

Patient Waiting Time in the Emergency Department at Al Ain Hospital

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Abstract

Emergency departments around the world face a serious issue that interferes with the completion of their assigned tasks. At the same, it has a very serious impact on patient health. This issue is the extended waiting time in emergency department before the correct treatment is provided.

In this report, I aim to explore this issue in more depth using an actual hospital scenario. I investigated the existence of this quality issue within the emergency department in “Y” hospital.

Introduction

Waiting is generally considered a pervasive and arduous element of most customer service situations (Taylor, 1994). For many customers, waiting for service is viewed as a negative experience (Scotland, 1991). Thus, improving the speed at which services are delivered is increasingly becoming critical to service organizations (Katz, Larson, and Larson, 1991).

Many of the challenges facing emergency departments today are the same challenges they have faced for years such as overcrowding, limited staff, long wait times, rushed interactions between patients and care providers. However, today it is recognized that patients' quality perceptions are equally important. Moreover, recent trends in health care competition, transparency, quality mandates, changes in insurance, all place more power in the hands of health care consumers.

In addition, today's revolving healthcare world, emergency departments have turned out to be a significant indicator of the state of the healthcare system in any country. This is

because emergency departments have become the main access point for patients to the healthcare system. As a result, they became overcrowded and the time a patient has to spend in the waiting room until he or she receives the appropriate treatment is getting longer. This quality issue is examined in this report using a real hospital scenario.

The body of this report is divided in five chapters. The first chapter paves an introduction to the report, then explores the reason for being chosen, next is the purpose and finally includes a brief discussion about emergency department, its typical layout, waiting time in emergency department, factors causing long waiting time and its implications and explains in details the quality issue that was chosen (Acknowledgement, Abstract, Introduction, Significance, and Literature Review). The second chapter will be the situational analysis of the “Y” hospital Emergency department, explaining the history, department and unit of the institution.

This will be followed by the fourth chapter (Research methodology). This part will consist of data collection methodology, analysis of the collected data and the interpretation of the results.

Finally, recommendations on how to solve the selected quality issue based on others experiences will be highlighted at the end of this report.

Objectives of the study

As the emergency department is considered as the first door of access for urgent treatment, the expectation of patients coming to the emergency department became high. Today’s patients expect a high quality of care at the time of receiving treatment. This type of quality can not be achieved when patients spend hours waiting to see a doctor or to receive a lab result due to overcrowded emergency department. ”Emergency department overcrowding has become an important issue and can be defined as a situation in which the demand for emergency services exceeds the ability

at a department to provide quality of care with acceptable time frames” (Rawe, B. Channan, P. Bullard, M. and Blitz, S.(2006)

As a result of this and in addition to the effects caused by long waiting time in emergency department (mentioned above), I chose to explore long patient waiting time in the emergency department as the objective of my report.

Significance of the study

The effect of overcrowded emergency department is mainly the extended waiting time in the emergency department. This increase in waiting time has led to many negative effects. For example, physicians and nurses feel rushed and overextended, which increase the risk of medical errors. As a result, this will lead to insufficient and compromised patient care. Also, with increasing waiting times, pain relief and improvements in physical, emotional and mental health are delayed beyond acceptable limits. According to the Joint Commission on Accreditation of Healthcare Organizations (JCAHO), “over one half of all cases of morbidity and mortality secondary to delays in treatment occur in hospital emergency departments”. (Rivers, 2003).

This in return, decreases nurse/physician satisfaction as they feel gradually more accountable to provide patients with the best care. However, in case of overcrowding it is not possible. (The Canadian Association of Emergency Physicians, 2000). As a result, “Overcrowding in the emergency department decreases health care quality and may lead to poor patient outcomes” (Miro.2003)

The number one cause of patient dissatisfaction with emergency department services is the long waiting queue. This in some cases made a larger number of patients to leave without being seen, which is risky and could be linked to fatalities in some cases due to treatment delay. (The Canadian Association of Emergency Physicians, 2000)

Hypothesis

In this situation, long waiting time is often viewed by patients as a daily problem in “Y” hospital emergency department. It was identified as the main reason for seeking

treatment in other emergency departments. Also, overcrowding was considered as a negative factor affecting the quality of health care in the hospital. This issue was highlighted by more than 46% of patients in the last satisfaction survey. This survey was conducted by the quality department to assess the level of satisfaction among the emergency department patients. This report hypothesis states there is long waiting in Y hospital emergency department.

Literature Review

Emergency Department

The emergency department is defined as “a hospital or primary care department that provides initial treatment to patients with a broad spectrum of illnesses and injuries, some of which may be life-threatening and requiring immediate attention” (The Wikimedia Foundation, 2006). Emergency department is addressed differently in different countries. For example, in the United Kingdom it is referred to as the accident and emergency department (A&E), while in the United States is known as the emergency room (ER). Academically and among most professionals, the term emergency department is constantly used. (The Wikimedia Foundation, 2006).

Due to the vast development in healthcare systems during the 20th century, emergency departments have expanded considerably. This was a result of the increased necessitate for speedy assessment and effective management of serious health conditions. Worldwide, emergency department has become an essential division of any healthcare facility and core entrance point to medical care. Hence, many physicians now have specialized in emergency medicine. (The Wikimedia Foundation, 2006).

The emergency department requires different equipment and special approaches than the other hospital departments. Patients visiting emergency department often have unstable conditions that must be treated immediately. Information such as medical history, allergies, and blood type might be difficult to obtain most of the time. Therefore, emergency department staffs are qualified to work fast and effectively with minimal

information and under any situation. They function 24 hours a day and 7 days a week. (The Wikimedia Foundation, 2006).

Time is very crucial in the treatment of emergency cases. Therefore, most emergency departments have their own diagnostic facilities such as radiology facilities including CT scanners and ultrasonography equipment. If the emergency department did not have its own "STAT Lab" for basic labs tests (blood counts, blood typing, toxicology screens, etc), tests will be given the first priority to be handled by the hospital lab, and then returned as soon as possible. (The Wikimedia Foundation, 2006).

Emergency Department Typical Layout

Emergency departments typically have one main entrance with a hall and a waiting room for patients with less-urgent conditions, and another entry reserved for ambulances. Typically, emergency department is divided to a number of specialized areas that each deals with different degree of severities or type of complaint. The most common areas are:

- **Triage area:** when patients turn up in the emergency department, they go to this area first. A triage nurse performs an initial assessment to verify the nature and seriousness of the patient condition. Based on this preliminary evaluation, patient is either transferred to another area of the emergency department or a different department in the hospital. Life-threatening cases bypass triage and get examined by a physician directly. (The Wikimedia Foundation, 2006).

The main function of the triage nurse is to categorize patients according to the severity of their complaints. Patients could be assigned to one of the five triage levels, which are resuscitation, emergent, urgent, less urgent and non urgent. Each level comes with an anticipated response time representing the maximum waiting time. (The Canadian Association of Emergency Physicians, 2005)

- **Resuscitation area:** is the most critical area in the emergency department. It usually has some individual adult resuscitation bays and sometimes with one pediatric resuscitation bay. Each bay must have a defibrillator, airway equipment, oxygen, electrocardiogram (ECG) machines, intravenous fluids and lines, and

emergency medications. Other equipment such as, non-invasive ventilation (NIV) and portable ultrasound devices could be found also. Most resuscitation areas are connected to X-ray services and minor operation room for quicker access in case of accidents. (The Wikimedia Foundation, 2006).

Cases such as cardiac arrest and major trauma are commonly seen in the resuscitation area. Survival in such cases greatly depends on decreasing the waiting time for interventions. (The Canadian Association of Emergency Physicians, 2005)

- **Majors or General Medical area:** is very busy most of the time and occupied by a variety of medical and surgical cases. Many of the patients in this area will need additional investigation and might require admission. (The Wikimedia Foundation, 2006).
- **Minors or Fast track area:** is used by patients who do not require urgent treatment and have fast treatable cases. Even if not urgent, those patients might have significant problems such as, minor fractures, minor injuries, dislocations, and lacerations requiring suturing. This area is usually staffed by emergency nurse practitioners and/or physicians. Patients in this area receive faster treatment instead of being forced to wait for hours until serious conditions are treated. (The Wikimedia Foundation, 2006).

According to the population being served by the emergency department, other areas might be allocated. Some departments may dedicate separate areas for children. A play therapist might be hired for this area to help reduce children anxiety and use a diversion therapy with them during simple procedures. Other emergency departments have a separate psychiatric area for aggressive people who could injure themselves or others. In this area, a psychiatrist, a psychiatry-trained nurse and psychiatric social worker might work there. It is uncommon to find an emergency department that allocates a separate area for obstetrics (pregnant women). This is because, a pregnant woman who does not have any another medical condition that needs immediate treatment, is transferred without delay to the Labor and Delivery unit or the obstetrics ward. (The Wikimedia Foundation, 2006).

Waiting Time in Emergency Department

There are two main ways for patients' arrival at emergency departments, either by ambulance or independently. The ambulance team alerts the hospital in advance of the severity degree of the patient being transported. The severely-ill patients are swift to the emergency department's resuscitation area, where the resuscitation team is geared up. Patients arriving independently are triaged by a trained nurse in emergency medicine to other emergency department areas or other hospital departments. Based on the condition severity, patients are seen not based on arrival time. (The Wikimedia Foundation, 2006).

The waiting time in an emergency department involves the time a patient spends in the *waiting room* till seen by the doctor. For some patients this time may exceed one hour, if they were categorized as less urgent. It could be also the time a patient spends after being seen by a doctor waiting for a lab results or a procedure that need to be done for him. Another type of waiting time in emergency department is the time a patient spends on an acute care stretcher in the *emergency department* waiting to be admitted. (The Canadian Association of Emergency Physicians, 2005)

In this report, I will refer to the Canadian Triage and Acuity Scale (CTAS) that was identified by Canadian Association of Emergency Physicians (CAEP) in 1998 to define the medically acceptable wait times in emergency departments. (The Canadian Association of Emergency Physicians, 2005)

Level	Level of Acuity/illness	Nursing Response Time	Physician Response Time	Sentinel Diagnosis	Fractal Response
Level 1	Resuscitation	Immediate	Immediate	Cardiac Arrest	98%
Level 2	Emergent	Immediate	< 15 mins	Chest Pain	95%

Level 3	Urgent	< 30 mins	< 30 mins	Moderate Asthma	90%
Level 4	Less Urgent	< 60 mins	< 60 mins	Minor Trauma	85%
Level 5	Non Urgent	< 120 mins	< 120 mins	Common Cold	80%

Canadian Triage and Acuity Scale (CTAS)

Factors Causing Long Waiting Time in Emergency Department

The issue of prolonged waiting time in Emergency Departments is an international continuous epidemic matter. Therefore, many studies were conducted to discover the contributing factors to this issue. The majority of these studies agreed on one root cause which is emergency department overcrowding. (The Canadian Association of Emergency Physicians, 2005)

Overcrowding is “a situation in which the demand for emergency services exceeds the ability of an emergency department to provide quality care within medically acceptable time frames” (The Canadian Association of Emergency Physicians, 2005). In other words, it is when the emergency department function is hindered, mainly due to the amount of patients waiting to be seen, going through assessment and treatment, or waiting for discharge, goes beyond the emergency department physical or staffing capability. (Fatovich, D M., Nagree, Y., & Sprivulis, P, 2005).

As a result, to identify the contributing factors for the long waiting time patients spend in the emergency department, I need to look for the causes of overcrowding. The most common causes for emergency department overcrowding found in the literatures are:

- Lack of beds for admitted patients from the emergency department.
- Shortage of physician and nursing staff.
- The number and quality of staff in the Triage Room.
- Increased complexity and acuity of patients coming to the emergency department.

- Large number of patients with non-urgent conditions.
- Lack of required diagnostic testing and facilities in the emergency department.
- The quality of the technology system used in the admission process.
- The process prioritizing patient cases to be seen first (Triage scale).

(The Canadian Association of Emergency Physicians, 2000)

1. SATISFACTION at Y hospital

The emergency department aims to provide emergency care to those in need of it, following Ministry of Health policies and procedures. Nurses assigned to this department are twenty in total number. These nurses are assigned to different shift duties in a rotation form. Two general practitioners are assigned as doctors to see the attending patients per evening and afternoon shifts. Only one doctor is covering the morning shift due to decreased number of attending patients.

The results of this study could be important in improving the patient-centered quality of care in the emergency department, assisting policy-making decisions, and developing staff and public education programs.

My study indicates a need for further studies comparing emergency department function in institutions with innovations such as emergency department observation units and rapid patient admission protocols. Future studies should specifically evaluate the observed changes in staff work patterns to identify potential measures that may enhance the delivery of efficient care and determine whether safe and effective care is being compromised.

2. INSTITUTION

History

Y Hospital is located in the city of Al Ain, about 160 kilometers east of the capital city Abu Dhabi. Al Ain has been a vital link between the Indian Ocean and the Arabian Gulf for thousands of years due to its strategic position and good water supply.

It was in Al Ain that Y Hospital opened in November 1960 at the invitation of Sheikh Zayed bin Sultan Al Nahyan and his brother Sheikh Shakhbut. Having experienced American medical care in Muscat and Bahrain, the rulers asked Drs. Pat (Burwell) and Marian Kennedy to open a similar hospital here.

From 1960 to 1963, Drs. Pat & Marian Kennedy and their small medical team, set up their first clinic in a guest house that Sheikh Zayed had let them use. Located in what is now downtown Al Ain, the temporary facility featured quickly constructed palm branch patient rooms. The local people welcomed the new doctors and their staff, often inviting them into their homes. Patients came by camel and on foot from villages near and far as news spread of the availability of medical care. Often they would set up camp right on the hospital grounds for days at a time.

That first permanent facility remained functional until the completion of the present in-patient structure in 1990. Then a new out-patient clinic was added in 1995. These present facilities, along with staff accommodations, were built entirely by my own engineering and maintenance staff using revenue generated by the hospital. Y Hospital has always operated on a not-for profit basis, and continues to do so today. All revenue generated from patient fees is used for operating and capital expenses.

Needless to say, life and healthcare have changed dramatically in Al Ain since Y Hospital began in 1960. A population that was once decimated has since surged. Infant mortality rates that stood at 50% are now less than 1%, and maternal mortality is almost unheard of. Y Hospital delivers about 1900 babies and treats over 50,000 out-patients annually. We have brought over 80,000 children into the world over the years, to families from the UAE, Oman, and nearly every country of the world.

Y hospital is a tertiary hospital which provides a wide range of In-Patient medical and surgical services with 24-hour emergency service to the residents of Abu Dhabi. It consists of 20 different in-patients units, 7 operations rooms and 15 different out-patients clinics.

The hospital main business is to promote health awareness and provide health care services to the multicultural population. The hospital has adopted the preparation for ISO certification which was not obtained for many times due to non-conformance

practices in some departments. There is a quality improvement worker whose roles and work outcome are not prominent and not observed in manager and staff level of practice.

3. Research methodology

The emergency department of the selected hospital maintains a folder of emergency care forms for all seen patients. This folder is sent on weekly basis to the medical record department for permanent filing. Emergency form contains the data of demographic information about the client, time of arrival, assessment findings and treatment provided, and at the bottom of the form, the time of release is written by the treating physician. On daily basis, an average of 200 clients attends the emergency department. The majority of these patients attend at afternoon and evening time of the day.

The head of the department and charge nurse were contacted and permission obtained for data collection on clients' arrival time and release (discharge) time. A random sample was selected from separate inconsecutive two days. Five observations were collected every two hours of a day. Some forms were escaped because of unrecorded discharge time. The total number of samples is twenty four making a total of hundred and twenty number of observations over the two days. (**Appendix B**)

Scope

The hospital is located in Al Ain city and it serves Abu Dhabi Emirate. The selected emergency department for my report is a widely utilized department at a major private hospital in Abu Dhabi (Al-Ain city). The selected department is the emergency department which provide the urgent care and after hospital working hour service. The physical layout of the department is presented in **appendix A**. It shows the number of examination rooms, resuscitation, triage, wound dressing, and minor suturing rooms. Two patients' waiting rooms are allocated close to the department entrance. The department is considered small in size compared to the size of the target population it serves.

The staff of the department has a rapid turnover with many resignations and arrival of new nurses on bimonthly basis. The charge nurse attempts to have an effective professional communication with her subordinates. However, nurses work under great pressure due to shortage of staff during various shifts and increased demands by the patients and relatives. See **appendix B** for the department's process flowchart.

Patients and relatives frequently complain to the administration officer about delay in response by emergency nurses and doctors. Considering the importance of attaining customer satisfaction and on time delivery of service as vital quality concepts to be ensured, I am examining this complain to explore the issue and forward my recommendations to the hospital administration.

Limitation

My study is limited by several factors. I relied on administrative data that are not collected primarily for research purposes. The data elements I used for my primary analysis were complete; however, there were some missing data for the time of first physician contact. I compared patients with and without time of first physician contact documented and found no substantive differences

Also, the study data were gathered manually from handwritten patient charts. As with any chart review, deficits in documentation prevented the accurate capture of data elements for several patient care records.

Convincing the hospital administration to allow me to do the study in their hospital was the biggest obstruction I faced, which was finally solved by help of friend and promising the hospital not to mention their hospital name.

Finally, a lack of statistics knowledge was another obstacle that I faced during this project, that is why I asked for help from a friend to overcome this difficulty.

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Data Analysis

In my report, I collected data from a random sample of patients attending "Y" hospital emergency department, in order to reach a conclusion about the whole population

served by this department (inferential Statistics). To do this, I applied different tools to display my data.

- **Stem and Leaf:**

“This method is used in preliminary analysis to give the real values for the collected data”, (Keller & Warrack, 1999). It divides the observations into two parts as its name stem and leaf. The table below shows the stem and leaf display for the data:

Stems	Leaves
0	66666667777888888999
1	000122223333344444445555566666788888999
2	001111222233d 3445788899
3	0001223356778
4	35556779
5	06678
6	355
7	56
8	27
9	-
10	59
11	1
12	1
13	9
14	-
15	4

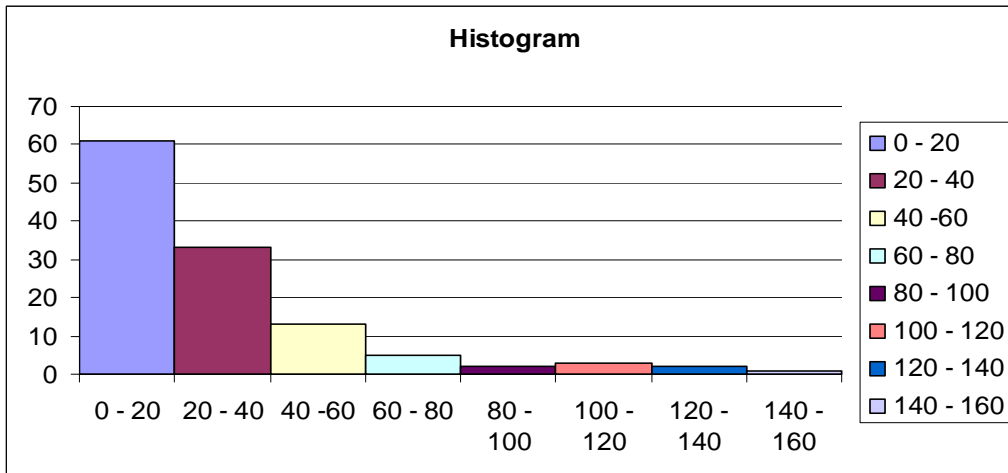
The table above shows that the data is concentrated from 6 to 29 minutes. While, there is a big variation in the rest of the data.

- **Histogram:**

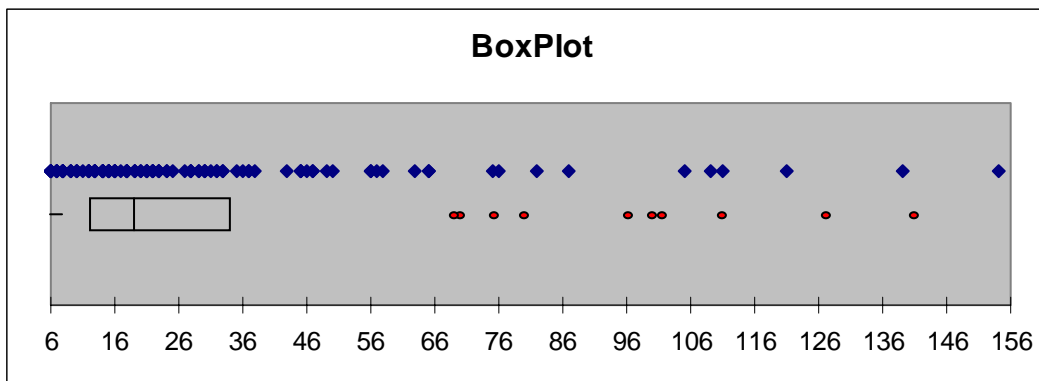
“Is a statistical tool, that shows graphically the frequency of the observations in a specified group” (Keller & Warrack, 1999). It provides clearer picture about the distribution

of the data and interpretation. The histogram gives a clue about the concentration of the data and its distribution.

The figure below shows the histogram distribution of the obtained data:



The above figure shows that the data is concentrated between (0 to 40) min and the shape is positively skewed. This means that the duration of the service is accepted. Also, using the Plot Box, we found the same result:

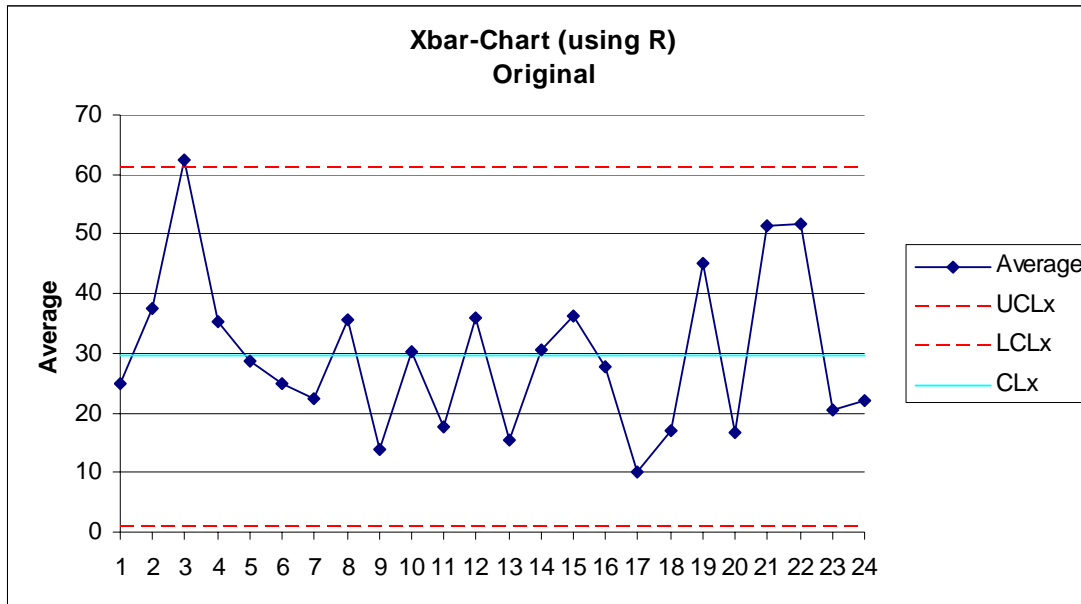


- **X-R Charts:**

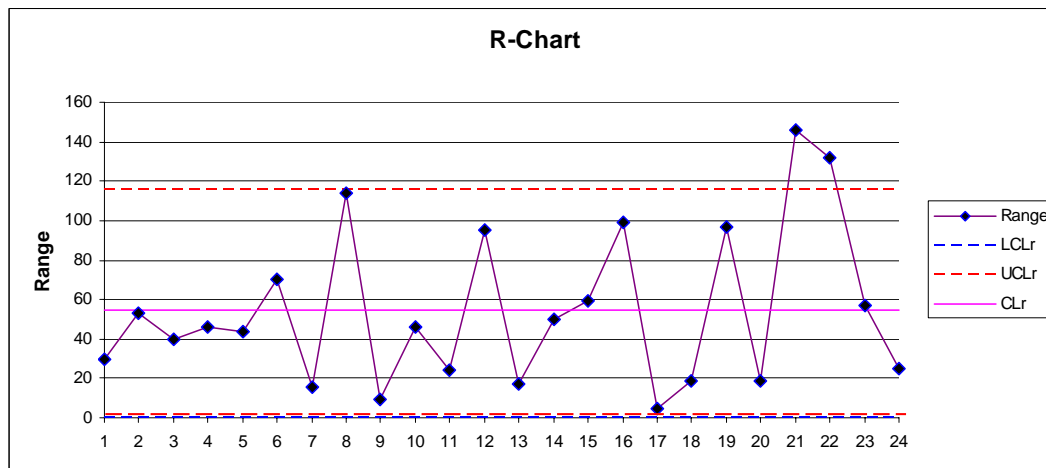
This method is used with variable data to check if the quality process is under control or out of control by using statistics (Keller & Warrack, 1999). The figure below shows the x-chart:

The below figure shows that some observations are near the center line (CL) = 29.74 and some a way from the CL. It's noticed that one value is out of control more than the

UCL = 61.24. This is due to special causes related to the hospital circumstances affecting the process at that time.



Using the R-chart to check the control limit of the data, depending on the range of the observations, and the graph below shows the process:



The above figure shows that there is two points out of control due to special causes affecting the process at that time.

4.1 Data Analysis

Causes for long time waiting at the emergency department:

The most common factors responsible of causing prolonged waiting time at the selected emergency department have been brainstormed in collaboration with the department charge nurse and experienced emergency nurses. The first most common factor is inadequate number of doctors in the department.

In relation to the process, the triage system which is expected to sort out patients and determine the emergent, urgent and non-urgent cases and respond accordingly, is not adequately implemented. It does not follow a standard triage system such as the Canadian Association of Emergency Physicians. Therefore, nurses assigned to triage room do not have a clear guide to follow and to appropriately assign patients without delay. Another factor is public's un-awareness of emergency room functions and roles, which lead to people attending to emergency departments with conditions that are not emergent and adding more burdens on emergency department that causes delay of response to those who are really emergency cases and require immediate response. The long distance between the laboratory and emergency department has resulted in delay in sending samples and obtaining lab test's results. Another factor is the delay that occur at the busy X-ray department which is covering both; inpatients from all hospital wards as well as cases referred from emergency department.

The aspect of material has also added more factors causing prolonged waiting time. The emergency department is considered small in size once compared with other hospitals covering same target population. Its physical layout consists of a single triage room, single resuscitation room with three beds, six examination beds, one dressing and wound suturing room, and two physician offices. The waiting area is small and not equipped with comfortable chairs and TVs.

The category of manpower has many deficits as well. Inadequate number of doctors, as having only one doctor covering the department in morning shift and only two doctors in the afternoon and evening shifts. These doctors are general practitioners responding to all conditions and age groups of clients. Probably inadequate knowledge

and skills to cover all cases would result in waiting for on-call specialist to arrive which adds further more to more delay. Rapid nurses' turnover is a factor that leads to inadequate skills and knowledge which eventually results in inappropriate and delayed response to patients. There are in-adequate in-service education activities in updating nurses with latest recommendation in their specialty. Poor communication skills with clients and their families, added to public's misconception of emergency care. This gives a negative image about the whole hospital. In addition, the number of workers send to various departments such as laboratory and X-ray department is low as having two staff for each shift results in waiting for them to be back and then to accompany next patient.

- **Capability analyses:**

It is used to check if the measures meet the specification limit or not. In the **Appendix D** I made three tests to change the process to be under control for applying Capability analysis.

The following steps are done to make the process under control as shown in appendix D:

1. Test No 1: elimination of samples no. 8, 21, 22 due to failure of these samples and failing out of control in R-chart , then I found that the process is still out of control.
2. Test no 2 is done in R-chart for elimination samplers no. 11, 15, 18 that are also out of control.
3. Test No.3 is done to eliminate one sample no.3 that failed out of control in X-chart.

Then the process is under control with the following statistical values:

$$\bar{R} = 34.6471, \bar{X} = 23.7647, UCLx= 43.7561, LCLx= 3.7734, UCLr= 73.2785, LCLr= 0$$

From Specification:

- Upper Specification Limit (USL) = 30 minutes.
- Lower Specification Limit (LSL) = 10 minutes.

And from the Data analysis and calculation:

Slandered Deviation (s) = \bar{R} / d_2

N=5 → $d_2 = 2.326$, $\bar{R} = 34.6471$ → $s = 14.896$ minutes

Capability Index (PCR): which compares the 6 standard deviation spread of measurement with the difference between the upper specification limit and the lower specification limit, which is known as the tolerance (Keller & Warrack, 1999).

$$PCR = 6s / (USL - LSL) = 4.47$$

Capability index (Cp): which measures if the process meets the specification or not. If the value of Cp is more than one, the process will be capable, and the larger value of PCR the process will be more capable

$$- Cp = (USL - LSL) / 6s = 0.2238 < 1$$

→ The process not Capable

It means that the process is poor and it is not within the specification limits.

Conclusion

In this report a significant quality issue was examined in the domain of healthcare system. This is the problem of prolonged waiting time at an emergency department of a major governmental hospital, which tackles a quality problem of interference with on-time delivery of care in a service organization. This probably would impair customers' satisfaction with provided service which renders organizational attempts of quality improvement.

The application of statistical process control concepts and charts has facilitated my aim of identifying the status of quality application and provided me with insight into the fact of having a real quality problem.

The factors contributing to the prolonged waiting time have been explored and appropriate strategies were set as recommendation for process improvement. The process when examined by control charts was found to be under control, however, when process capability analysis was done, it showed that the process is beyond the

specification limits which is between 10 minutes as a lower specification limit and 30 minutes as an upper specification limit. It was found that delayed waiting time at the specified emergency department is not making the provided service match with the customer expectations by causing serious and even fatal medical complication and a negative image about the whole hospital. Modifications are urgently needed to maintain a positive prestige and performance of the hospital in the current competitive healthcare organizations' field. The quality department within the indicated hospital has to support its recommendations with facts such as the outcome of these statistical tests to better get the support of hospital administration for actions for improvement.

Recommendations

Whenever patients are asked to recall a bad hospital experience, the first thing that jumps to their mind is emergency room waiting times. So, in order to re-establish patients' confidence in the healthcare system and especially emergency departments, the issue of emergency department waiting time must be tackled. (The Canadian Association of Emergency Physicians, 2005)

Emergency department long waiting time can be solved by using effective strategies. For example:

- Provide the emergency waiting room with facilities that can reduce the patient stress while waiting. For example; keeping a television and video tape that include health education programs will help the patient benefit from the time waiting. (Health Care Strategic Management, 2005)
- Frequent visits to the waiting area by the emergency staff, will comfort and reassure the patient that he was not forgotten.
- The triage staff should be able to prioritize the cases according to the urgency of the patient case.
- Bed capacity needs to be restored in order to relieve overcrowding and prolonged wait times. (The Canadian Association of Emergency Physicians, 2005)

- Matching the level of care to the level of patient needs and on moving the 'right patient' to the 'right bed. (The Canadian Association of Emergency Physicians, 2005)
- It was found that half of the patients arrive between 3 pm and 11 pm, so increasing the staffing number in the afternoon and night shifts will reduce the waiting time. (Health Care Strategic Management, 2005)
- The use of streamline registrations, triage and testing in which the treatment can be given to patient before occupying emergency department beds. (Health Care Strategic Management, 2005)
- Establishing new preadmission areas for patients waiting to be admitted, this will free more emergency beds.
- Allocate a separate area with a play room for pediatric patients and their families.
- Coordination between all the departments involved such as lab, x-ray department will make the process more efficient.

The changes in the emergency department are required to improve communication and to make sure patients move efficiently through the system.

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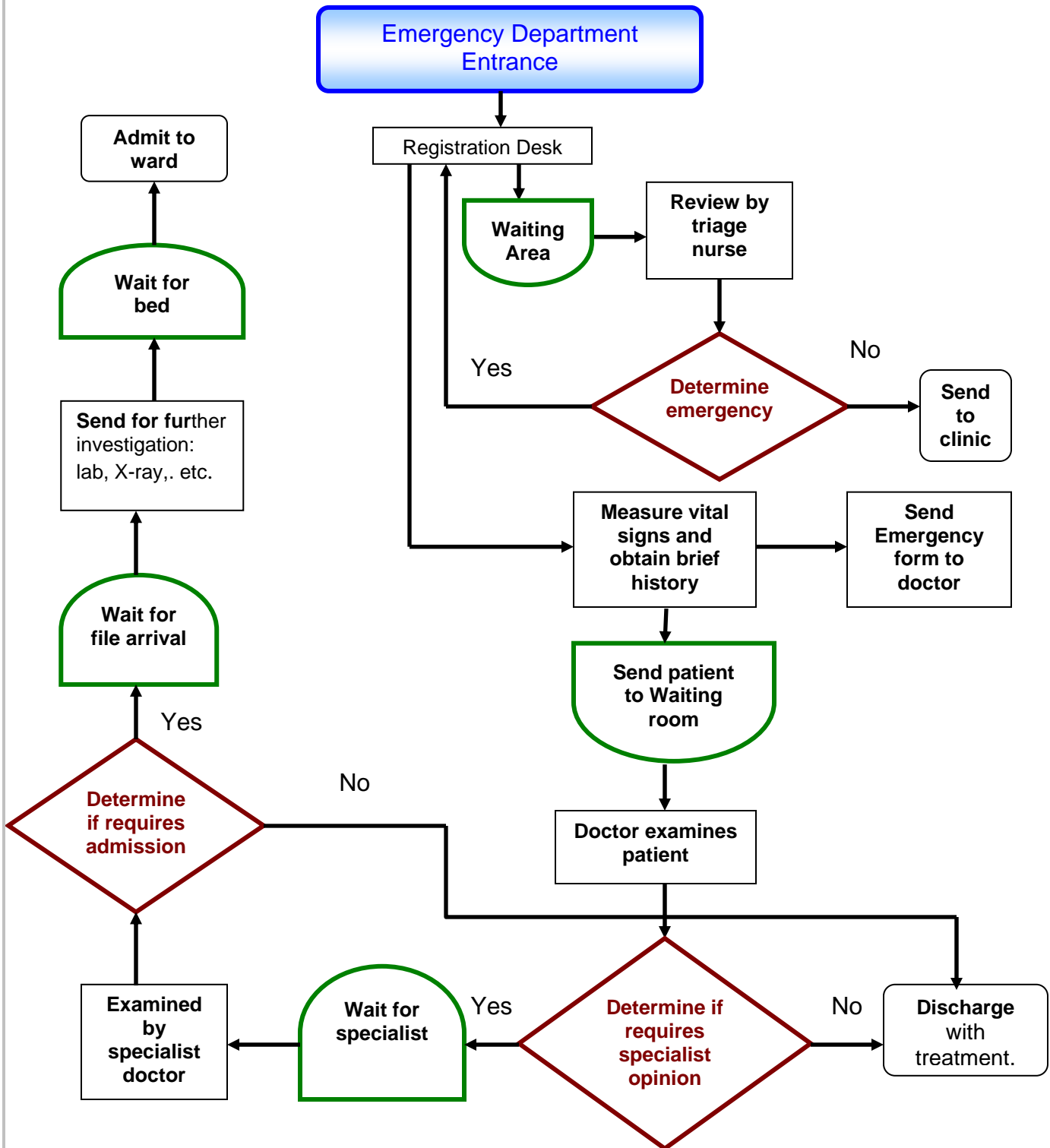
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Appendixes

- 1. Appendix A: "Y" hospital Emergency Department Flow Chart.**
- 2. Appendix B: Data Collected.**
- 3. Appendix C: X Bar and R Chart**
- 4. Appendix D: Capability Analysis**

1. Appendix A: "Y" hospital Emergency Department Flow Chart.

"Y" hospital Emergency Department Flow Chart



2. Appendix B: Data Collected

Emergency Department Waiting Time Data

Sample number	Time Received	Time Released	Duration hh:mm	Duration in mins
Sample 1				
02:12-02:20 am	02:12	02:20	00:08	8
02:08-02:40 am	02:08	02:40	00:32	32
01:26-01:50 am	01:26	01:50	00:24	24
00:48-01:10 am	00:48	01:10	00:22	22
00:32-01:10 am	00:32	01:10	00:38	38
Sample 2				
07:35-08:20 pm	07:35	08:20	00:45	45
07:26-07:45 pm	07:26	07:45	00:19	19
06:35-07:40 pm	06:35	07:40	01:05	65
06:33-06:45 pm	06:33	06:45	00:12	12
06:14-0700 pm	06:14	700	17:46	46
Sample 3				
09:23-10:10 pm	09:23	10:10	00:47	47
09:18-10:40 pm	09:18	10:40	01:22	82
09:03-10:30 pm	09:03	10:30	01:27	87
08:51-09:40 pm	08:51	09:40	00:49	49
08:38-09:25 pm	08:38	09:25	00:47	47
Sample 4				
07:55-08:15 pm	07:55	08:15	00:20	20
07:35-08:20 pm	07:35	08:20	00:45	45
07:26-07:45 pm	07:26	07:45	00:19	19
06:45-07:50 pm	06:45	07:50	01:05	65
06:32-07:00 pm	06:32	07:00	00:28	28
Sample 5				
05:37-06:00 pm	05:37	06:00	00:23	23
05:35-06:45 pm	05:35	06:45	01:10	50
04:30-05:00 pm	04:30	05:00	00:30	30
03:54-04:00 pm	03:54	04:00	00:06	6
03:25-04:00 pm	03:25	04:00	00:35	35
Sample 6				
07:59-08:05 am	07:59	08:05	00:06	6
07:25-07:40 am	07:25	07:40	00:15	15
06:59-08:15 am	06:59	08:15	01:16	76

06:09-06:15 am	06:09	06:15	00:06	6
05:54-06:15 am	05:54	06:15	00:21	21
Sample 7				
04:45-05:00 am	04:45	05:00	00:15	15
04:09-04:30 am	04:09	04:30	00:21	21
04:04-04:35 am	04:04	04:35	00:31	31
03:37-04:00 am	03:37	04:00	00:23	23
03:08-03:30 am	03:08	03:30	00:22	22
Sample 8				
02:20-02:40 am	02:20	02:40	00:20	14
02:19-04:30 am	02:19	04:30	02:11	121
01:48-01:55 am	01:48	01:55	00:07	7
01:36-01:50 am	01:36	01:50	00:14	14
01:28-01:50 am	01:28	01:50	00:22	22
Sample 9				
00:15-12:30 am	00:15	12:30	12:15	15
00:12-00:30 am	00:12	00:30	00:18	18
00:07-00:20 am	00:07	00:20	00:13	13
11:54-12:05 pm	11:54	12:05	00:11	9
11:46 pm-12:00 am	11:46	12:00	00:14	14
Sample 10				
11:35-11:45 pm	11:35	11:45	00:10	10
11:34-12:10 pm	11:34	12:10	00:36	36
11:24-11:45 pm	11:24	11:45	00:21	21
11:17-11:45 pm	11:17	11:45	00:28	28
11:14-12:10 am	11:14	12:10	00:56	56
Sample 11				
11:09-11:30 pm	11:09	11:30	00:21	21
11:03-11:20 pm	11:03	11:20	00:17	9
11:01-11:10 pm	11:01	11:10	00:09	17
10:47-11:20 pm	10:47	11:20	00:33	33
10:46-10:55 pm	10:46	10:55	00:09	9
Sample 12				
10:29-10:45 pm	10:29	10:45	00:16	16
10:17-10:35 pm	10:17	10:35	00:18	18
10:14-10:30 pm	10:14	10:30	00:16	16
10:11-10:30 pm	10:11	10:30	00:19	19
10:05-11:56 pm	10:05	11:56	01:51	111
Sample 12				

Sample 13				
00:32-12:45 am	00:32	12:45	12:13	13
00:26-12:46 am	00:26	12:46	12:20	20
00:12-12:35 am	00:12	12:35	12:23	23
11:45-12:00 pm	11:45	12:00	00:15	15
11:39-11:45 pm	11:39	11:45	00:06	6
Sample 14				
11:38-12:35 pm	11:38	12:35	00:57	57
11:33-11:40 pm	11:33	11:40	00:07	7
10:57-11:10 pm	10:57	11:10	00:13	13
10:17-11:00 pm	10:17	11:00	00:43	43
09:42-10:15 pm	09:42	10:15	00:33	33

Sample 15				
09:38-10:00 pm	09:38	10:00	00:22	22
09:24-09:48 pm	09:24	09:48	00:24	24
09:20-10:35 pm	09:20	10:35	01:15	75
09:15-10:00 pm	09:15	10:00	00:45	45
09:14-10:30 pm	09:14	10:30	01:16	16
Sample 16				
08:48-09:00 pm	08:48	09:00	00:12	12
08:38-08:45 pm	08:38	08:45	00:07	7
08:24-08:30 pm	08:24	08:30	00:06	6
08:23-10:08 pm	08:23	10:08	01:45	105
08:22-08:30 pm	08:22	08:30	00:08	8
Sample 17				
08:22-08:30 pm	08:22	08:30	00:08	8
07:59-08:10 pm	07:59	08:10	00:11	11
07:57-08:10 pm	07:57	08:10	00:13	13
07:02-07:10 pm	07:02	07:10	00:08	8
06:35-06:45 pm	06:35	06:45	00:10	10
Sample 18				
05:56-06:10 pm	05:56	06:10	00:14	14
05:35-05:45 pm	05:35	05:45	00:10	10
04:46-05:00 pm	04:46	05:00	00:14	14
04:42-05:00 pm	04:42	05:00	00:18	18
04:36-05:05 pm	04:36	05:05	00:29	29

Sample 19				
04:18-04:30 pm	04:18	04:30	00:12	12
04:12-05:10 pm	04:12	05:10	00:58	58
04:05-04:21 pm	04:05	04:21	00:16	16
03:34-05:45 pm	03:34	05:45	02:11	109
03:30-04:00 pm	03:30	04:00	00:30	30

Sample 20				
03:21-03:35 pm	03:21	03:35	00:14	14
03:14-03:30 pm	03:14	03:30	00:16	16
03:12-03:30 pm	03:12	03:30	00:18	18
03:10-03:37 pm	03:10	03:37	00:27	27
02:01-06:00 pm	02:01	06:00	03:59	8

Sample 21				
08:26-11:00 am	06:16	08:35	02:19	154
05:45-06:15 am	06:15	06:40	00:25	30
06:27-06:35 am	05:33	06:05	00:32	8
05:52-06:20 am	05:19	06:15	00:56	28
03:53pm-04:30 pm	05:08	05:15	00:07	37

Sample 22				
06:16-08:35 am	06:16	08:35	02:19	139
06:15-06:40 am	06:15	06:40	00:25	25
05:33-06:05 am	05:33	06:05	00:32	32
05:19-06:15 am	05:19	06:15	00:56	56
05:08-05:15 am	05:08	05:15	00:07	7

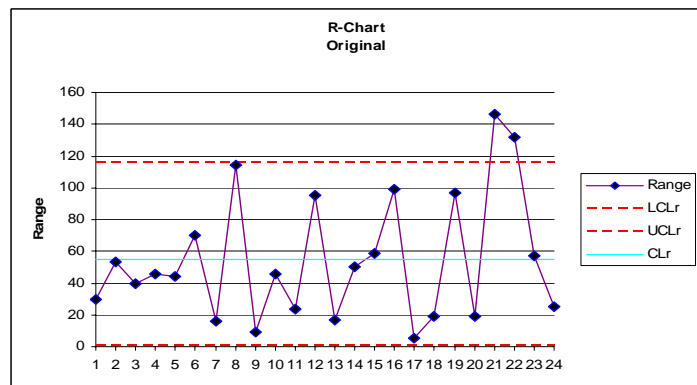
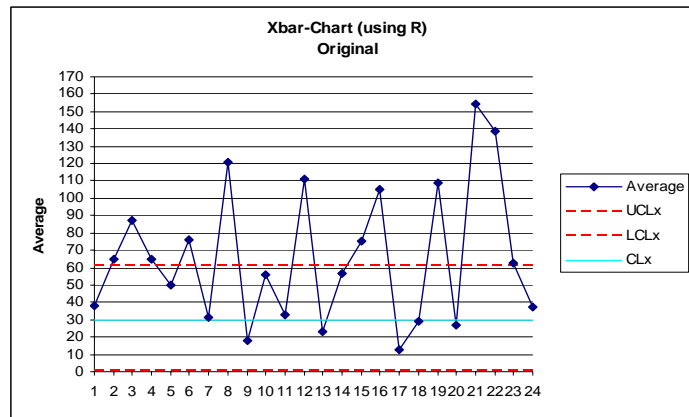
Sample 23				
05:04-05:10 am	08:26	11:00	02:34	6
04:27-05:30 am	05:45	06:15	00:30	63
03:55-04:10 am	06:27	06:35	00:08	15
03:52-04:05 am	05:52	06:20	00:28	13
03:49-03:55 am	03:53	04:30	00:37	6

Sample 24				
03:47-04:05 am	03:47	04:05	00:18	18
02:53-03:05 am	02:53	03:05	00:12	12
01:56-02:25 am	01:56	02:25	00:29	29
01:45-02:22 am	01:45	02:22	00:37	37
01:26-01:40 am	01:26	01:40	00:14	14

3. Appendix C: X Bar and R Chart

sample #	XBar	R
1	24.8	30
2	37.4	53
3	62.4	40
4	35.4	46
5	28.8	44
6	24.8	70
7	22.4	16
8	35.6	114
9	13.8	9
10	30.2	46
11	17.8	24
12	36	95
13	15.4	17
14	30.6	50
15	36.4	59
16	27.6	99
17	10	5
18	17	19
19	45	97
20	16.6	19
21	51.4	146
22	51.8	132
23	20.6	57
24	22	25

Statistical Process Control	
Xbar-Chart	
Upper control limit =	61.2843
Centerline =	29.7417
Lower control limit =	0
Pattern Test Failed at Points: 3	
R-Chart	
Upper control limit =	115.62
Centerline =	54.6667
Lower control limit =	0
Pattern Test Failed at Points: 8, 21, 22	
PROCESS OUT OF CONTROL	

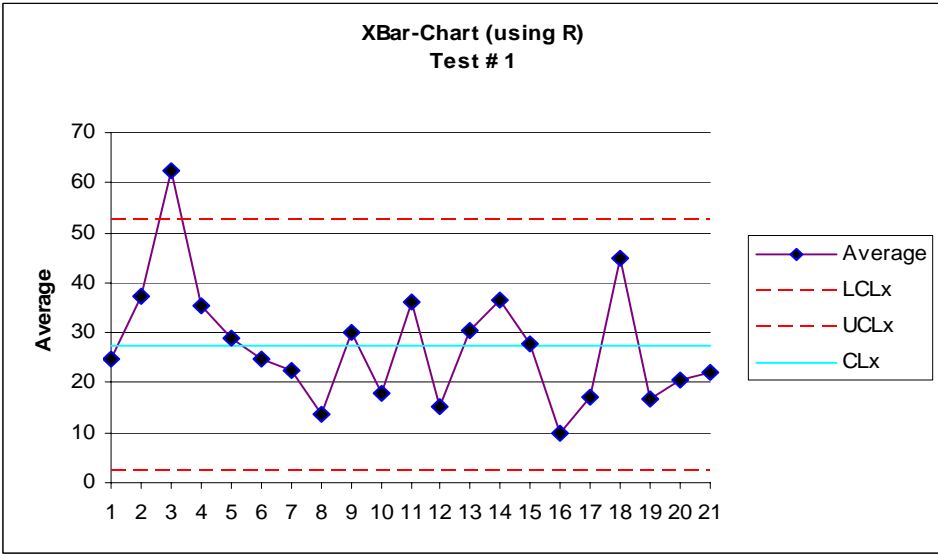
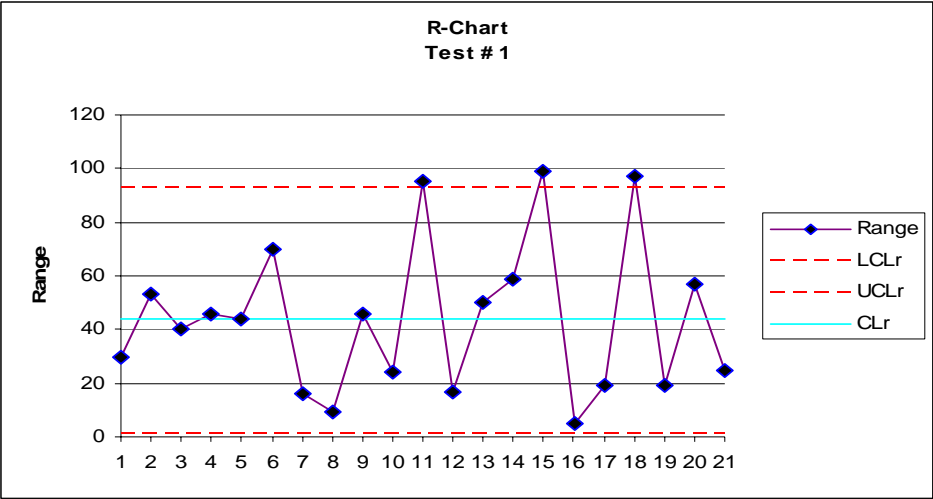


4. Appendix D: Capability Analysis

TEST # 1

sample #	Xbar	R
1	24.8	30
2	37.4	53
3	62.4	40
4	35.4	46
5	28.8	44
6	24.8	70
7	22.4	16
8	13.8	9
9	30.2	46
10	17.8	24
11	36	95
12	15.4	17
13	30.6	50
14	36.4	59
15	27.6	99
16	10	5
17	17	19
18	45	97
19	16.6	19
20	20.6	57
21	22	25

Statistical Process Control	
TEST # 1	
XBar-Chart (using R)	
Upper control limit	52.659
Centerline	27.381
Lower control limit	2.1029
Pattern Test #1 Failed at Points: 3	
R-Chart	
Upper control limit	92.6571
Centerline	43.8095
Lower control limit	0
Pattern Test #1 Failed at Points: 11, 15, 18	
PROCESS OUT OF CONTROL	

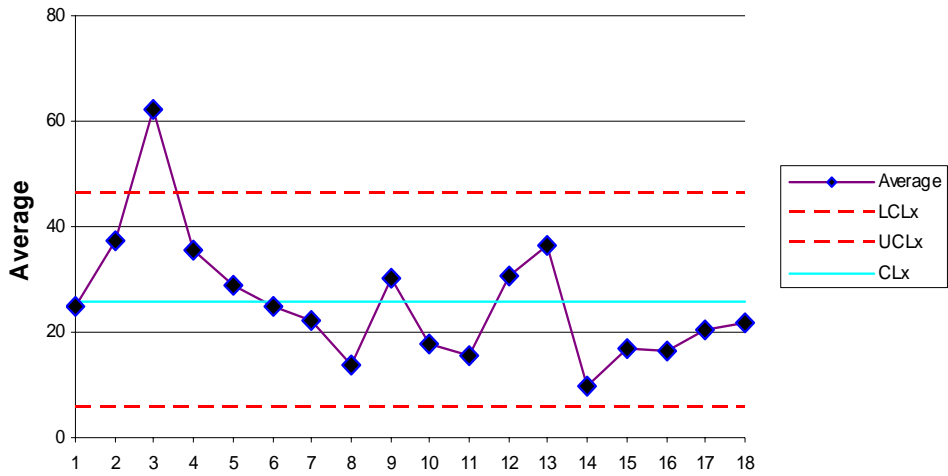


TEST # 2

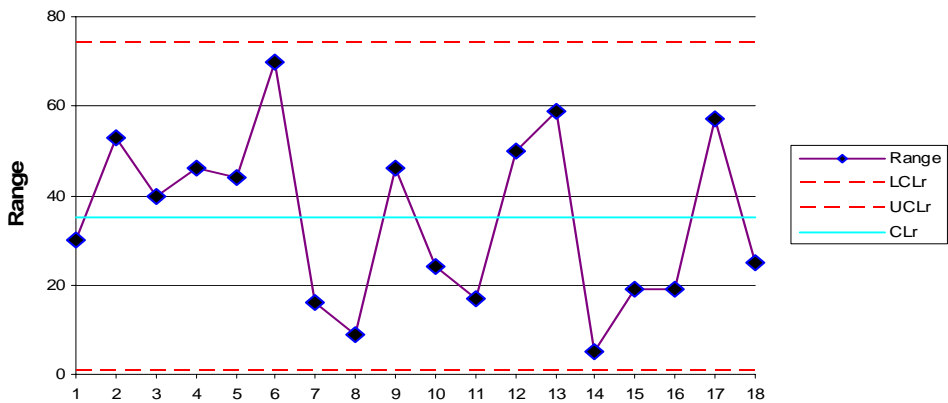
Sample #	Xbar	R
1	24.8	30
2	37.4	53
3	62.4	40
4	35.4	46
5	28.8	44
6	24.8	70
7	22.4	16
8	13.8	9
9	30.2	46
10	17.8	24
11	15.4	17
12	30.6	50
13	36.4	59
14	10	5
15	17	19
16	16.6	19
17	20.6	57
18	22	25

Statistical Process Control	
Test # 2	
XBar-Chart (using R)	
Upper control limit	46.0741
Centerline	25.9111
Lower control limit	5.7482
Pattern Test # 2 Failed at Points: 3	
R-Chart	
Upper control limit	73.9075
Centerline	34.9444
Lower control limit	0
PROCESS OUT OF CONTROL	

XBar-Chart (using R)
Test # 2



R-Chart
Test # 2



TEST # 3

Statistical Process Control	
TEST # 3	
XBar-Chart (using R)	
Upper control limit	43.7561
Centerline	23.7647
Lower control limit	3.7734
R-Chart	
Upper control limit	73.2785
Centerline	34.6471
Lower control limit	0
PROCESS UNDER CONTROL	

sample #	Xbar	R
1	24.8	30
2	37.4	53
3	35.4	46
4	28.8	44
5	24.8	70
6	22.4	16
7	13.8	9
8	30.2	46
9	17.8	24
10	15.4	17
11	30.6	50
12	36.4	59
13	10	5
14	17	19
15	16.6	19
16	20.6	57
17	22	25

