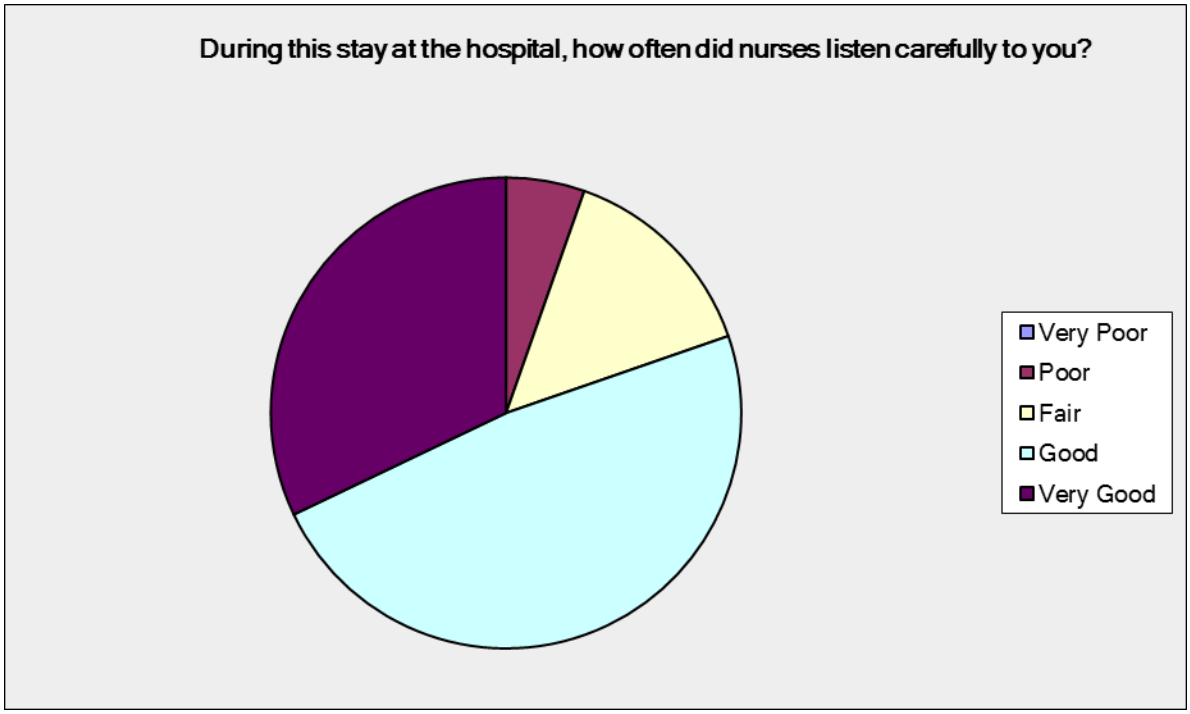
Patient Satisfaction Surveys Outcomes

During this stay at the hospital, how often did nurses treat you with courtesy and respect?		
Answer Options	Response	Response



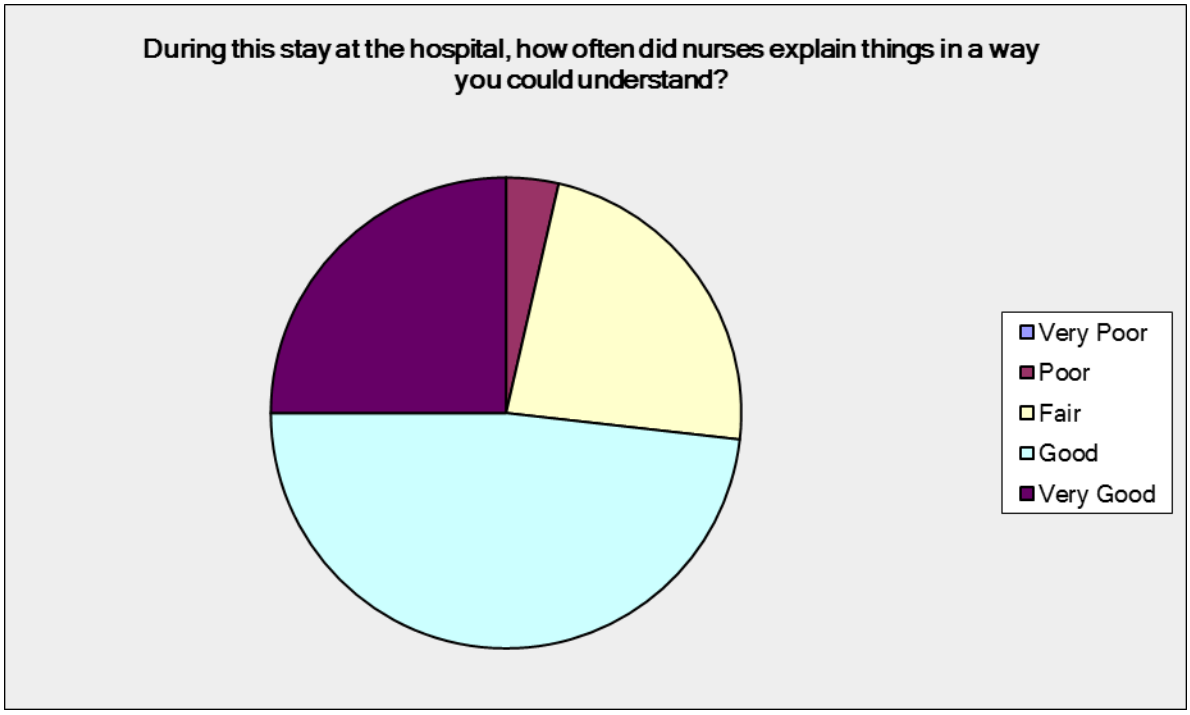
Question 2:

During this stay at the hospital, how often did nurses listen carefully to you?		
Answer Options	**Response Percent**	**Response Count**
Very Poor	0.0%	0
Poor	5.4%	3
Fair	14.3%	8
Good	48.2%	27
Very Good	32.1%	18
	answered question	**56**
	skipped question	**0**



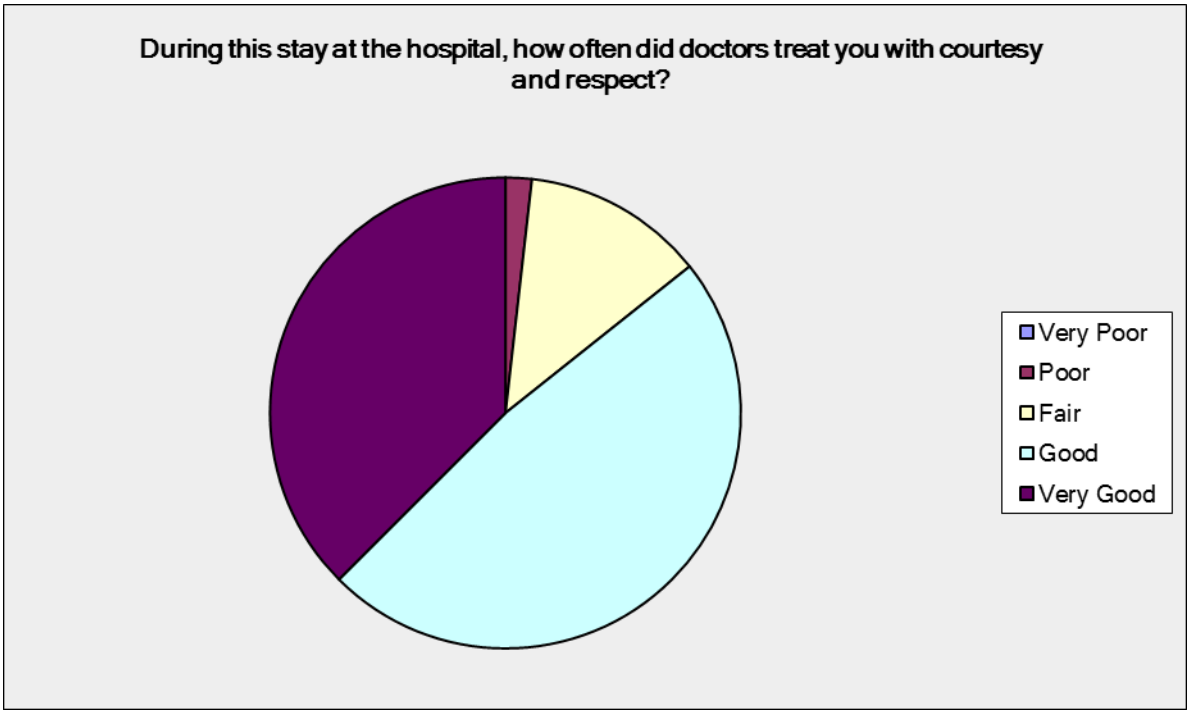
Question 3:

During this stay at the hospital, how often did nurses explain things in a way you could understand?		
Answer Options	**Response Percent**	**Response Count**
Very Poor	0.0%	0
Poor	3.6%	2
Fair	23.2%	13
Good	48.2%	27
Very Good	25.0%	14
answered question		56
skipped question		0



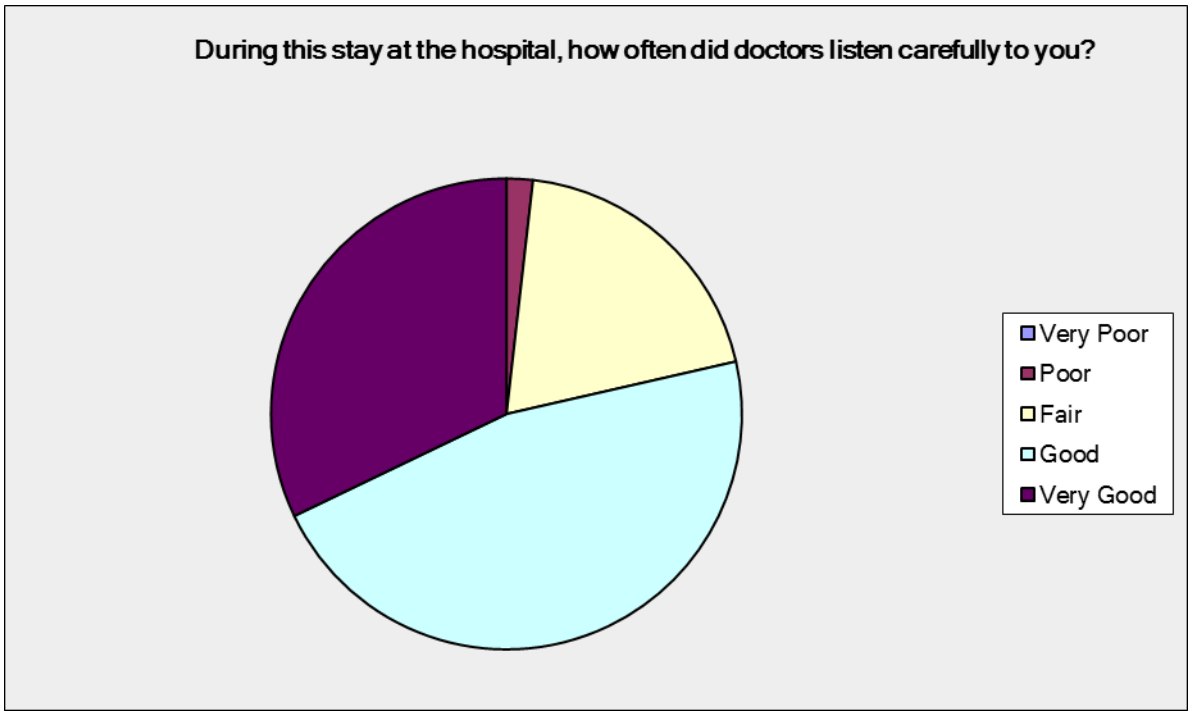
Question 4:

During this stay at the hospital, how often did doctors treat you with courtesy and respect?		
Answer Options	**Response Percent**	**Response Count**
Very Poor	0.0%	0
Poor	1.8%	1
Fair	12.5%	7
Good	48.2%	27
Very Good	37.5%	21
	answered question	56
	skipped question	0



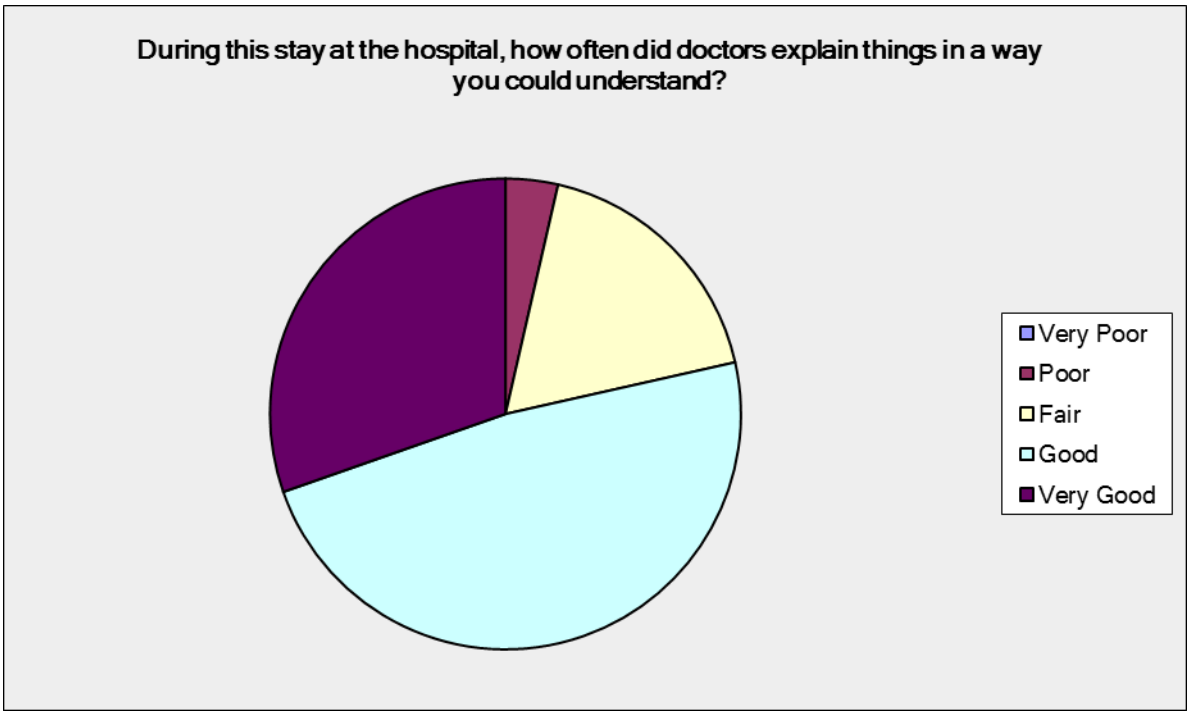
Question 5:

During this stay at the hospital, how often did doctors listen carefully to you?		
Answer Options	**Response Percent**	**Response Count**
Very Poor	0.0%	0
Poor	1.8%	1
Fair	19.6%	11
Good	46.4%	26
Very Good	32.1%	18
	answered question	56
	skipped question	0



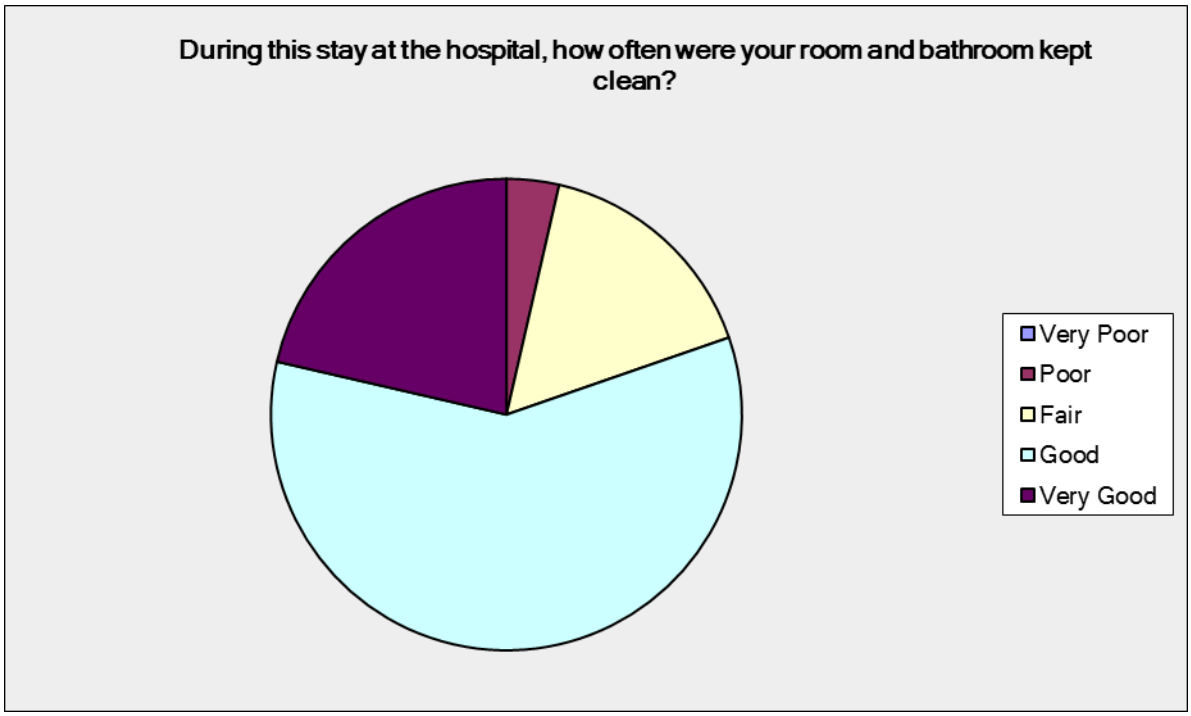
Question 6:

During this stay at the hospital, how often did doctors explain things in a way you could understand?		
Answer Options	**Response Percent**	**Response Count**
Very Poor	0.0%	0
Poor	3.6%	2
Fair	17.9%	10
Good	48.2%	27
Very Good	30.4%	17
answered question		56
skipped question		0



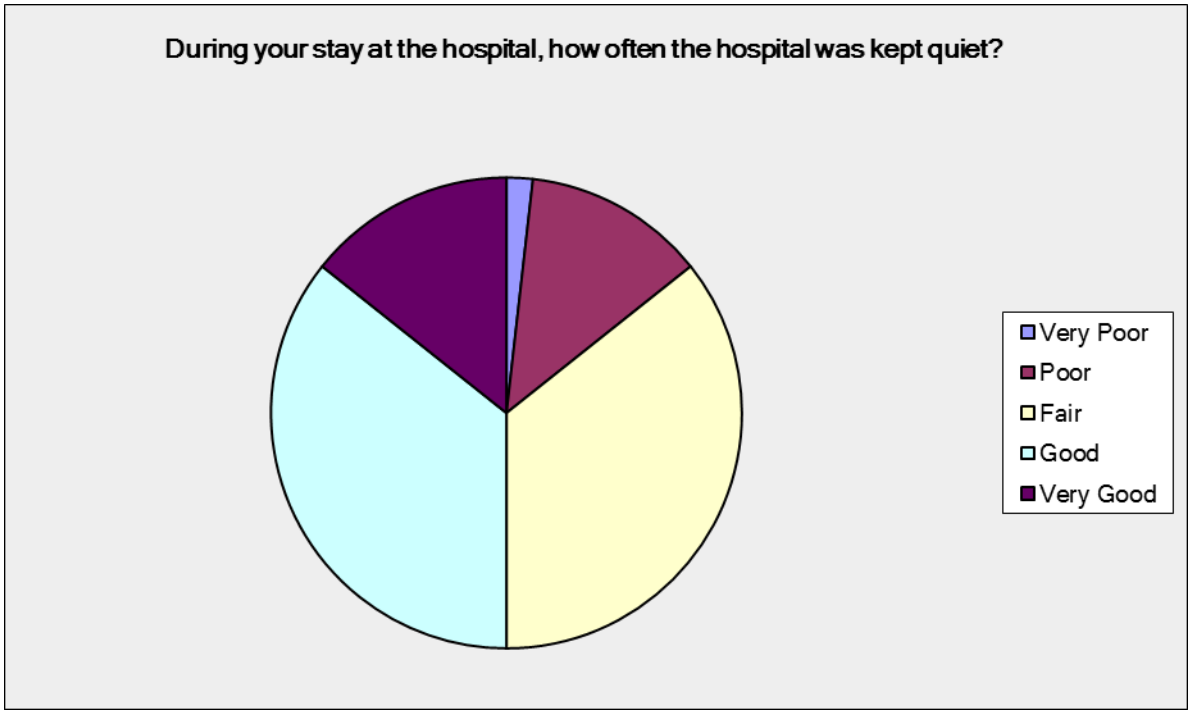
Question 7:

During this stay at the hospital, how often were your room and bathroom kept clean?		
Answer Options	**Response Percent**	**Response Count**
Very Poor	0.0%	0
Poor	3.6%	2
Fair	16.1%	9
Good	58.9%	33
Very Good	21.4%	12
answered question		56
skipped question		0



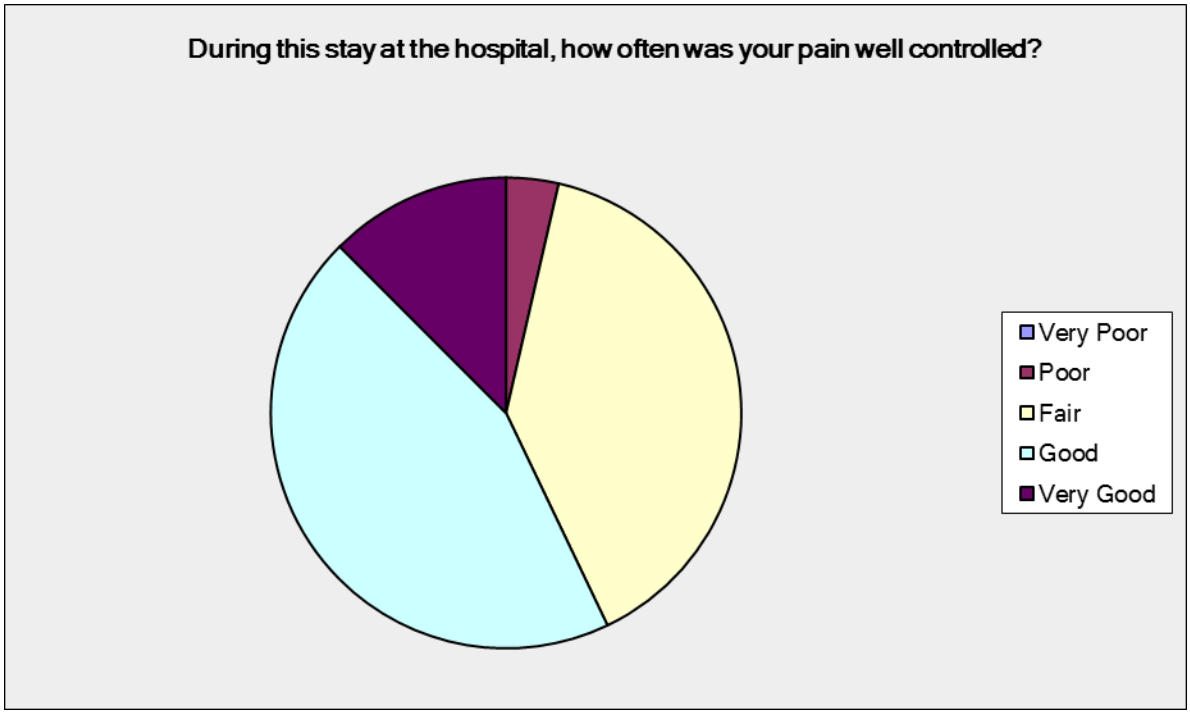
Question 8:

During your stay at the hospital, how often the hospital was kept quiet?		
Answer Options	**Response Percent**	**Response Count**
Very Poor	1.8%	1
Poor	12.5%	7
Fair	35.7%	20
Good	35.7%	20
Very Good	14.3%	8
	answered question	56
	skipped question	0



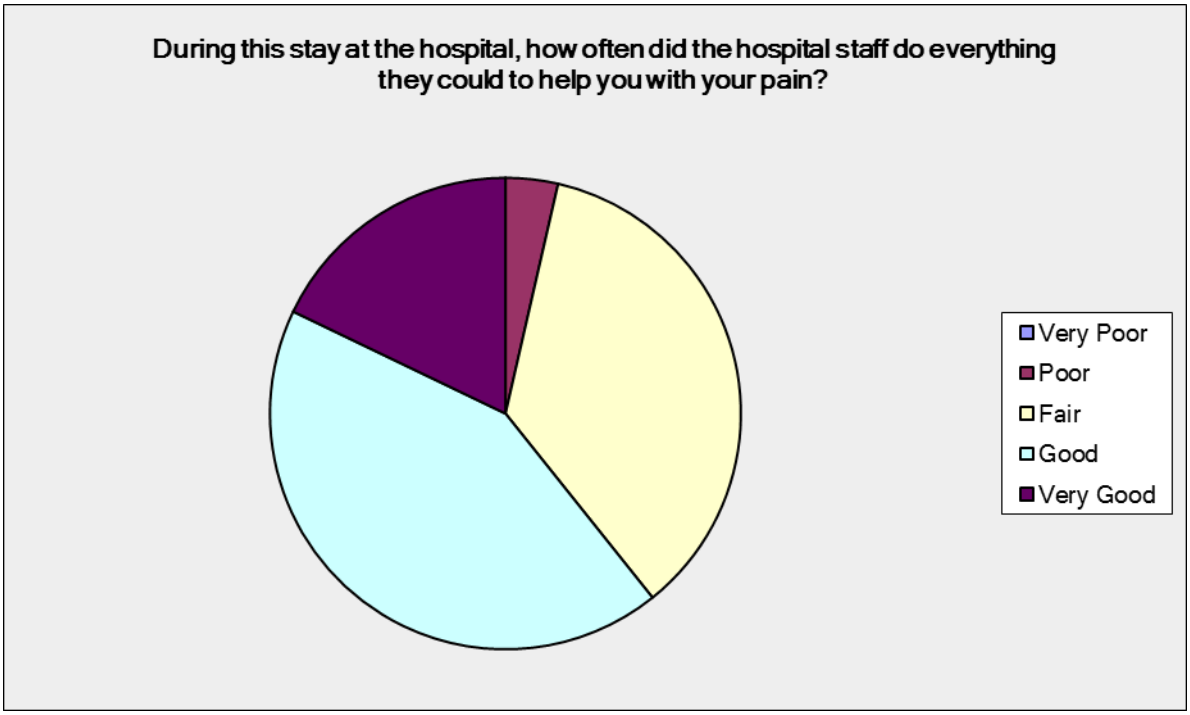
Question 9:

During this stay at the hospital, how often was your pain well controlled?		
Answer Options	**Response Percent**	**Response Count**
Very Poor	0.0%	0
Poor	3.6%	2
Fair	39.3%	22
Good	44.6%	25
Very Good	12.5%	7
answered question		56
skipped question		0



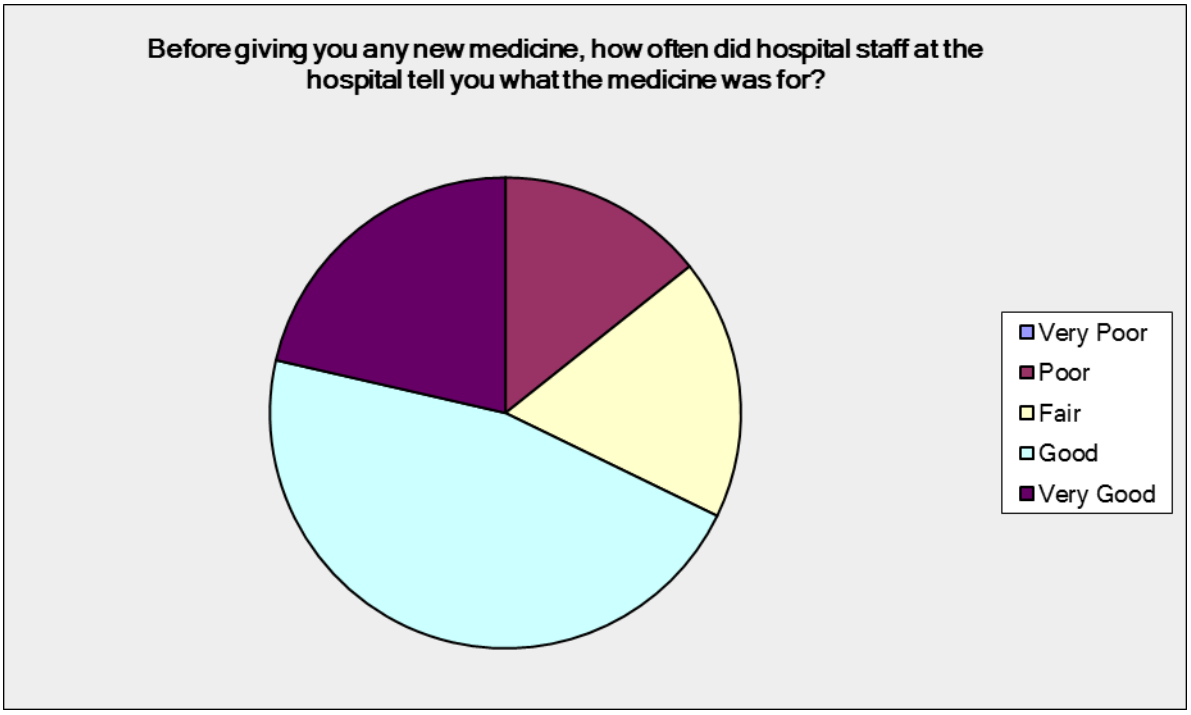
Question 10:

During this stay at the hospital, how often did the hospital staff do everything they could to help you with your pain?		
Answer Options	**Response Percent**	**Response Count**
Very Poor	0.0%	0
Poor	3.6%	2
Fair	35.7%	20
Good	42.9%	24
Very Good	17.9%	10
answered question		56
skipped question		0



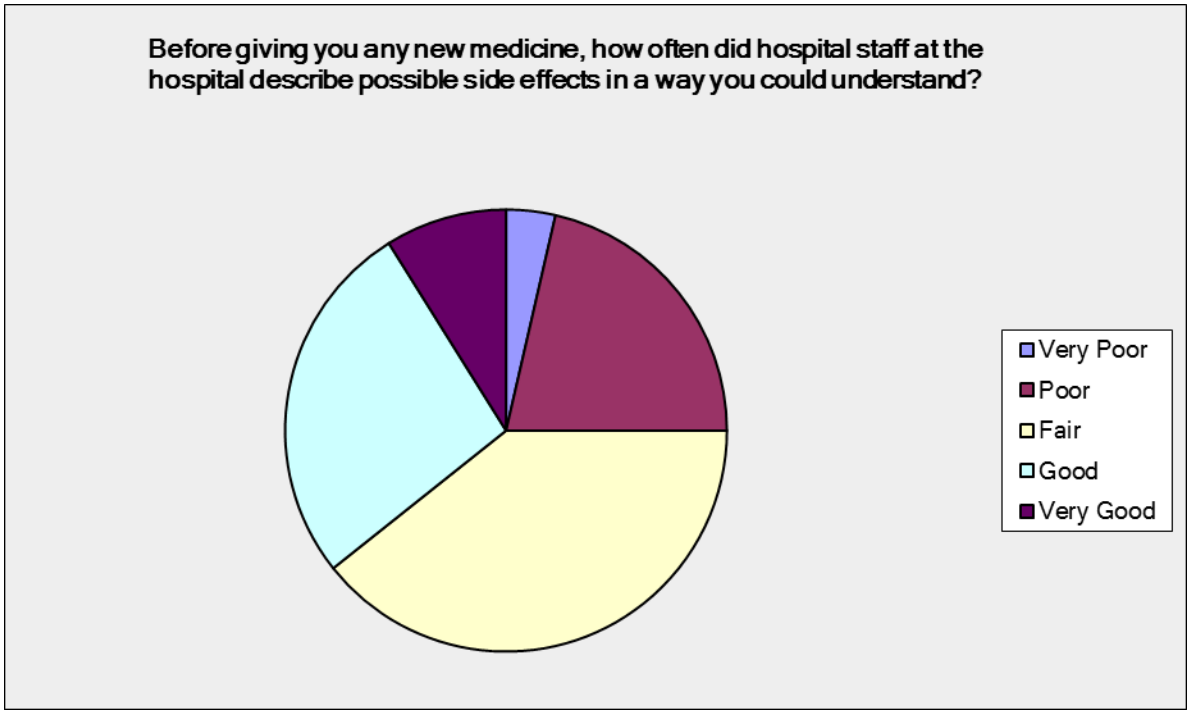
Question 11:

Before giving you any new medicine, how often did hospital staff at the hospital tell you what the medicine was for?		
Answer Options	**Response Percent**	**Response Count**
Very Poor	0.0%	0
Poor	14.3%	8
Fair	17.9%	10
Good	46.4%	26
Very Good	21.4%	12
answered question		**56**
skipped question		**0**



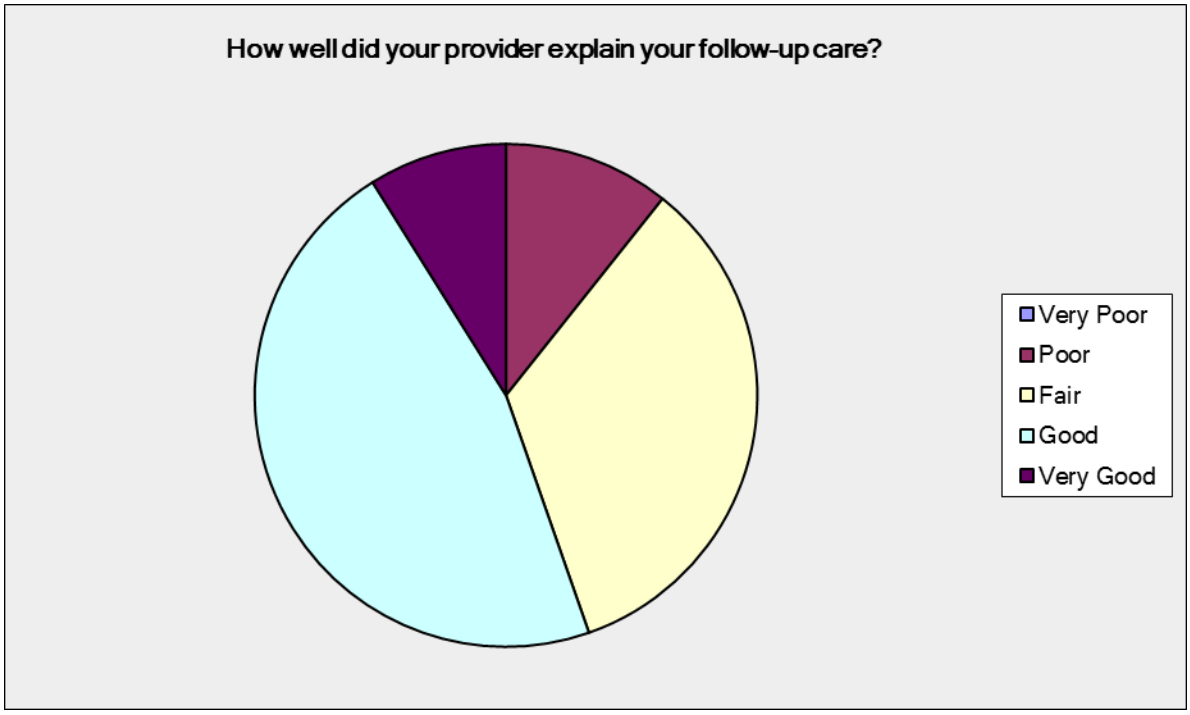
Question 12:

Before giving you any new medicine, how often did hospital staff at the hospital describe possible side effects in a way you could understand?		
Answer Options	**Response Percent**	**Response Count**
Very Poor	3.6%	2
Poor	21.4%	12
Fair	39.3%	22
Good	26.8%	15
Very Good	8.9%	5
answered question		56
skipped question		0



Question 13:

How well did your provider explain your follow-up care?		
Answer Options	**Response Percent**	**Response Count**
Very Poor	0.0%	0
Poor	10.7%	6
Fair	33.9%	19
Good	46.4%	26
Very Good	8.9%	5
	answered question	**56**
	skipped question	**0**



Survey Questions

Patient Satisfaction Surveys

Comments (describe good or bad experience):

Answer Options	Response Count
	21
answered question	21
skipped question	35

Number	Response Date	Response Text	Categories
1	Apr 14, 2016 2:21 PM	Cockroach in the toilet	
2	Apr 14, 2016 2:34 AM	Good luck	
3	Apr 13, 2016 5:42 PM	hospital now getting better then before specially in Abu Dhabi	
4	Apr 13, 2016 4:00 PM	Great experience, supportive staff, nurses and doctors	
5	Apr 13, 2016 3:49 PM	A good one	
6	Apr 13, 2016 3:19 PM	50%	
7	Apr 13, 2016 3:01 PM	Good experience : givivg sick leave easilyBad experience : waiting too long to get treated	
8	Apr 13, 2016 11:33 AM	fair	
9	Apr 13, 2016 10:57 AM	My experience with middle eastern doctors in general is not good. They don't quite treat patients with respect and generally they don't do a very good analysis on the main cause either. I switched to Indian NMC hospital. I'm happy with it. My grading in this poll was for the Indian hospital. And I didn't stay, I was outpatient.	
10	Apr 13, 2016 9:19 AM	Good...	
11	Apr 13, 2016 6:48 AM	so far so good but i think the experience rating depend on which hospital, if they focus on the staff skills more it may improve everything :)	
12	Apr 13, 2016 5:16 AM	Long waiting time for scheduled treatment is a problem.	
13	Apr 13, 2016 5:11 AM	From my last visit to the hospital I had a good experience, visible Quality in (Management, Assurance and Control).	
14	Apr 13, 2016 5:02 AM	-	
15	Apr 13, 2016 4:58 AM	-	
16	Apr 13, 2016 4:57 AM	In general all was good.	
17	Apr 13, 2016 4:57 AM	The doctor was good, trying to find different possibilities and solutions.The staff are really friendly and helpful and they do their job very well.	
18	Apr 13, 2016 4:56 AM	During my last visit for dental check up. I realized that hospital staff do unnecessary checks in order to claim insurance.	
19	Apr 13, 2016 4:22 AM	Two things that haven't included in the survey, the diagnosis and treatment.Our problem in this country with these two things.Most of the people here get the wrong diagnosis which lead them to get the wrong treatment.	
20	Apr 13, 2016 3:57 AM	Normal experience there is room for improvement	
21	Apr 13, 2016 3:31 AM	Bad experience : Waiting too long to get treated Good experience: They give you sick leave easily	