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Patient Flow Through a Hospital Emergency Department

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THE CARL AND WINIFRED LEE HONORS COLLEGE

CERTIFICATE OF ORAL EXAMINATION

Mark Czuk, having been admitted to the Carl and Winifred Lee Honors College in 1992, successfully presented the Lee Honors College Thesis on April 28, 1994.

The title of the paper is:

"Patient Flow through a Hospital Emergency Department"

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Patient Flow
Through a Hospital Emergency Department

Mark Czuk
Honors Thesis

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Acknowledgments

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Introduction

Bronson Methodist Hospital, located in Kalamazoo, Michigan, is committed to the goal of providing comprehensive health care to the people of Southwestern Michigan. Bronson is actively involved in continually improving their services in order to better serve the community. This process of continuous improvement covers all hospital operations including the Emergency Department. Through studying the Emergency Department process, and how the department interacts with other departments in the hospital, improvements can be made which can lead to a better service provided to the community.

This project is the first step in a larger study designed to provide data in order to objectively look at the Emergency Department as a whole, including its interactions with radiology and laboratory services, to improve the overall quality of service that patients receive during treatment. The study is designed to target the patients' length of stay in the Emergency Department through the identification of activities in the patient treatment process. Through analyzing various data on the length of stay of patients in the Emergency Department, it will be possible to make recommendations on means of utilizing current resources to minimize the effects of bottlenecks, and improve the flow of patients through the Emergency Department. In this project data were collected and analyzed for both the Main Emergency Department, and the Express Care portion of the Emergency Department. Express Care is a special department within the Emergency Department which specializes in treating patients with minor injuries and illness. Express Care provides the community with fast and high quality treatment. This phase of the study focuses on developing and implementing a

data collection tool, and performing an initial analysis of the data to determine which areas of the Emergency Department should be looked to for improvement.

Literature Review

There is an increasing interest level among hospitals to continually improve the quality of their health care delivery systems. This dedication to improvement includes measuring quality and continuously improving the Emergency Department process. Three recent articles have shown how other hospitals have approached the difficult task of analyzing the Emergency Department process. These three hospitals have used a variety of tools in their efforts to continually improve including time studies and simulation. Through studying how these hospitals approached the problem of analyzing the Emergency Department, it is possible to obtain a better understanding of the analysis process and to design a more effective study. One study has shown how a hospital has used time studies to improve the flow and verify the process of chest pain patients flowing through the Emergency Department (Lupfer et al, 1991). Another study has shown how time studies were used to help determine delays and problems in the Emergency Department of a different hospital (Saunders, 1987). Finally, computer modeling simulation techniques have been employed to help measure the flow of patients through an Emergency Department and to help assure quality of treatment (Pallin & Kittell, 1992). With increasing emphasis on the quality of patient treatment, it is important for hospitals to be able to measure and evaluate their treatment processes. Through outlining the methodology employed in the analysis of the Emergency Departments and through providing results of these studies, articles such as the three above help provide the framework for establishing standards for benchmarking and measuring quality in hospital Emergency Departments as well as providing the methodology for future studies to take place.

Procedure

With the assistance of Emergency Department physicians, Scott Larson, and Dan Stewart, Western Michigan University Industrial Engineering Professor Liwana Bringelson, and Bronson Management Systems Consultant Pam Franssen a data collection form was developed to gather times when specific activities occur in the Emergency Department. Following the creation of the data collection form, a pilot program was implemented in the Emergency Department to test the usability of the form in a "real-time" situation. Through the pilot program potential problems in the data collection were identified and solved before the actual study. The pilot program lasted approximately one week and resulted in some revisions of the data collection form. For example, the pilot program found that it was easier for physicians rather than nurses to record the time when x-rays were returned. Therefore, the space for x-ray return time was moved from the nurse section of the form to the physician section.

The data collection form (Appendix A) consists of five sections, each representing the group of people responsible for filling the data into that section. On the form there were sections for triage personnel, nurses, physicians, and Emergency Department clerks to fill in times of critical activities in the Emergency Department. There was also a section specifically designed to obtain information on patients who go through Express Care.

The triage section of the form gathers information on patient demographics, acuity level, type of arrival, either a walk-in patient or a patient arriving by ambulance. The time that the patient arrives and the time when the patient is registered was also recorded by the triage personnel.

The nursing section of the form requested the nurses to fill in times such as when the patient was placed in a room, when the patient was ready to be seen by a physician, and when urine and blood were drawn. The nursing staff was also responsible for the times that IVs and medications were given. Finally, the nurses were instructed to fill in the time that the patient was either discharged or admitted to a floor of the main hospital.

The Emergency Department physicians and clerks were also required to record several statistics on the form. Statistics recorded by physicians included the time the patient was assessed, the time when tests were ordered, whether the tests were routine or special, and the time when IVs and medications were ordered. Also, information regarding the time when x-rays were ready, and the times when admission or discharge was requested was to be recorded on the form. Finally, the primary diagnosis of the patient was requested on the form, so that it might be possible to study the relationship between the type of treatment and the time the patient spent in the Emergency Department. The Emergency Department clerks were asked to record times when labs and x-ray orders were sent by computer and the times when labs and EKGs were completed.

The final section of the data collection form was only to be filled out for patients who went through the Express Care portion of the department. The times gathered in this section included four segments of care: a) when the patient's chart was placed on the rack for processing, b) when the patient was placed in the room, c) when the patient was ready to be seen by a physician, and d) whether a x-ray protocol was used for "common" injuries. Additional information regarding whether the patient required crutches, sutures, or other possible time

consuming activities was also included on the form. Finally, patient assessment and discharge information was requested on the form.

The data collection process in the Emergency Department was implemented during the month of November, 1993. Through tracking every fifth patient who entered the facility, it was hoped that a goal of sampling 1,000 patients could be reached. The implementation of the data collection process required the cooperation of ER physicians, nurses, triage personnel and clerks to enter times in "real-time" on the data collection sheet. Express Care, main department, and patients arriving by ambulance were each sampled independently, so that a equal distribution of each group of patients could be studied. Over the month long study statistics were gathered on approximately 600 patients.

Data gathered from the data collection form were analyzed using a Lotus 123 spreadsheet. The spreadsheet organized the data into individual columns for each time which allowed the data to be easily manipulated. Lotus 123 statistical functions were also used in calculating averages and standard deviations. The data collected in this study were not included in the report because of the confidential nature of the information gathered.

Results

The data collected in the Emergency Department study provided a very large number of possible combinations of results. The time between any two activities on the data collection form could be determined and sorted by almost any of the non-activity data on the data collection form. Because of this large scope, only select time intervals were calculated and analyzed. Through discussions with Emergency Department physicians it was decided that the study would focus on

the average length of stay for different groups of patients and would also focus on the times patients would go through different phases of the treatment process. The Emergency Department staff could use these times as an immediate measure of quality, e.g., are the sickest patients being seen first, and the staff could also use the times as benchmark for further studies. Further analysis could be performed on the data provided by the study. This study includes an analysis of both the main Emergency Department and Express Care.

In the main department, the average length of stay was calculated for all patients and was broken down by patient acuity. The average length of stay was also broken down by 17 ICD-9 diagnosis code categories. In addition, the average length of stay was calculated for patients who required laboratory services, x-rays from radiology, both lab work and x-rays, and neither lab or x-rays. In an effort to measure the time between when a patient is registered and when that patient first sees a physician, the time between chart generation and physician assessment time was calculated and broken down by patient acuity level. Additionally, important steps in the patient flow through the Emergency Department were identified and patient flow through these steps was measured and broken down by patient acuity level. In the Express Care portion of the Emergency Department, the average length of stay was calculated along with an analysis of the patient flow through the important steps in the treatment process.

With the help of Margaret Schumacher in Respiratory Care, and Donna Ellis in Radiology, this study also provides an analysis of how time is spent by respiratory care staff, and the turnaround time for x-rays in the Radiology Department. Margaret Schumacher coordinated and collected data on the

activities of the respiratory care staff in the Emergency Department, and Donna Ellis collected times of the arrival of orders for x-rays and the times that those orders were completed.

Sample Population Characteristics

In the study of the main department, data were collected on 417 patients who visited the Emergency Department beginning in late October, 1993 and ending at the end of November, 1993. Data was collected on every fifth patient arriving. As shown in Table 1, the distribution of patients by acuity level showed over half of the patients were Type 2 or Type 3. Fifteen percent of the patients acuity levels in the study were not listed on the data collection form and are classified as unknown patient type.

Table 1 - Population Acuity Characteristics

Acuity Level	Patients	Percent
Type 1	18	4 %
Type 2	77	18 %
Type 3	135	33 %
Type 4	95	23 %
Express Care	30	7 %
Unknown	64	15 %
Total	**428**	**100 %**

The sample was also broken down by shift. As shown in Table 2, 127 (30%) of the patients studied arrived during the 7 a.m. to 3 p.m. shift, 145 (35%) arrived during the 3 p.m. to 11 p.m. shift, 41 (10%) arrived during the 11 p.m. to 7 a.m. shift (10%), and 104 patients did not have a shift time listed on their data collection form.

Table 2 - Population Shift Characteristics

Shift	Patients	Percent
7 am to 3 pm	127	30 %
3 pm to 11 pm	145	35 %
11 pm to 7 am	41	10 %
Unknown	104	25 %
Total	**417**	**100 %**

Length of Stay Results

From the data gathered in the Emergency Department average lengths of stay (LOS) could be calculated from the different arrival and discharge times. lengths of stay statistics were calculated for the main Emergency Department patients, Express Care patients, and patients requiring x-rays or laboratory services, and for patients with different diagnosis classifications (ICD-9 Codes). The Length of Stay information can help the Emergency Department staff determine if a particular type of patient significantly spends a larger than needed amount of time in the Emergency Department.

Main Department

The average length of stay in the Emergency Department found in Table 3 was calculated by subtracting the triage time from the discharge time. The average length of stay in the Emergency Department for all patients was 2 hours and 20 minutes (n = 254). There was not a large difference in the length of stay based on patient type (Figure 1). Type 1 patients spent an average of 2 hours 19 minutes (n=4), Type 2 patients spent an average of 2 hours and 40 minutes (n=47), Type 3 patients spent an average of 2 hours and 20 minutes (n=98), Type 4 patients spent an average of 2 hours and 14 minutes, and Express Care patients who went through the main department spent an average of 1 hour and 33 minutes (n=15). The only group of patients whose length of stay appeared to

significantly vary from the overall average length of stay was the Express Care patients in the main department. These patients are patients who are classified as Express Care patients but arrive at the Emergency Department when Express Care is closed. The 15 patients in this group had an average length of stay which was 47 minutes below the mean length of stay.

Table 3 - Length of stay in the Emergency Department

Acuity Level	Patients	LOS (hours:minutes)
Type 1	4	2:20
Type 2	47	2:40
Type 3	98	2:20
Type 4	90	2:14
EC (main department)	15	1:33
Total	**254**	**2:20**

Express Care Average Length of Stay

The average length of stay for patients visiting the Express Care portion of the Emergency Department was calculated from data on 235 patients. The average length of stay of these patients was found to be 1 hour and 4 minutes. A 95% confidence interval suggests that 95% of the patients visiting Express Care spend between 61.45 and 66.54 minutes in the Emergency Department (Mean = 64 minutes).

The average length of stay for Express Care patients who go through the Express Care portion of the Emergency Department is significantly lower than the length of stay for Type 4 patients ($z = 8.21$, $p < 0.05$) and Express Care patients ($z = 2.11$, $p < 0.05$) who go through the main department. This shows that Express Care, which specializes in treating patients with minor injuries and illness, is quicker in treating these patients than the main department is in

treating patients with similar injuries and illness. This can be used to help show that Express Care is meeting its goal of providing fast service to the community.

Length of Stay by Laboratory and Radiology Services

In this study, the average length of stay for patients was compared for several combinations of laboratory and radiology services (Table 4) The length of stay for patients with just lab, just x-ray, both lab and x-ray, and neither lab or x-ray were compared. As shown in Figure 2, it was found that patients requiring both lab and x-ray had the longest length of stay at 3 hours and 18 minutes; patients with just lab averaged a 3 hour and 12 minute length of stay, and patients with just x-ray spent an average of 2 hours and 52 minutes in the Emergency Department. Patients who required neither of the services provided by lab and x-ray averaged the shortest length of stay at 1 hour and 55 minutes.

Two sample hypothesis tests were performed to determine if there was a statistically significant difference between the length of stay of patients with lab or x-ray from the overall average length of stay. The study found that there is no evidence to refute the hypothesis that patients with lab and x-ray have a longer than average length of stay. ($z=1.96$) Additionally, another two sample hypothesis test showed that there was no evidence to refute the hypothesis that patients requiring just lab averaged a longer length of stay than patients with just x-ray ($z=6.44$).

Table 4 - Comparison of Length of Stay Based on Labs and X-rays

	LOS Avg.	LOS lab	LOS x-ray	LOS Both	Neither lab or x-ray
Sample Size	254	70	66	33	151
Average	2:20	3:12	2:52	3:18	1:55
Standard Dev.	1:11	1:07	1:00	0:57	1:03

Diagnosis Code Categories (ICD-9)

The average length of stay for patients was also analyzed by diagnosis code category. The hope in this analysis was to determine if there was any significant difference in the length of stay based on common treatments for similar diagnosis. The breakdown by diagnosis code categories consisted of 17 different diagnosis code categories (Appendix B). The analysis of the data showed that most of the diagnosis codes resulted in average times that were similar to the overall average length of stay of 2 hours and 20 minutes. (Figure 3) Only two categories of diagnosis, *infectious and parasitic diseases*, and *diseases of the blood and blood-forming organs* were significantly larger than the average; however, they contained very small sample sizes of two and one respectively. The categories of *diseases of the skin and subcutaneous tissue*, and *mental disorders* were the only categories which were significantly lower than the average length of stay at 1 hour and 45 minutes and 1 hour and 46 minutes, respectively. The largest categories were *symptoms, signs, and ill-defined conditions*, and *injuries and poisoning*. These categories had sample sizes of 65 and 42, as well as lengths of stay of 2 hours 32 minutes and 2 hours and 5 minutes, respectively.

Patient Flow Results

In addition to studying the length a patient spends in the Emergency Department, it is also important to analyze where the patient spends his/her time in the system. Information on where the patient spends his/her time can be used to identify bottlenecks in the system and can be used to develop goals for improvement. An example of a goal could be; 95% of all Type 1 and Type 2 patients need to be seen by a physician within 5 minutes. The hospital could then try to continually improve this standard set by themselves.

Chart Generation Time to Physician Assessment Time

One of the many measures of quality in the Emergency Department is to determine whether physicians are attending to the most seriously ill or injured patients first. To obtain a measure of this quality, this study compares the registration time (when the chart is generated) to the time when the physician first sees the patient for each of the four patient acuity levels plus the Express Care patients who were seen in the main department of the Emergency Department. The results showed that the average time for a patient to wait before seeing a physician was 42 minutes. As shown in figure 4, Express Care, Type 4, and Type 3 patients all averaged times very similar to the 42 minute average. Patients with acuity levels of 2 and 1 averaged lower than average waiting times to see a physician. Forty-three Type 2 patients averaged a waiting time of six minutes, and four Type 1 patients averaged a waiting time of 13 minutes. The large waiting time for Type 1 patients may be an artifact of the small sample size.

Main Department

There are many ways in which the flow of patients through the Emergency Department can be measured and quantified. This study identified four important

interim times in the patient flow process and compared these times across the overall average and the four patient acuity levels.

The four critical steps in the patient flow process include the time between the time it takes to register the patient and patient discharge or admit. 1) The first segment of care is from registration to the patient's chart being placed on the rack to begin the patient prep process. 2) The next important time is the time from the patient's chart to when the patient is "ready to be seen" by the physician. 3) Following this time is the time it takes from when a patient is "ready to be seen" to the physician actually seeing the patient. 4) The final time is physician assessment to discharge.

Analysis of the flow through times for the different patient acuity levels showed that Type 1 and Type 2 patients had the lowest time for the first three stages of the emergency process (Chart to Rack, Rack to Ready to Be Seen, and Ready to Be Seen to Physician Assessment). (Figure 5) These patients also appeared to have longer assessment to discharge times than average. The time spent in the Emergency Department for Type 3, Type 4 and Express Care patients appeared to be more evenly distributed across the four stages in the emergency process. Figure 5 shows the different distributions of time spent in the Emergency Department for each of the patient types, as well as the overall average. The results of this analysis are encouraging in the sense that they show that the Type 1 and Type 2 patients are seen quickly, since they are the sickest or most seriously injured, and the time spent in the Emergency Department for the less ill or injured patients appears to be fairly evenly distributed across the four critical steps in the emergency process.

Express Care

The flow of Express Care patients through the Emergency Department was also tracked. The times between four critical events in Express Care were calculated. These events include the chart to rack time, the rack time to when the patient is ready to be seen by a physician, the time after a patient is ready to be seen and when the patient is assessed by a physician, and finally the time after assessment and before discharge. Figure 6 shows the distribution of time spent between each of these activities. The interim times are fairly evenly distributed across the four events with the longest time occurring between assessment and discharge.

Special Department Results

In addition to the data collection in the Emergency Department, Respiratory Care and Radiology also collected data on their activities to look for means of improving their services to the Emergency Department. Respiratory Care conducted a work sampling of their activities, and Radiology tracked Emergency Department X-ray turn-around times for the month of the study.

Summary of Respiratory Care Study

In addition to tracking individual patients through the Emergency Department, this report also includes a study of the activities of respiratory personnel in a typical day. Margaret Schumacher coordinated and collected data on the times and frequency of several specific activities performed by Respiratory Care Staff in the Emergency Department over four non-consecutive weeks between November 1 and December 18, 1993.

The frequency of specific activities can be determined from these data, as well as estimates for the amount of time spent on certain activities. The Respiratory

Care personnel spend approximately 70 percent of their time on seven activities. These activities include venous blood draws, AGBs, AERO/MDIs, EKGs, POs, COOL AEROs, and MDI Instruction. Over the four week period respiratory care personnel performed 2,510 of these seven activities which account for 70% of the working day. The frequency of these activities is shown in Table 5.

Table 5 - Summary of Respiratory Care Study Data

Activity	Frequency
Venous Blood Draws	43.7 %
AGBs	2.3 %
AERO/MDIs	0.1 %
EKGs	18.6 %
POs	0.6 %
COOL AEROs	0.2 %
MDI Instruction	1.24 %
Total	**66.74 %**

The remaining 30% of the time was spent on a variety of tasks, including: trauma call, code, vent/intube, art line, transporting patients, respiratory care work such as restocking equipment, troubleshooting equipment, and helping patients with questions regarding the use of oxygen. Finally, Respiratory Care personnel also spent a portion of their time assisting nurses (Table 6).

Table 6 - Summary of Respiratory Care Study Data

Activity	Duration
Trauma Call	40.0 %
Restock / Maintenance	25.6 %
Assisting Nurses	16.8 %
Vent / Intube	8.3 %
Patient Transportation	6.3 %
Code / Art Line	< 2.0 %

Margaret Schumacher has also made recommendations on improving the efficiency of the Respiratory Care staff in the Emergency Department. She believes that the Respiratory Care staff should be educated in the Emergency

Department process as well as establishing a contact person for problems which arise. Finally, improvements should be made in the system of paging Respiratory Care staff to assure that there is consistent communication between the Emergency Department clerks and the Respiratory Care staff. The data collected shows that a large portion of time is spent in the Emergency Department assisting with trauma cases and helping nurses. A better understanding of the Emergency Department process would help the Respiratory Care staff in becoming more efficient during the times that they are assisting in the Emergency Department.

Summary of Radiology Study

During the study, information on turn-around times on x-rays in the Radiology Department were also gathered and collected by Donna Ellis. Times were recorded when orders were sent and when orders were completed for both the Main Department and Express Care parts of the Emergency Department.
In the Express Care part of the Emergency Department, Radiology averaged a turn-around time of 11 minutes. A 95% confidence interval showed that x-rays requested by Express Care were completed between approximately 9 and 13 minutes. In the main department x-rays required a slightly longer average turnaround time of 17 minutes. The longer average turn-around time in the main department can be attributed to delays which are a result of complications due to the more serious nature of injury or illness of the patients in the main department. Examples of delays in x-rays include breathing difficulty, IVs, and laboratory tests.

Recommendations

The results of this study can be used as a means of quality control in the Emergency Department and as a measure to benchmark against other hospitals of similar size. The data on length of stay for both the main department and Express Care can be used to measure of the quality of care for a particular acuity level, or diagnosis code patients receive. Large variations in the length of stay data could be a signal that there is a problem in the treatment process of patients with a particular patient acuity level or diagnosis code. The data on length of stay for patients with labs and/or x-rays can be used to identify when there are problems in the lab and x-ray processes which need to be corrected. The data on the time between registration and when the patient is seen by a physician can be used by the hospital to assure that patients who are the most ill or most seriously injured are seen first, and that patients of all degrees of acuity are seen by a physician within a reasonable length of time. Finally, the patient flow-through times can be used to help see that no bottlenecks develop in the Emergency Department process and that all patients are processed within reasonable waiting times.

Finally, a system should be put in place where important times from the data collection form could be derived from times already gathered by Emergency Department staff, or incorporate the data collection into already established systems such as the EMERGE system. Through automating the data collection, the important quality measuring statistics could be gathered with much larger samples of patients, and could provide almost immediate feedback on the performance of the Emergency Department.

Eventually, additional tools such as computerized simulation, could be used with data similar to the data collected in this study to simulate the Emergency Department system in real time and provide staff, patients, and family members with accurate estimates of the time required to wait in each stage of the Emergency Department process. This could help both patients and family members know what to expect in terms of waiting and could help them relax at a time of high anxiety.

Improvements

As in any study there are several ways in which the study could be improved if it were to be replicated. In the case of this study, a greater effort should have been made to define the scope of the project prior to the data collection. The data collection should have focused on particularly important statistics, and the Emergency Department staff should have made sure that these essential statistics were gathered on every patient. Finally, ICD-9 codes should have be included in the data collection form so that patients could be sorted and compared by illness or injury.

Conclusion

This study looked at how quality could be measured in a Emergency Department through the collection of times of critical events which occur in the Emergency Department process. These times provide valuable information on the length of stay of patients with specific acuity levels or with common diseases and injuries. Additionally, information can be gathered on the flow of patients through the Emergency Department. This information can be useful in assuring that there are no problems in the treatment process, and can be an indicator of the development of bottlenecks in the Emergency Department process. In the future,

probabilistic models such as real time simulation may use data similar to the data used in this study to simulate the flow of patients through the Emergency Department in real-time which could provide the Emergency Department staff, and patients and their family members with accurate estimates of the waiting times required in the treatment process. This study helps provide the framework for additional research on improving the quality of service patients receive through understanding and management of the flow of patients through an Emergency Department.

Figures

Figure 1

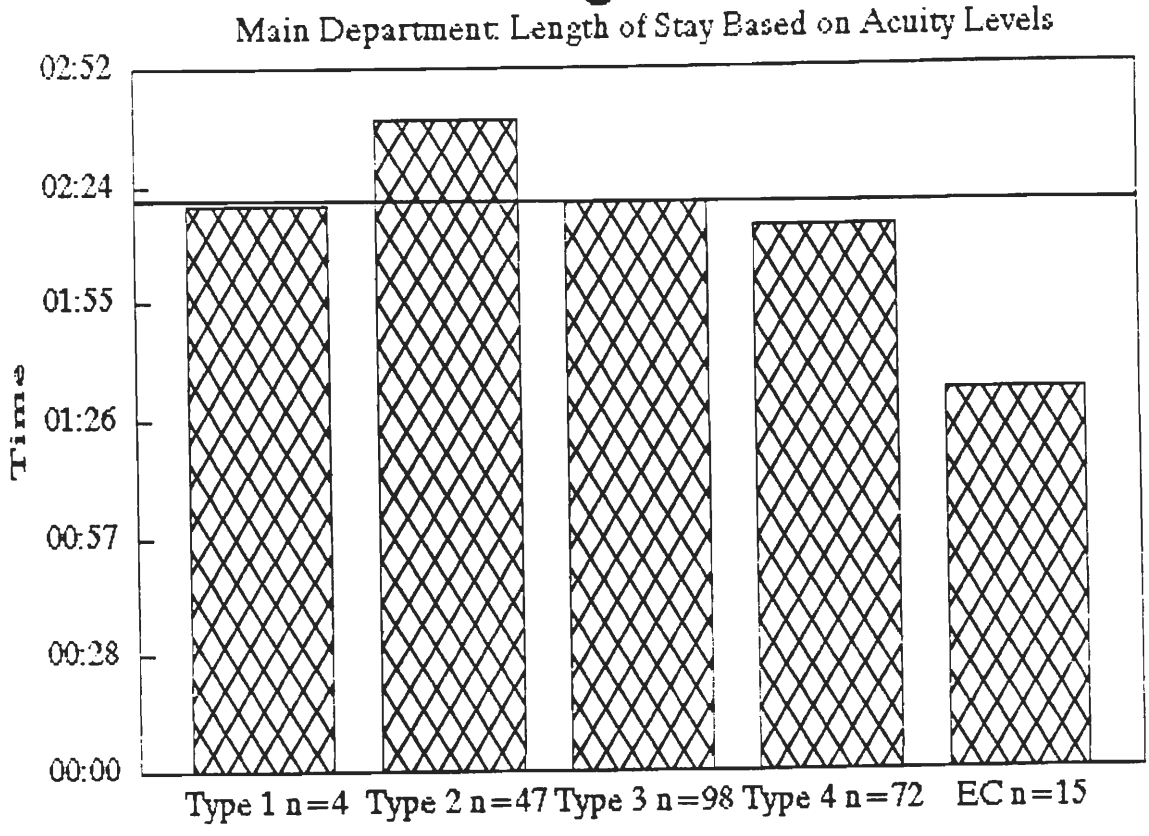

Main Department: Length of Stay Based on Acuity Levels
02:52
02:24
01:55
01:26
00:57
00:28
00:00
Time
Type 1 n=4
Type 2 n=47
Type 3 n=98
Type 4 n=72
EC n=15

Figure 2

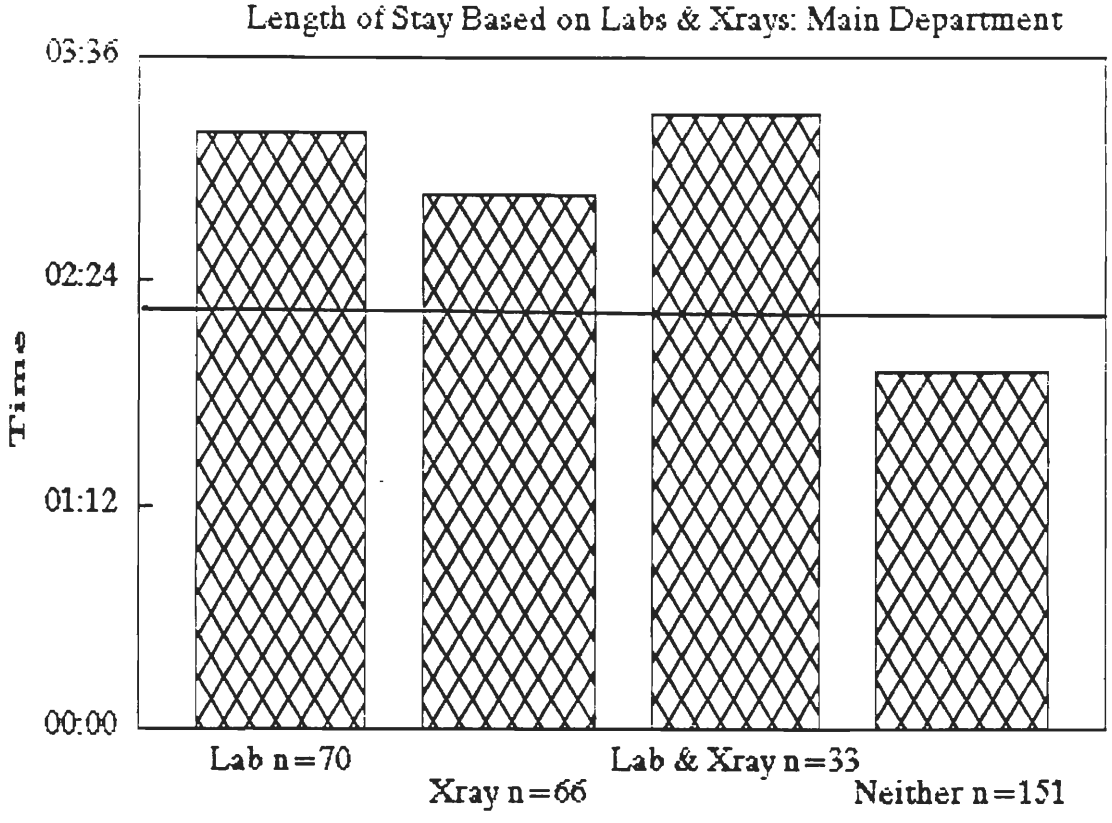

Length of Stay Based on Labs & Xrays: Main Department
05:36
02:24
01:12
00:00
Time
Lab n=70
Xray n=66
Lab & Xray n=33
Neither n=151

Figure 3

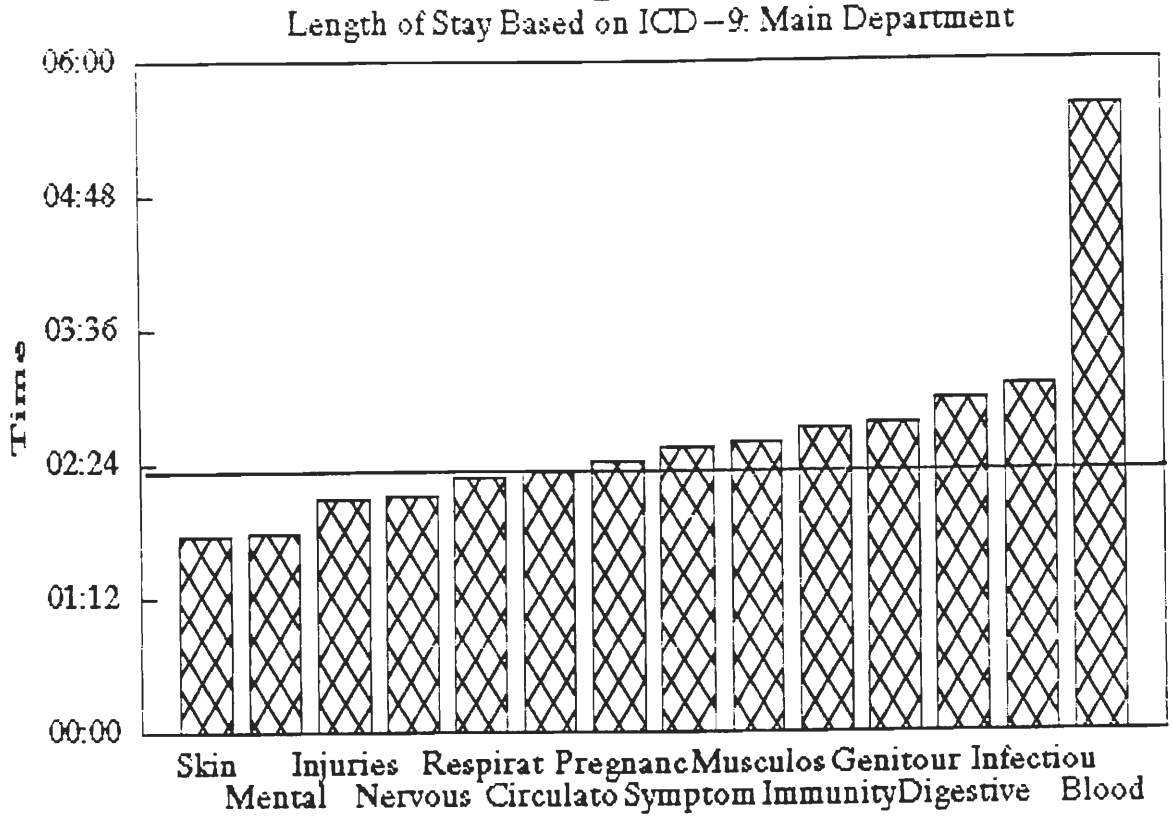

Length of Stay Based on ICD – 9: Main Department
06:00
04:48
03:36
02:24
01:12
00:00
Time
Skin
Injuries
Respirat
Pregnanc
Musculos
Genitour
Infectiou
Mental
Nervous
Circulato
Symptom
Immunity
Digestive
Blood

Figure 4

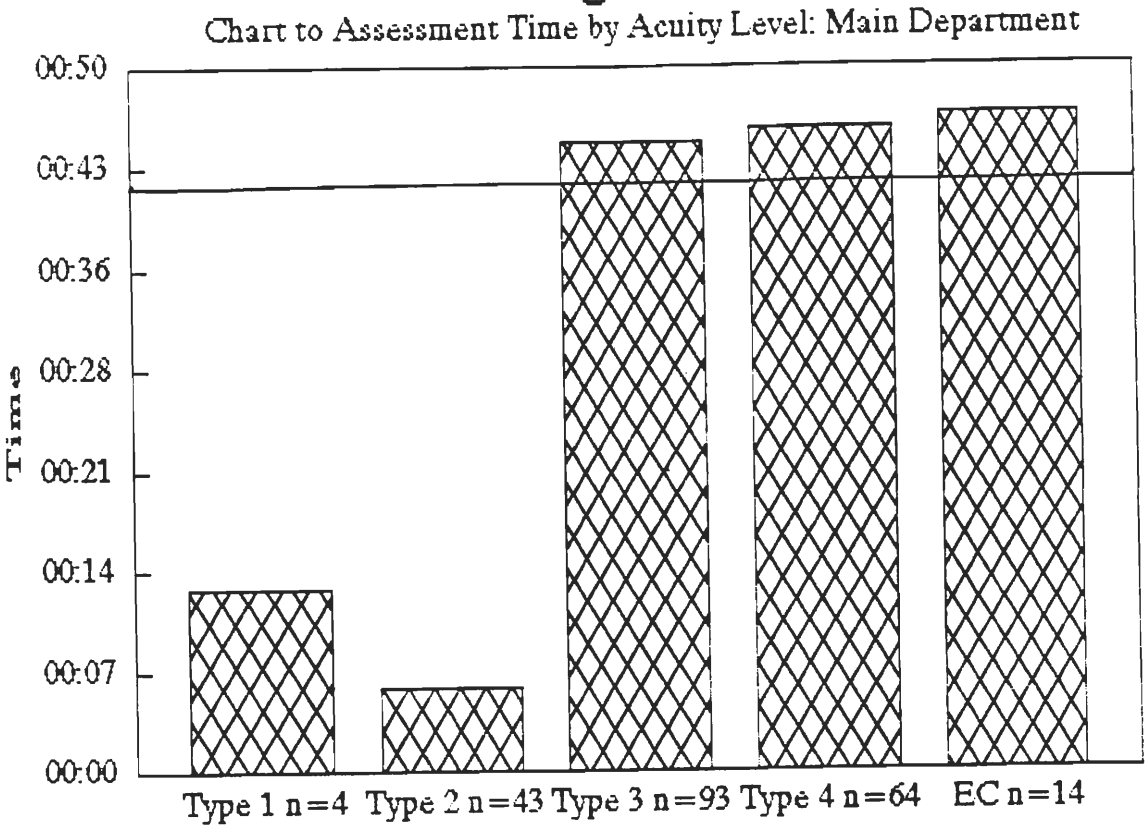


Chart to Assessment Time by Acuity Level: Main Department
00:50
00:43
00:36
00:28
00:21
00:14
00:07
00:00
Time
Type 1 n=4
Type 2 n=43
Type 3 n=93
Type 4 n=64
EC n=14

Figure 5

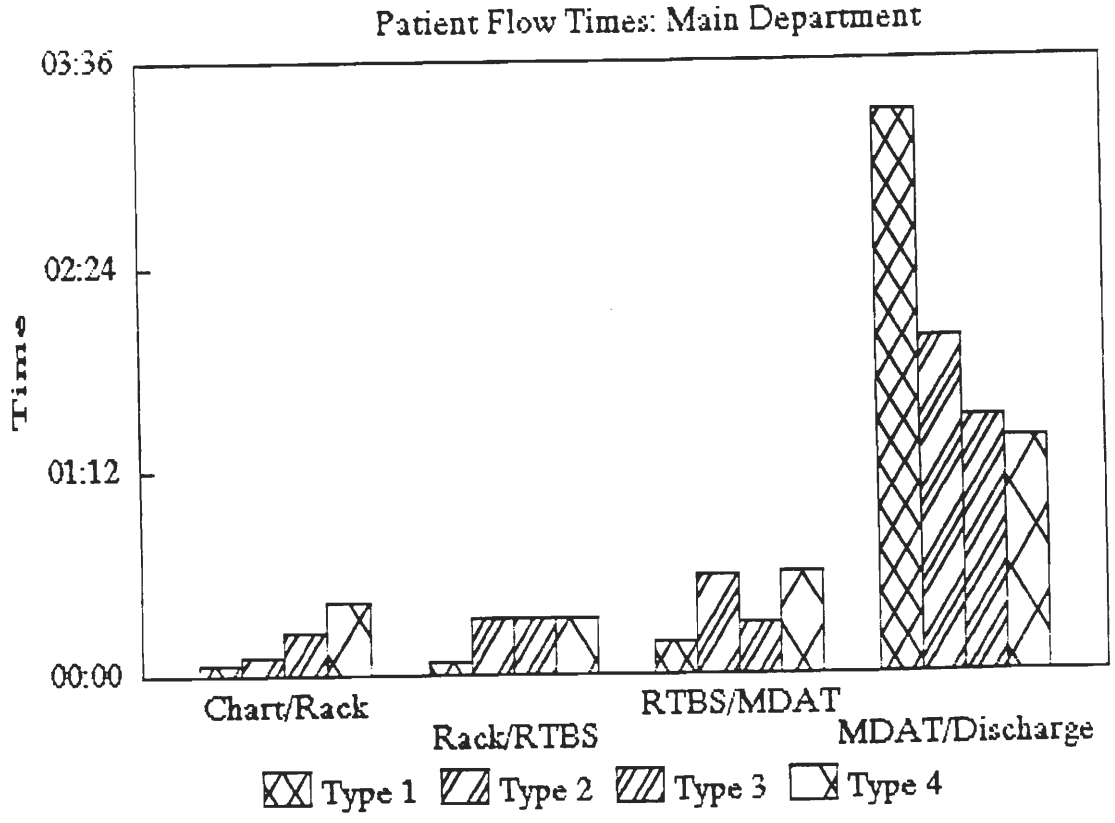
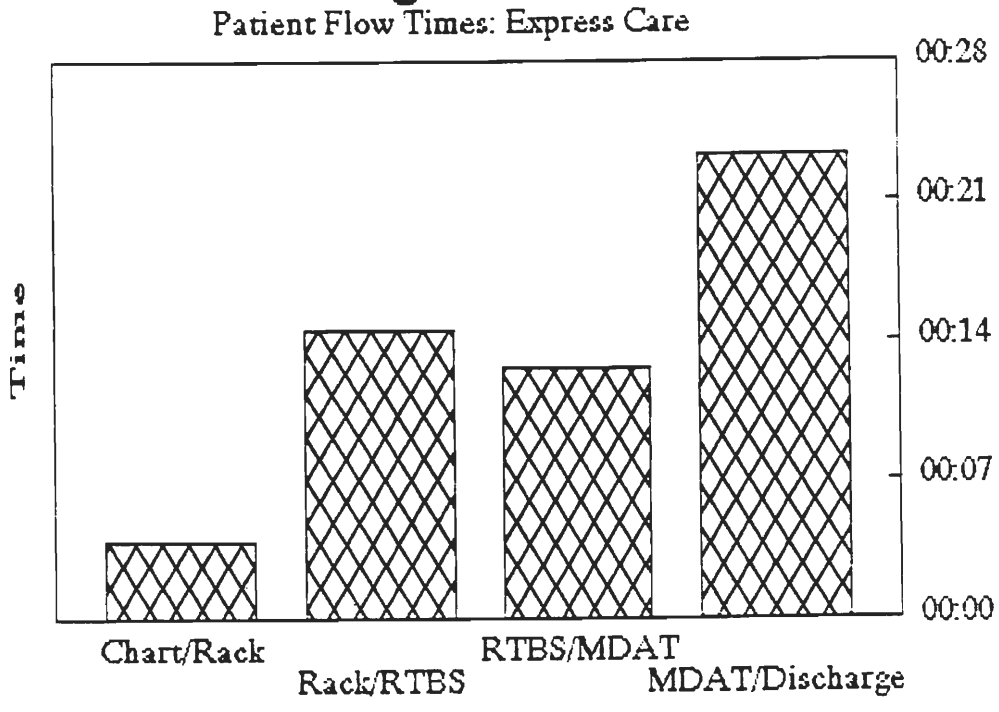

Patient Flow Times: Main Department
03:36
02:24
01:12
00:00
Time
Chart/Rack
Rack/RTBS
RTBS/MDAT
MDAT/Discharge
Type 1
Type 2
Type 3
Type 4

Figure 6


Patient Flow Times: Express Care
Time
00:28
00:21
00:14
00:07
00:00
Chart/Rack
Rack/RTBS
RTBS/MDAT
MDAT/Discharge

Appendix A

Data Collection Form

Triage

1. Name: _____
2. Date: 10/ ___ / 93 3. Shift 7-3 ___ 3-11 ___ 11-7 ___

4. Patient Type: I ___ II ___ III ___ IV ___ EC ___
5. Mode of Arrival: Walk-in ___ Ambulance ___

6. Triage Time: _____
7. Chart Generation Time: _____

8. Room Assignment Time: _____ 9. Room O B S A B C
1 2 3 4 5 6 7 8 EC

Nurse

1. Placed in Room: _____
2. RTBS by Physician: _____

3. Urine Sent Time: _____ 4. Blood Draw Time: _____

5. First: a. IV _____ b. PO MED _____
c. IV MED _____ d. IM MED _____

6. Discharge Time: _____
7. Admit Time (To Floor): _____

8. Other Comments: _____

Physician

1. Physician Assessment Time: _____
2. Tests Ordered (time): _____

Lab: Routine Special
Xray: Routine Special

3. 1st IV/IM Order: _____ 4. 1st PO MED: _____

5. Xrays Back: _____

6. Primary Diagnosis: _____

7. Request Admission: _____
8. Request Discharge: _____

Clerk

1. 1st Rack Time: _____

2. 1st Lab Order Sent (computer): _____
3. 1st Xray Order Sent (computer): _____

4. All Labs Back: _____
5. EKG Completion: _____

Express Care

1. 1st Rack Time: _____
2. Patient in Room (First Pick Up Chart): _____
3. RTBS: _____

4. Xray Protocol: Yes ___ No ___ Time: _____

5. Please Check All That Apply

___ PO MEDS (a)
___ IM MEDS (b)
___ Drug Screen (c)
___ BHAC (d)
___ Lab (Blood/Urine) (e)
___ Crutches (f)
___ Sutures (g)
___ Ortho. Tech. (h)
___ Ortho. Res. (i)
___ Other (Specify) (j) _____

6. Discharged: _____

7. Physician Assessment Time: _____ 8. Xrays Back: _____
9. Discharge Request: _____

Appendix B

Classifications of Diseases and Injuries

001-139	Infectious and Parasitic Diseases
140-239	Neoplasms
240-279	Endocrine, Nutritional, and Metabolic Diseases and Immunity Disorders
280-289	Diseases of the Blood and Blood Forming Organs
290-319	Mental Disorders
320-389	Diseases of the Nervous System and Sense Organs
390-459	Diseases of the Circulatory System
460-519	Diseases of the Respiratory System
520-579	Diseases of the Digestive System
580-629	Diseases of the Genitourinary System
630-676	Complications of Pregnancy, Childbirth, and the Puerperium
680-709	Diseases of the Skin and Subcutaneous Tissue
710-739	Diseases of the Musculoskeletal System and Connective tissue
740-759	Congenital Anomalies
760-779	Certain Conditions Originating in the Prenatal Period
780-799	Symptoms, Signs, and Ill-Defined Conditions
800-999	Injury and Poisoning

References

Lupfer PA; Altieri M; Sheridan MJ; Lilly CC (March 1991) Patient Flow in the Emergency Department: The Chest Pain Patient. *American Journal of Emergency Medicine*. ; 9(2): 127-30.

Saunders CE (November 1987) Time Study of Patient Movement Through the Emergency Department: Sources of Delay in Relation to Patient Acuity. *Annals of Emergency Medicine*.16(11):1244-8.

Pallin A, Kittell, R (February 1992) Mercy Hospital: Simulation Techniques for ER Processes. *Industrial Engineering*. 35-37.