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Emergency Department Patient Flow Simulation at HealthAlliance

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Abstract

One of the challenges faced by the healthcare industry is the growing number of patients, which has caused an increase in wait time and staff utilization. These effects greatly influence patient flow, resulting in unnecessary costs. For this project, we used discrete event simulation to study and improve processes within the Emergency Department at HealthAlliance Hospital in Leominster, Massachusetts.

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Many individuals contributed to the success of our project. First, we would like to thank the Process Improvement team for their guidance and assistance throughout the duration of the project. We would also like to thank the staff at HealthAlliance for being so accommodating and friendly during our observations, interviews, and visits. Lastly, we would like to thank our project advisor, Renata Konrad, for her continuous guidance and contributions to our project.

Authorship

Carl Anderson

Carl focused on the experimental design of the simulation model received from the Process Improvement Team. He contributed to the interview process and assisted in time studies.

Christopher Butcher

Christopher was the analyst for all gathered data. He led the data collection efforts through interviews, observations, and time studies. He also parsed data received from the UMass Process Improvement team.

Amanda Moreno

Amanda was the coordinator of the group, ensuring meetings were scheduled and action items were accomplished. She was responsible for validating and verifying the simulation model received from the Process Improvement Team, and was also involved in observations.

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Executive Summary

The Emergency Department at the HealthAlliance Hospital in Leominster, MA, does not currently have the capacity or manpower to help its clients quickly enough. This has led to patient flow delays, disruptions, and inefficiencies, and it has caused some patients to leave before being served, resulting in a loss of potential revenue and safety concerns for these patients. In order to combat these challenges, we analyzed data and conducted interviews to establish a comprehensive understanding of the hospital's emergency department, strengthened the existing Arena simulation model through verification and validation, and performed experimentation of the model to improve operations and patient flow.

Background

HealthAlliance Hospital has been providing community care since 1902. In order to provide "clinical and service excellence to individuals in [its] diverse communities" (HealthAlliance), constant improvement efforts to quality and safety of care have been undertaken. To improve on the processes in the hospital, resource flow and allocation must be identified. Analysis of flow and the tracking of resource allocation is challenging because of numerous emergency department processes and varying acuity levels for patients. To analyze flow while combating these issues, our group used simulation modeling.

Simulation provides a model of a real life process, or series of processes, that can be used to see how entities flow through a system. Changes can then be made to the process and the effects can be seen without the commitment of any physical resources or interruption of the system. This form of evaluation has become an effective tool for many healthcare institutions. By identifying constraints, bottlenecks, and inefficiencies within healthcare systems, simulation has proven to be a valuable resource in saving time and money while improving the quality of care.

Research Methodology

To identify potential improvements in the Emergency Department at HealthAlliance, we analyzed patient flow data, performed interviews, and conducted observations. Through the use

of visual aids such as value stream maps and spaghetti diagrams, we were able to understand patient flow in the emergency department.

After the model was built, we tested the model to ensure it ran correctly and accurately depicted the emergency department's patient flow. We did this first through verification, in which we debugged the model and checked that it ran as intended. After verification, we validated the model, which means that we ensured that it behaved as the emergency department did in real life. We developed test matrices, in which we defined what we were looking for, to organize the model testing process.

Once we verified and validated model, we performed experiments on the model to identify possible constraints and bottlenecks within the system. We determined which of the possible parameters and structural assumptions had the greatest effect on the selected performance measure of patient flow. To accomplish this, we grouped these input parameters, conducted production runs, and observed the effects on the groups as we carried out these runs through different levels (values assigned to inputs).

Results and Conclusions

During data analysis, we discovered that some of the hospital's beliefs about patient flow patterns were correct, but we also discovered that others were not. The data analysis painted a clear picture of the emergency department's operations and helped us to identify potential areas for improvement. Because patient flow varies throughout the week, we recommend that HealthAlliance create a staffing schedule that better matches the patient arrival distribution. During testing, we discovered that the model was accurate but had room for improvement. During experimentation, we conducted hundred of simulation runs in which we changed the values of staffing and structural inputs within the simulation to find an optimal input combination that maximized patient throughput.

Chapter 1: Introduction

Healthcare is essential to the general welfare of society. It provides for the prevention, treatment, and management of illness and the preservation of mental and physical well-being through the services offered by medical and allied health professions (Houghton Mifflin Company, 2007). Today, the issue of healthcare is receiving much attention through the media and politics. Healthcare is faced with unprecedented challenges, such as staffing shortages (American Nurses Association, Inc., 2010) (Cornerstone Communications Group, 2001), an aging population (Hellmich, 2008), rising costs (Bodenheimer, 2010), and inefficient hospital processes (New England Healthcare Institute, 2010). In light of these challenges, a need for review and reform of our healthcare practices has become apparent.

Lean is one way in which these issues can be addressed. The basic concept of lean is "using less to do more" (Institute for Healthcare Improvement, 2005). For healthcare, in particular, one can apply the principles of lean thinking to improve such processes as patient wait time, levels of staffing, and quality of care. Improvements to such processes can greatly impact the health of the community.

HealthAlliance Hospital, a member of UMass Memorial Healthcare located in Leominster, Massachusetts, is facing issues common in the healthcare industry. These issues include staffing, scheduling, and perceived inefficient operations. HealthAlliance's Emergency Department is currently understaffed by six employees, but they cannot hire additional staff due to a hiring freeze. As a result, their emergency department staff feels overworked. Furthermore, the Emergency Department at HealthAlliance has a bed turnover rate of 1900 patients per bed per year, which is high compared to the national average of 1400 patients per bed per year. Patients must wait several hours before entering the emergency department, which has caused patients to leave without being served. The national average for patients leaving without being seen is about 2% (Agency for Healthcare Research and Quality, 2007). To address these issues and provide a higher quality of care, HealthAlliance is examining its processes within the emergency department. The objective of our project was to:

- Collect and analyze data in order to accurately define the current state of patient flow at the HealthAlliance Emergency Department.

- Verify and validate the existing simulation model, which was created by the UMass Process Improvement team, to ensure that the model behaved as intended and that it accurately represented the emergency department's current state.
- Perform experimentation to explore potential improvements to the HealthAlliance Emergency Department.

In Chapter 2, we included an overview of literature about lean applications in healthcare, problems facing the nation's emergency departments, and methods used to improved patient flow. In Chapter 3, we explain our methodology, which includes data collection and analysis, testing of the Arena simulation model to ensure its functionality and validity, and experimentation to explore the affects of changing metrics in the HealthAlliance Emergency Department. In Chapter 4, we present the results we obtained after implementing our methodology. In Chapter 5, we suggest areas to explore in the future to improve the HealthAlliance Emergency Department. Lastly, in Chapter 6, we discuss the implications of our project, identify limitations present, and make recommendations.

Chapter 2: Literature Review

Before we could implement improvements in the Emergency Department at HealthAlliance, we first needed to develop a solid understanding of lean applications in healthcare and methods to address patient flow issues. Accordingly, this section discusses the concepts of lean thinking, implementing lean into an organization, and successes lean has had within healthcare. We then discuss various methods to model the patient flow and identify waste within the process, including queuing analysis, Markov processes, and simulation.

2.1 Lean in Healthcare

The general principle behind lean is "using less to do more" (Institute for Healthcare Improvement, 2005). The concept of lean thinking was developed by the Japanese as a way to describe the elimination of *muda,* or waste, in their manufacturing processes. Waste encompasses any action that does not add value to the product or service from the perspective of the customer and anything for which the customer is not willing to pay (Hadfield, 2006). For example, "a patient does not want to pay for a second surgical tray if only one instrument was used from it" (Hadfield, 2006).

The first step in lean thinking is the identification of value-added activities. An activity is considered to add value only if it is essential to meeting the needs of the customer. For example, if a patient goes to a hospital for a blood test, the only thing the customer is willing to pay for is the test results (England, 2010).The second step is the identification of non-value-added activities, or waste. The eight chief wastes in healthcare are "unnecessary services or overproduction, mistakes or defects, delays or waiting, unnecessary motion or movement, over-processing, excess inventory, excess transport, and unused creativity" (Hadfield, 2006). In the blood test example, there are several steps that must happen before the lab results can be determined. Waste is often "baked into those steps—such as movement to different stations to complete registration, waiting for a registration person, waiting for an open room, moving to a different room, etc." (England, 2010).

Two process mapping tools—value stream maps and spaghetti diagrams—can help identify value-added and non-value-added activities. A value stream map, which is a tool used to

follow the flow of resources, creates a visual representation of both value and non-value added processes (Kaisen Institute Lean Advisors, 2010). Without a value stream map, obvious waste, and even hidden waste, could not be identified. An example of obvious waste is repeated activities, and an example of hidden waste is managing inventories and the costs associated with them (Young &

FIGURE: This is an example of a spaghetti diagram. The diagram got its name because of how it resembles a pile of tangled noodles. It shows a movement path in a room and also is used as a waste observation tool.

Figure 1: Spaghetti Diagram (Mortland & Mortland)

McClean, 2009). A spaghetti diagram, as shown in Figure 1, can also create visual representations by drawing the "actual flow" of a process through a system. Through this drawing, distances travelled can be determined to provide baseline performance (Six-Sigma-Material.com, 2007).

The entire company must be actively engaged and involved in lean applications, as their input and acceptance of lean initiatives are necessary for success. There must be a top-down transformation, with the full commitment from the entire workforce (Gioia & Herman).

According to HealthMEDX, "for every dollar spent on healthcare, over 75 cents is spent on the non-patient care activities of communicating, scheduling, coordinating, supervising, and documenting care (Hadfield, 2006)." This indicates that there is a huge amount of activity that is not essential to the needs of the customer and illustrates a great potential for improvement to healthcare operations.

There are a number of successful examples of lean applications in hospitals. At Avera McKennan [a hospital in Sioux Falls, South Dakota], a team observed emergency department patients to identify value-added time and waiting time. While the average length of stay was 140

minutes, the team discovered that two-thirds of that time was spent waiting. The department reconfigured its triage process, ensuring each patient would be initially seen within 20 minutes of arrival (Graban, 2009).

Virginia Mason Medical Center in Seattle, Washington, is a leader for applying lean to healthcare. Through the development of the Virginia Mason Production System (VMPS), a "management methodology based on principles of lean management from the Toyota Production System (Virginia Mason Management Principles, 2006)", the hospital has continually improved patient care while also saving money. While designing a new Center for Hyperbaric Medicine, the team at Virginia Mason was able to save $2 million in construction costs and also provided treatment to more patients. Virginia Mason Chairman and CEO Gary Kaplan, MD, told the Institute for Healthcare Improvement that the hospital is "continually identifying ways to provide quality care and eliminating non-value-added elements of the patient experience" (Virginia Mason Management Principles, 2006).

2.2 Challenges Facing Emergency Departments

There are a number of issues present in the nation's emergency departments. Problems include lack of resources, long wait times, overuse of emergency departments, the high stress work environment, medical errors, and staff dissatisfaction. The United States Center for Disease Control (CDC) and the American College of Emergency Physicians both found that emergency departments, in general, tend to be overcrowded and have a lack of resources such as beds. This has caused long wait times, even for ambulance patients, sometimes resulting in death (AFSCME, 2006) (American College of Emergency Physicians, 2010). Another problem facing emergency departments is their overuse; patients visit the emergency department for non-urgent care.   Reasons include mental health issues, the patients' desire to not wait for an appointment, and lack of primary care (Dr. Erik Steele, 2009). The short time allowed for decision making and the fact that many processes occur simultaneously cause a high stress environment in the Emergency Department; as a result, employees may feel pressured to make quick decisions and not have much time to make the most efficient decision leading to wasted time and processes (Croskerry, Cosby, Schenkel, & Wears, 2008). Another issue plaguing American emergency departments is staff dissatisfaction, which includes overworked staff and nurse burnout (Vahey, Aiken, Sloane, Clarke, & Vargas, 2004). Lastly, these conditions may contribute to medical

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errors, such as misdiagnosis, incorrect procedures, and incorrect prescriptions (Fordyce, et al., 2003). The extent and impact of these issues may vary from place to place, but they are present nonetheless and contribute to difficulties in emergency departments across the country.

2.3 Addressing Patient Flow Issues

Patient flow, which is the progression of patients through healthcare institutions (Kucukyazici, Verter, Nadeau, & Mayo, 2007), is one area that can be examined to identify non-value-added activities. Patient and admissions, patient routing, flow schemes, and scheduling and availability of resources can significantly impact on patient flow (Jacobson, Hall, & Swisher, 2006). A number of quantitative approaches exist to document, analyze, and ultimately improve these three areas affecting patient flow. The following subsection discusses three such approaches used to measure, analyze and describe patient flow—queuing theory, Markov processes and discrete event simulation.

2.3.1 Queuing Analysis

One method to document and analyze patient flow is the use of queuing models. Queuing analysis is "a set of analytic techniques in the form of closed mathematical formulas to describe properties of the processes with a random demand and supply" (Alexander Kolker).

Queuing analysis is useful to determine layout planning, resource allocation, and "appropriate levels of staff, equipment, and beds" (Green, 2006). Queuing analysis offers certain modeling advantages. Outputs of a queuing model are fairly easy to understand and utilize when predicting performance measures" (Green, 2006). Because of these strengths, queuing analyses can be used without incurring a high cost and are more accurate at predicting optimal solutions than simply "estimating the system performance for a given scenario" (Green, 2006).

A disadvantage of queuing analysis is that "a number of simplifying assumptions must be made to derive equations for parameters of interest" (Stallings, 2000). One problem for this is that a queuing model can only be effective when patient arrivals are entirely random; however, patient arrivals tend to be "non-ordinary and non-stationary, a process for which queuing [models] are not valid" (Alexander Kolker). In turn, if multiple patients were admitted simultaneously, queuing analysis would only account for one patient in the model.

2.3.2 Markov Processes

Markov analysis considers a set of states or events and analyzes the tendency of one event to be followed by another. Through Markov analysis, a new series of random yet related events can be created (Fuqua, Markov Analysis, 2003). There are two different methods for Markov analysis: Markov Chain and Markov Process. The Markov Chain "assumes discrete states and a discrete time parameter; with the Markov Process, states are continuous" (Fuqua, Markov Analysis, 2003).

Markov modeling offers several advantages. For example, Markov models can be used to easily determine the probability of one event resulting from another event or a sequence of sub-events (Fuqua, Markov Analysis, 2003). Markov models can also easily perform system reconfiguration due to failures.

A major drawback of Markov modeling is the exponential growth of the number of states within the model as the system increases. Large systems have many different processes, which are not only complicated and challenging to construct but are also "computationally extensive" (Fuqua, Markov Analysis, 2003). Markov models can be used when analyzing smaller "pseudo-systems" with strong dependencies, and other analysis techniques can analyze the entire system using "simpler probabilistic calculation techniques" (Fuqua, Markov Analysis, 2003).

2.3.3 Simulation

Fundamentally, simulation is a model of a process or system over a period of time. Within the last 30 years, simulation has become one of the most popular tools in evaluating a given system. Its popularity can be attributed to the fact that most complex, real-world systems with stochastic, or random, elements require more than analytical mathematical models to describe their behavior. Thus, simulation provides for an effective method in solving these kinds of problems.

Simulation has many advantages over other common operation research tools like linear programming and queuing theory. For example, simulation allows for the testing of various system scenarios without the commitment of physical resources. This, in turn, generally proves to be a wise long-term investment. Arena Basic Edition, a popular simulation software, has an initial cost of $1900. It is not uncommon for companies to make a profit of ten times this initial

cost after implementation of solutions offered by simulation. Another strength is the ability of time compression and expansion for evaluating a system at a given time. For instance, with simulation software, a user can observe all of the details of a process within a one second time frame; likewise, the user can view all of the data of a process for a day, month, or even year timeframe.

Although there are many benefits when using simulation software, there are some disadvantages as well. Simulation may be costly to initially develop; the cost of the software and the training to use it may prove to be too expensive for some businesses. In addition, the construction and validation of a simulation model may be costly and time consuming, as some models require thousands of data points. Another challenge of simulation is that the user needs to establish the inputs of the simulation model; if the correct inputs are not identified, then the model will not provide an accurate portrayal of real life. This could result in a company choosing unjust solutions and therefore wasting money.

Apart from the advantages and disadvantages of simulation, there are several ways to classify simulation models. It may, however, be easiest to organize them into three classifications: static vs. dynamic, continuous vs. discrete, and deterministic vs. stochastic (Kelton, Sadowski, & Sturrock, 2007):

- A *static* model does not consider time. It is a representation of a system at a particular time or a system in which time plays no role. *Dynamic* models, on the other hand, represent systems that evolve over time. They are the most common operational models.
- In a *continuous* model, the state of the system changes constantly over time (e.g. the level of a reservoir as water flows in and is let out). In a *discrete* model, however, change can occur only at separated events in time. These events can be can be defined as instantaneous occurrences that may change the state of a system (e.g. arrival of customers).
- *Deterministic* models are those that have no random inputs. An example would be an agency that has a fixed schedule for a given day. In contrast, *stochastic* models are those that operate with at least some inputs being random. Often, in computer-based simulations these random inputs are accounted for through the use of probability distributions (Kelton, Sadowski, & Sturrock, 2007).

Despite the differences among these kinds of simulations, the processes required to conduct these studies remain relatively the same. The first steps in conducting a simulation study begin with the formulation of a problem and a plan of the study. Every study must begin with a clear statement of the study's overall objectives and specific issues to be addressed. This provides for a clear vision that is essential for success. The overall study should then be planned in terms of the people, the cost, and the time required for each aspect (Law & Kelton, 1991).

The next step in performing a simulation study is to collect data and define the model. Information and data should be collected on the system of interest and used to specify operating procedures and probability distributions for the random variables used in the model. Once enough data is collected, one can start building and validating the model. When building a model, it is imperative to involve people in the study who are intimately familiar with the operations of the actual system. This will ensure the accuracy, credibility, and validity of the study. Once enough information is gathered about the system, construction can begin through the use of a computer program. Software, like Arena, can provide alternative and interchangeable templates of graphical simulation modeling and analysis modules that can combine to build a fairly wide variety of simulation models (Law & Kelton, 1991).

Pilot runs should then be made once the model is verified. These runs can be used to test the sensitivity of the model's output to small changes in the inputs. If the outputs change greatly, the user must obtain a better estimate of the input parameters (Law & Kelton, 1991).

One can design experiments if the pilot runs confirm the validity of the simulation model. The first step in the design process is to find out which of the many potential parameters and structural assumptions have the greatest effect on a performance measure; in other words, the user must determine which set of model specifications appears to lead to optimal performance. Once this information is established, decisions need to be made on issues, such as initial conditions for the simulation runs, the length of the warm-up period (if any), the length of the simulation run, and the number of independent simulation runs to make for each alternative (Law & Kelton, 1991).

Production runs can take place to provide performance data on the system designs of interest once the experiments are established. Statistical techniques are used to analyze the data

generated from the production runs. The analysis is then used to decide which simulated system is best, relative to some specified measure of performance. Finally, the results are documented, presented, and if all goes well implemented (Law & Kelton, 1991)

2.4 Conclusion

This knowledge provided for a solid foundation for the rest of the evaluation process as it established a framework to help in executing the three phases of our methodology. Our comprehension of the application of lean principles in healthcare directly affected the quality of our process observations and staff interviews—both essential parts of the data collection phase of our methodology. Our understanding of simulation and the steps involved in conducting a simulation study gave us a strong base for verifying and validating the simulation model. Lastly, our awareness of the challenges facing emergency departments and the techniques associated with addressing patient flow provided us with insight when establishing the parameters of our experiments.

Chapter 3: Methodology

The purpose of this project was to reduce patient flow delays, disruptions, and inefficiencies at the HealthAlliance Emergency Department. To accomplish this, we began by defining the current state of patient flow through the emergency department. Next, we ensured that the simulation model worked correctly and accurately depicted the HealthAlliance Emergency Department. Lastly, we experimented with the model to determine ways in which the patient flow could be improved. We developed a method to accomplish our goals and objectives, as shown in Figure 2; these included research and interviews to establish an understanding of the hospital's emergency department, verification and validation of an Arena simulation model of HealthAlliance's current state, and experimentation and analysis of the model to improve operations and patient flow.

Data Collection and Analysis	
Interviews	Numerical Data

Testing the Arena Simulation Model	
Verification	Validation

Experimentation of Arena Simulation Model	
Identify areas to investigate	Evaluate responses to input parameter changes
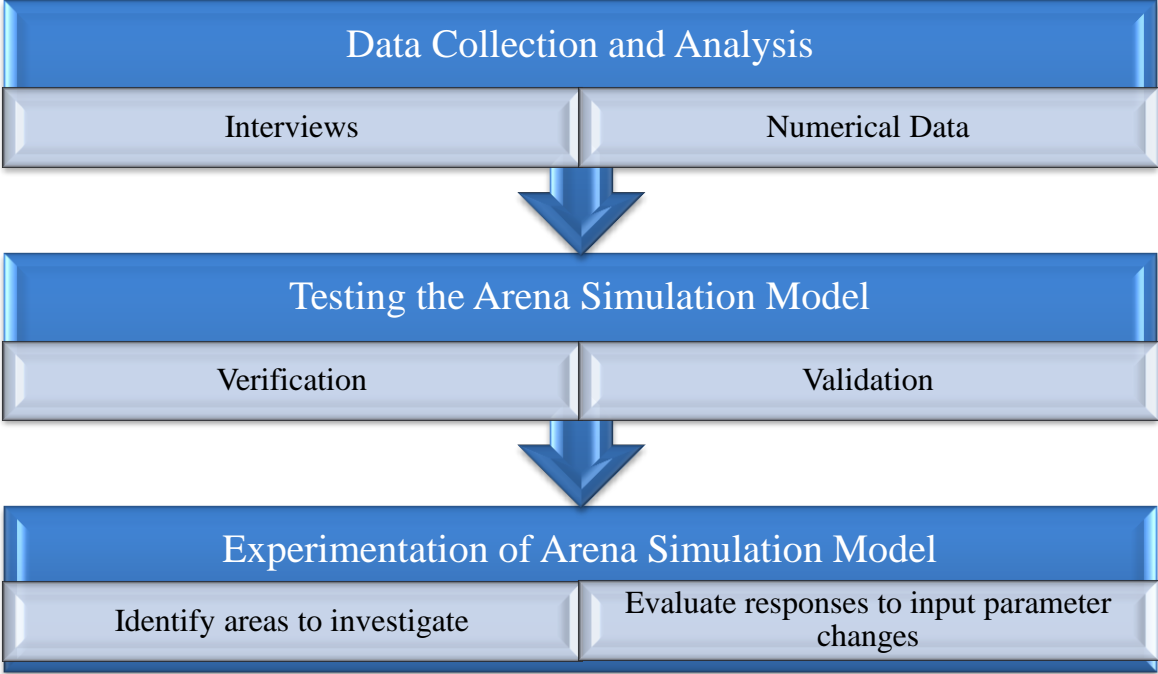
Figure 2: Outline of Methodology

3.1 Data Collection and Analysis

To gain a comprehensive understanding of the patient flow at HealthAlliance, we performed analysis of patient data distributions and conducted interviews of the staff within the

emergency department. This was important because the quality of a simulation is judged on its "ability to imitate the behavior of a particular system" (Blake, Carter, & Richardson, 1996).

3.1.1 Patient Data

First, we analyzed data that the Process Improvement Team from UMass Memorial had already acquired from HealthAlliance. There was three years of fiscal year data from October 2007 through September 2010. It included patient arrival and departure times, a CPT billing code and description, and the mental health classification of the patient (as applicable). The patient data consisted of emergency room patients and urgent care patients. When performing analysis on the data, we eliminated urgent care patients from the data set.

The data was parsed, identifying the patient arrival rates that vary from month to month, as shown in Figure 3, and day to day, as shown in Figure 4. The weekly patient arrival distribution was also identified.

We received a second set of patient data spanning 12/04/09 to 11/30/10 from the Process Improvement Team; this set of patient data contained information regarding arrival time, arrival method, acuity level, whether the patient was admitted or not, any tests the patient received, and patient departure time. The time a patient left the emergency department was only recorded for admitted patients, which limited length of stay calculations.

We also calculated the amount of treatments administered to patients. For the different treatments, we identified the total number performed and a breakdown of treatments by acuity levels. We evaluated the distribution of patients receiving multiple treatments. We determined the ratio of patient admittance and then separated it by acuity level. We identified the number of patients arriving by ambulance, also separated by acuity level.

3.1.2 Interviews

After gaining a general understanding of patient arrival distribution in the Emergency Department through fiscal year data, we conducted interviews of various emergency department staff, including doctors, nurses, and technicians. There were three chief goals that we accomplished throughout the interview process:

1. A general understanding of HealthAlliance hospital, its operations, and its employees.
2. Identification of potential staff to follow for observations.
3. Identification of issues faced by the emergency department.

We conducted in-person open-ended interviews to complete these goals. As suggested by the UMass Process Improvement team, we asked role-specific questions to all interviewees to understand each step a patient takes within the emergency department and to ensure the interviewees were confident in the answers they provided us. Our questions were open-ended as to avoid limiting responses. Interviewees were encouraged to clarify answers when needed, but the interviews were conducted in a "question and answer" type of session (Suler). Because we asked the same questions to interviewees with similar roles, "this approach facilitated faster interviews that were more easily analyzed and compared" (Valenzuela & Shrivastava).

When conducting the interviews, we were sure to eliminate interview bias. This was important because if bias had been present, our results would have been jeopardized and we would have received an inaccurate perception of the hospital (Valenzuela & Shrivastava). In order to reduce bias, we began by ensuring that our questions did not lead the interviewees to answer in a certain way. Next, we avoided the use of double-barreled questions (multi-part questions). Double-barreled questions could have led to confusion if interviewees answered one but not all of the questions or if they agreed with part of the question (Dana Lynn Driscoll & Brizee, 2010). Our questions were designed with simplicity in mind, to reduce the deviation of the interviewees' interpretation. In compliance with the Institutional Review Board (IRB) agreement, interviewees completed consent forms, as shown in Appendix C.

3.2 Testing the Arena Simulation Model

We tested the Arena simulation model, created by the UMass Process Improvement team, to ensure that it was functional and accurate. We had two major test stages—verification and validation. First, we performed verification to debug the model and ensure that it performed as intended (Macal, 2005). Next, we completed validation of the model to ensure that it behaved as it would in real life and that it accurately represented the patient flow at the HealthAlliance Emergency Department.

To verify the model, we created a test plan identifying both allowable conditions (or situations that should be represented in the model) and non-allowable conditions (or situations that were undesirable in the model). The test plan included various types of conditions, including those related to patient flow order, entrance and departure of the system, times in queue, and service times. In the test plan, we also identified a method to evaluate the conditions present in the model. We identified the presence of the conditions in a variety of ways; our methods included checking the organization of and specifications in the modules in the simulation model, evaluating data produced in the Run Report, and graphing various metrics (e.g. patient entry patterns) when running the model. We checked each condition three times, by running three replications of the model, to ensure the accuracy of our results. See Appendix F for all test cases.

To validate the model, the team compared the simulation results to real-life data, spoke with emergency department employees, and conducted observations of the emergency department. To compare the simulation results to the data from HealthAlliance's Emergency Department, we identified two metrics: (1) the patient times from point of entry to discharge from the emergency department and (2) the number of patients through the system in a given amount of time. We compared the metrics from the simulation to information obtained through the data analysis portion of our project. We also visited HealthAlliance to confirm the validity of the model. We met with HealthAlliance Emergency Department employees and asked questions to validate that our model was an accurate representation of their emergency department. We asked them about how patients move through the emergency department, verifying that the flow and layout of the model were correct. Additionally, we conducted observations to strengthen our comprehension of the Emergency Department and to identify processes that were not accurately depicted in the model.

3.3 Experimental Design

After verification and validation, we then evaluated the model for different scenarios in order to identify possible constraints and bottlenecks within the emergency department. Identifying these areas of concern helped to determine a set of model specifications that could potentially lead to improved performance for the HealthAlliance Emergency Department (Law & Kelton, 1991). We were able to compare the responses, or performance outputs, from hundreds of different scenarios using Arena's Output Analyzer, Process Analyzer (PAN), and OptQuest

functions in order to establish a set of input parameters that maximized patient flow. The procedure used is located in Appendix H.

When comparing two different scenarios (e.g. the original model versus the original model with one more nurse per shift), we used the Output Analyzer application. The Output Analyzer was used to confirm any significant statistical differences between the original model and the model with one added nurse per shift. In addition, it provided a quantified magnitude of these differences. For example, with one more nurse per shift, we expected an increase in patient flow and a reduction in waiting time for patients. However, we were not sure of the total throughput enabled by this addition and to what extent wait time would be reduced. We performed a number of replications for each scenario because more runs with a tight confidence interval generally results in a more accurate average. Through this, the Output Analyzer was able to determine the impacts on patient throughput and wait time.

To evaluate the responses of many different scenarios at once, we used the Process Analyzer application. The Process Analyzer helped in managing the practical mechanics of making the model changes for all the different scenarios. It also proved beneficial in evaluating responses in a statistically valid way to sort out which scenarios differ significantly from others, which scenarios may be better than others, and which scenario would be best for our objective (Kelton, Sadowski, & Sturrock, 2007). To gain perspective, we considered the hypothetical situation that the Health Alliance Emergency Department was given $120,000 to help in improving patient flow. With this money they were allowed to do any of the following: add two nurses, add two rooms, add a nurse and a room, or improve the COW computer systems to run faster. Once we entered these different scenarios into the Process Analyzer, PAN executed each scenario delivering the response results for each one in a table. Therefore, we had a table featuring each scenario with their respective responses. In addition, we created bar charts to clearly see which scenario yielded the highest numerical value for patient throughput.

We also considered the situation in which we were free to explore all possibilities (in terms of staffing and number of beds, without budget restriction) with the goal of maximizing patient flow. For this scenario, we had four input control variables: nurses, physicians, lab technicians, and beds. This scenario yielded thousands of possibilities that would take weeks to evaluate. Arena, however, has an application called OptQuest that uses heuristics known as "tabu

search" and "scatter search" to move around intelligently in the input-control space and converge quickly to an optimal point (Kelton, Sadowski, & Sturrock, 2007). In other words, OptQuest looked through the model for potential controls (different combinations of our four defined input variables) and responses (the results relative to different control combinations) and sought a combination that optimized a defined objective (maximum patient flow).

3.4 Conclusion

By fulfilling the above phases, our group was able to obtain a comprehensive understanding of HealthAlliance's Emergency Department operations, successfully analyze the effectiveness of the simulation model, and then recommend improvements to reduce delays, disruptions, and inefficiencies.

Chapter 4: Results

The three phases of our methodology—data collection, simulation model testing, and experimentation—were completed in sequential order with the objective of improving patient throughput as well as patient and staff satisfaction. The first segment established information (e.g. arrival rates, busiest days, and staff to observe) that helped in verifying and validating the simulation model. Once the simulation model testing was complete and its accuracy ensured, different scenarios were implemented into the model and the respective results were recorded. From these experiments, we were able to determine an optimal combination of inputs that maximized patient flow while promoting patient and staff satisfaction.

4.1 Data Collection and Analysis

Through patient data analysis and interviews, we were able to collect the necessary information for the testing and experimentation of the simulation model.

4.1.1 Patient Data

We calculated average daily patient arrivals using the fiscal year data from October 2007 to September 2010. As shown in Figure 3, September was the busiest month for the emergency department, with the fewest number of patients arriving in December. We also discovered that weekly patient arrival patterns increase on Sunday, peak on Monday, then begin decreasing on Tuesday. As shown in Figure 4, this downward trend continues through the rest of the week, until the arrival pattern increases the following Sunday. The annual bed turnover rate, or the number of patients seen by the emergency department per bed, was 1900. HealthAlliance has an average of 128 patients per day and an average of 7.4 mental health patients arriving daily. As shown in Figure 5, the arrival distribution of mental health patients is relatively symmetric throughout the year. The average length of stay for non-mental health patients is just over three hours, while the average length of stay for mental health patients is over nine hours. A weighted length of stay was calculated to determine the total average length of stay for a patient within the emergency department, as shown in Table 1.
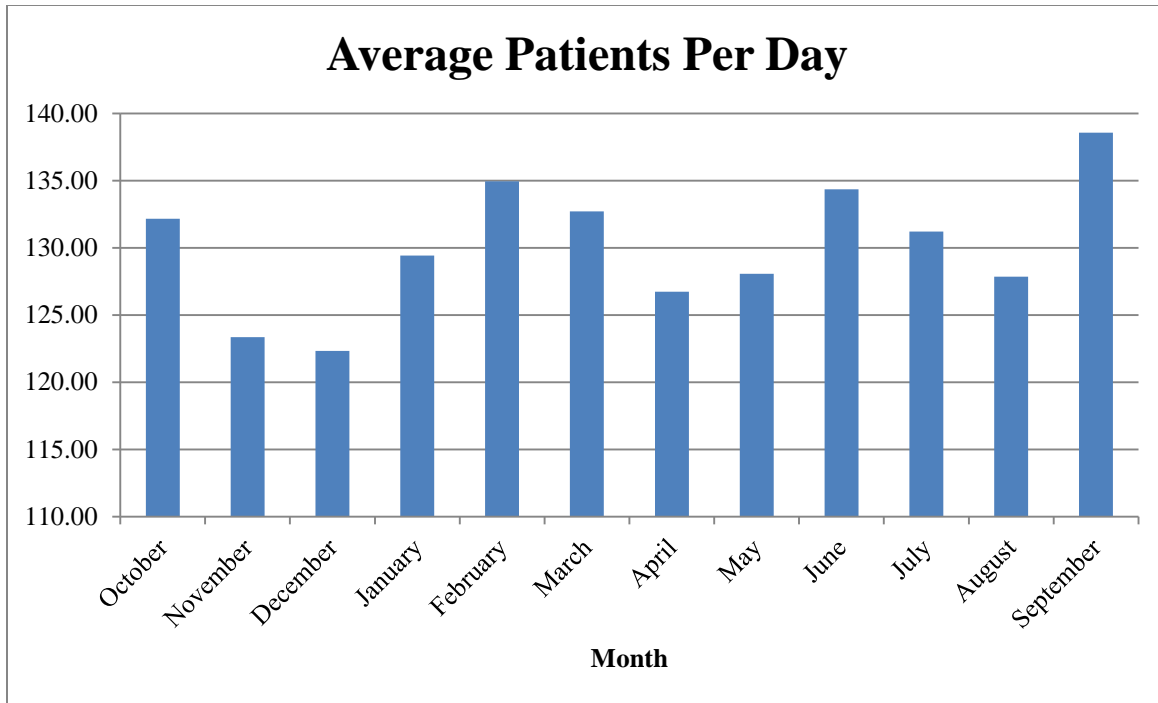
Figure 3: Average Daily Patients per Month
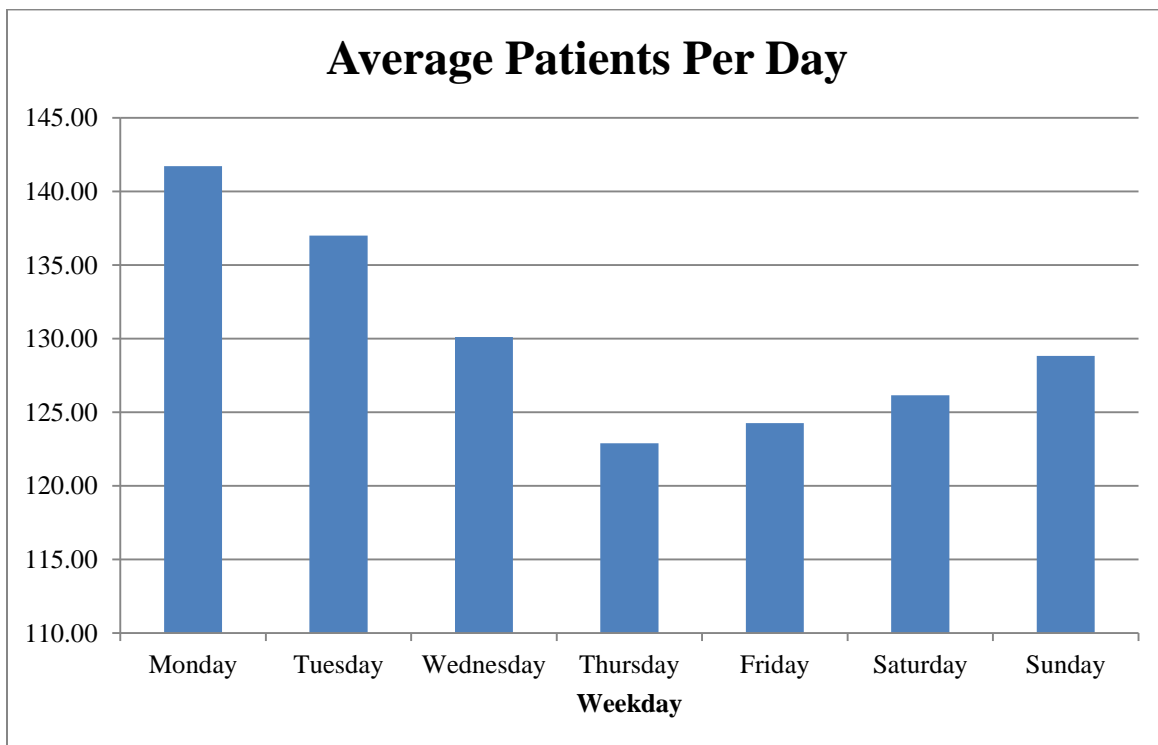
Figure 4: Average Daily Patients per Day
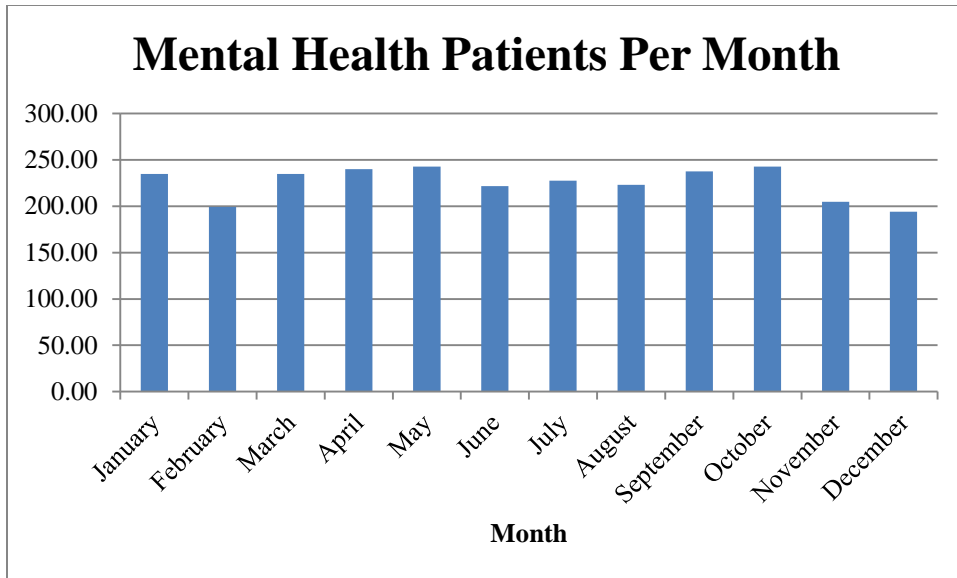
Figure 5: Mental Health Patient Arrival per Month

Table 1: Weighted Length of Stay for Emergency Department Patients

	Non-Psych	Psych
Count	39735	2536
Percentage	94%	6%
Length of Stay	3:48	10:11
Weighted Length of Stay	4:10	

The second data set received from the Process Improvement Team allowed for the identification of arrival patterns by acuity level, along with treatments given to patients within the emergency department. There were 11,102 patients who entered through the ambulance doors and 31,163 patients who entered through the waiting room. As shown in Table 2, the acuity level distributions for each were also calculated. It was identified that a majority of acuity level 4 patients enter the emergency department through the waiting room, while nearly all acuity 1 patients arrive by ambulance. Admitted patients were differentiated from patients who were not admitted, and the acuity distribution for admitted patients was identified.

Table 2: Acuity Distribution for Walk-In and Ambulance Patients

Walk-In Patients		Ambulance Patients	
Acuity	Count	Acuity	Count
1	15	1	172
2	4123	2	2779
3	13745	3	7198
4	12945	4	942
5	335	5	12
TOTAL	31163	TOTAL	11103

Table 3: Patient Admittance Distribution

	Count
Admitted	4856
Not Admitted	37415
Total	42271

Table 4: Acuity Distribution for Admitted Patients

Admitted Patients	
Acuity	Count
1	64
2	1876
3	2819
4	95
5	1

Along with patient arrivals, we identified the frequency of treatments performed. We tracked four treatments: CT scan, Diagnostic Imaging, EKG, and MRI. We calculated the acuity level distribution for each treatment and the number of patients who received multiple treatments. Of the 42,271 patients who visited between December 2009 and November 2010, 19,883 did not receive any treatment. A total of 236 patients received all four treatments.

Acuity	CT Scan	Diagnostic Imaging	EKG	MRI
1	48	109	109	3
2	1872	3639	4153	197
3	4303	7387	7275	263
4	439	4995	255	13
5	3	6	1	0

Table 6: Total Treatments Performed

Count	
CT Scan	6665
Diagnostic Imaging	16138
EKG	11795
MRI	476
None	19883

Table 7: Treatment Combinations

If CT		If Diagnostic Imaging		If EKG		If MRI	
Diagnostic Imaging	3292	CT	3292	CT	3516	CT	340
EKG	3516	EKG	7923	Diagnostic Imaging	7923	Diagnostic Imaging	333
MRI	340	MRI	333	MRI	401	EKG	401

4.1.2 Interviews

During the interview process, we identified 6 roles impacting flow within the emergency department. These included: head nurse, staffing nurse, triage nurse, physician, housekeeping, and director of radiology.

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The staffing nurse provided us with information regarding mental health patients, which was confirmed by the head nurse. A majority of the time (75%), a mental health patient requires a "sitter" to monitor the patient, ensuring the patients safety. The two factors affecting room selection were identified. These factors are the acuity level of the patient and equipment required by the patient.

The triage nurse was also very helpful during the interview process, providing us with some rough estimates that were implemented into the simulation model. It was estimated that 10% of patients going through triage do not return to the waiting room and are brought directly into the emergency department. It was also estimated that triage takes roughly 5 minutes to complete, with age and acuity level being the primary causes of delays.

During the interview process, we discovered that the emergency department at one time had a greeter that would document the basic information of patients in the waiting room, prior to entering triage. This reduced the time of the triage process. Another issue identified through interviews was the portable computers within the emergency department. The nursing staff has difficulty transporting the computers around the emergency department as they are bulky and heavy. In addition, the hardware within the computers appeared to be outdated, as there were numerous delays during patient data entry caused by a non-responsive computer.

The director of radiology provided us with crucial data concerning the interaction between the emergency department and the radiology department. Roughly half of all patients who flow through the radiology department originated in the emergency department. Additionally, patients within the emergency department have preferential treatment, allowing them to bypass the queue of the radiology equipment for tests. A more detailed summary of the interview results can be found in Appendix E.

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4.2 Testing the Arena Simulation Model

During the verification process, we found that the model met a majority of the requirements for the allowable conditions and non-allowable conditions. However, we encountered one issue with patient entry into the system. We found that the "Create" module (how entities enter the simulation model) limited the number of entities that could enter the system in a given run. This negatively impacted the model because resource utilization was unusually low (0 for many of the items) and we were unable to perform functional runs when conducting warm up period. This issue was fixed after we changed the number of maximum arrivals to "Infinite". More details about the final test results can be found in Appendices E and F.

During the validation process, we found that the model closely mimicked the operations of the HealthAlliance Emergency Department. However, we did identify areas in which the model could improve to better represent reality. Most of the discrepancies between the model and reality were caused by the difference between deterministic process times and stochastic process times. In the model, the modules times are deterministic, or constant, instead of stochastic with random variability. For example, in the original model, patients entered the system at a continuous rate of 1 patient every 15 minutes. In reality, patients do not enter at a consistent rate (e.g. multiple patients could enter at once or there could be no patients that enter the Emergency Department for an extended period of time). Patients also require varying amounts of time to complete processes; however, in the model, the times are the same for all patients. Additionally, as we discovered in the data analysis portion of the project, the number of patients in the Emergency Department vary by time of day, days of the week, and months in the year.

4.3 Experimental Design

Through the use of Arena's three response analysis applications—Output Analyzer, Process Analyzer, and OptQuest—we found a combination of input variables that maximized patient flow relative to our defined inputs. The experiments were designed as a three-step process to promote familiarity with Arena's experimentation tools and to ensure an optimal set of input parameters were identified.

The first phase of experimentation focused solely on the comparison of responses from two scenarios: the original model and the original model with an additional nurse. This run provided us with a base to build off in terms of experience as we progressed toward more in-depth experiments. Using the Output Analyzer to evaluate the responses, we generated a data table featuring the number of runs and patient throughput values for both scenarios.

Table 8: Two Scenario Comparison

Scenario Properties		Control	Response
Name	Reps	Nurse 1	Patient Throughput
Original Model	25	1	1256
One Additional Nurse	25	2	1280

Adding an additional nurse to the staff allows for 23 more patients to flow through the ED per week.

The second phase of the experimentation utilized the Process Analyzer application to evaluate several different scenarios. These included a model with two additional nurses, a model with two additional beds, a model with an additional nurse and bed, and a model with an additional triage nurse. Once we had the scenarios defined and the control values set to our specifications, PAN generated the information shown in Table 9.

Table 9: Four Scenario Comparison

Scenario Properties		Controls					Response
Name	Reps	Nurse 1	Nurse 2	Bed 1	Bed 2	Triage Nurse	Patient Throughput
Original Model	25	1	1	1	1	1	1256
Two Additional Nurses	25	2	2	1	1	1	1265
Two Additional Beds	25	1	1	2	2	1	1258
One Add. Bed, One Add. Nurse	25	2	1	2	1	1	1291
Additional Triage Nurse	25	1	1	1	1	2	1256

The addition of a bed and a nurse to Health Alliance's Emergency Department can potentially allow for 1291 patients to be admitted, treated, and discharged throughout a given week.

The third and final phase of the experimentation considered four input variables: nurses, physicians, lab technicians, and beds. Using the OptQuest application, we sought a combination of these inputs that maximized patient flow. After defining the input variables and constraints, we ran 400 different combinations of simulation and yielded a maximum patient throughput per week of 1475.667. The 172nd combination produced this throughput. The following represents the input variables that yielded this result:

Table 10: Optimal Control Combinations

Controls			
Control Name	**Best Value**	**Control Name**	**Best Value**
Bed 1	1	Bed 5	2
Bed 10	1	Bed 6	1
Bed 11	2	Bed 7	2
Bed 12	1	Bed 8	2
Bed 13	1	Bed 9	1
Bed 14	1	MD 1	2
Bed 15	1	MD 2	1
Bed 16	2	MD 3	2
Bed 17	1	MD 4	1
Bed 18	1	MD 5	2
Bed 2	2	Nurse 1	2
Bed 20	1	Nurse 2	1
Bed 21	1	Nurse 3	1
Bed 22	1	Nurse 4	1
Bed 23	1	Nurse 5	2
Bed 24	2	Tech 1	2
Bed 25	2	Tech 2	1
Bed 3	2	Tech 3	2
Bed 4	2		

4.4 Conclusion

Through the analysis of fiscal data provided to us by the UMass Process Improvement Team, we were able to identify several descriptive values (e.g. average patients per day, acuity level distributions) crucial in the development of the simulation model. In addition, the parsed data provided us with the busiest times of operation within the Emergency Department. We scheduled our observations, time studies, and interviews during these times and in turn received more data (e.g. nursing schedule, facility layout) that helped in the progression of the simulation model. Once the verification and validation was established, we began experimenting with the model. After adjusting and redefining the input variables of the simulation model, we used Arena's response analysis applications to find an optimal combination of inputs that maximized patient flow.

Chapter 5: Future Work

After our observations, interactions, and analysis of the HealthAlliance Emergency Department, we discovered methods, not necessarily related to our project, through which they could improve patient flow and overall operations. These include redesigning the floor layout, further integration of lean, and improving the pre-admittance processes.

5.1 Redesign Emergency Department Layout

As requested by the Process Improvement Team, a relationship chart for the emergency department, shown in Table 19, was created. Based on the relationship chart, the mental health rooms were identified as having an undesirable relationship with: the ambulance entrance, the trauma room, treatment rooms 3-16, and the family waiting room. Due to these undesirable relationships, an alternative layout should be developed. Facility layout design requires several inputs (McGraw-Hill Companies, 2006):

- Specification of output objectives of the system
- Estimation of service demand
- Processing requirements "in terms of number of operations and amount of flow" between entities.
- Space requirements for entities
- Space availability within the department or facility.

Two types of facility layout design, which can be applied to the HealthAlliance Emergency Department, are cellular manufacturing layout and fixed position layout. The cellular manufacturing layout process groups machines into work centers (or cells) that are designed to perform a specific set of processes. For example, radiology equipment (such as CT, MRI, EKG, etc.) can be grouped together, as they have the same impact on patient flow. Fixed position layout is used for arranging product entities in a fixed position, and it transports workers, materials, and machines (U Texas). Treatment rooms would be an example of a fixed position entity. A hybrid layout, or one that incorporates both cellular manufacturing and fixed position layout designs, would be ideal for HealthAlliance.

When comparing various layouts, the cost of the layout must be determined. Layout cost is the sum of the flow cost, which is calculated as:

$$Z = \sum\sum C_{ij}F_{ij}D_{ij}$$

C is the flow cost from I to J, F is the frequency of flow between I and J, and D is the distance between I and J.

5.2 Integration of Lean

Lean integration is a "natural way to solve many cross-organizational issues by applying principles such as waste elimination, team empowerment, and optimization of the whole rather than the parts" (Schmidt, 2010). A shared vision is required to eliminate waste, which can be challenging due to the "diverse range of incentives to all actors" within the process (Schmidt, 2010).

One way to ensure that there is a shared goal is to "empower the team". Lean Integration requires "bottom-up rather than top-down changes, driven by front-line staff" (Schmidt, 2010). Due to the disconnect between upper management and "day-to-day realities of work", the workforce must be "empowered to drive change". Two ways to assist the workforce is to provide them with the project plan and to support their ideas with the "appropriate tools and resources" (Schmidt, 2010).

5.3 Improvement to Pre-Admittance Processes

After conducting emergency department observations during the data collection portion of the project, we noticed that there was a backup in the waiting room and pre-admittance processes (triage and registration). HealthAlliance could improve their pre-admittance processes through a variety of methods, including electronic devices, different staffing schedules, and alternative approaches to the triage process.

One approach to shorten the time in triage is through the use of technology. First, HealthAlliance could implement the use of emergency department smart cards, like the ones used at Wellington Regional Medical Center in Florida, which would be free to its patients and keep track of patient information, such as contact information, medications, and medical conditions (Wood, 2008). Using smart cards would eliminate many questions asked in the triage

process and would improve the emergency department's quality of care by alerting the nurse to underlying conditions that could affect patient treatments. HealthAlliance could also improve their Emergency Department with technology by adding a kiosk machine for triaging patients. The kiosk would increase the hospital's capacity to serve patients and could automatically place patients in a queue depending on arrival time and severity of condition. This would reduce the burden on hospital staff. HealthAlliance could also shorten its pre-admittance processes by upgrading its computer system and computer units. Since the computers are older, they take a while to boot and often crash or freeze on the operator. A more modern and functional computer system would reduce time wasted waiting for these machines to function. Although these technology solutions could improve patient flow and the overall operations of HealthAlliance, they all require a significant financial investment. Therefore, they may not currently be feasible for the hospital given their budget cuts and hiring freeze.

Another approach to shorten the time in triage and registration is through the use of different staffing schedules for those areas. First, HealthAlliance could once again create a greeter position, which was recently terminated. The greeter would welcome the patients as they arrive, register patients, enter patients' basic information into the computer system, and serve as a liaison between patients and emergency department staff. The greeter position would relieve some of the burden from the triage nurses and speed up the triage process. Another option for shortening the pre-admittance processes is to implement a pull system for staffing the triage station. Once there were a certain number of patients in the waiting room, the charge nurse would assign a nurse to open an additional triage station. When the number of patients in the waiting room fell below a certain level or the emergency department reached a determined capacity, the triage area would return to its standard staffing of one nurse.

In improving a system like triage it is important to view it as a function and not a place (Jensen & Crane, 2008). By doing so, we can establish what components add value, what components can be performed more efficiently or effectively at other points in the encounter, and if this function is a bottleneck. Team triage and a fast track are two scenarios that could increase patient flow. Team triage is a program in which patients are quickly assessed by a team with a physician, a nurse, and a paramedic. Patients with urgent problems are promptly moved to a treatment room. Patients with non-urgent problems are tested and/or treated in the area where

triage takes place; they are then released or they return to the waiting area until test results and a treatment room are available. This system provides an effective one-in-process queue in which patients experience a one-stage assessment, treatment, and discharge process (Slovis & Lemonds, 2005). Another solution, emergency department fast-track systems, "stream" patients with non-urgent complaints to treatment in a dedicated area and aim to decrease waiting times and emergency department length of stay, reduce overcrowding, and increase patient and staff satisfaction. Fast-track systems are designed to improve emergency department capacity during peak demand. Fast-track systems are usually staffed by senior medical and nursing personnel underpinned by the notion that senior staff can make timely discharge decisions and that limiting staff running fast track will expedite care by decreasing handovers and fragmentation of care (Considine, Kropman, Kelly, & Winter, 2008).

Because there are many potential options for improving patient flow in the pre-admittance processes, HealthAlliance will need to evaluate these alternatives by considering the ease of implementation, costs, and the compatibility of these options with the culture at HealthAlliance and its patients.

5.4 Conclusion

We believe that HealthAlliance and the UMass Memorial Process Improvement team could greatly improve patient flow at the HealthAlliance Emergency Department if they choose to act on all (or even some) of these potential projects for the future. They could consider cost, ease of implementation, time required, and the team members' strengths and skills when deciding which projects to carry out.

Chapter 6: Conclusion

Many hospitals are addressing issues within the emergency department as a means to improve efficiency, safety, and both patient and staff satisfaction. Health Alliance is evaluating the current operations of its Emergency Department through the creation of a simulation model. The objectives of this project were to use the simulation model to define the current state and identify ways to improve patient throughput while enhancing patient and staff satisfaction. To do this, we analyzed data and conducted interviews to establish a comprehensive understanding of the hospital's emergency department, strengthened the existing Arena simulation model through verification and validation, and performed experimentation of the model to improve operations and patient flow.

6.1 Limitations of the Project

Although we are confident in our work and recommendations, we do recognize that they may not perfectly reflect the conditions in the Emergency Department at HealthAlliance. One limitation of the simulation model, and subsequently the testing and experimentation, is that we only accounted for one acuity level (or a ranking system of the severity of the patient's ailment) in the model. In reality, a patient's acuity level can affect the length of stay, type of treatment used, and type of care required. Because these things may vary when adding the additional acuity levels, the results found in the experimentation may have a greater or lesser impact on overall patient flow. The primary reason for only including one acuity level in the model is that verification and validation would have been much more complex with additional acuity levels as those would have been additional factors to consider. We also did not have data regarding how different acuity levels affected the use of resources and equipment.

During the data collection process, we encountered issues that compromised the validity of the simulation model. At each observation, the patient flow in the emergency department was quite low, restricting the amount of data we were able to collect. In addition, after receiving a constructed simulation model and associated input data from our sponsor, we realized that there was an issue with the arrival of patients. The data began tracking the arrival of patients once they began registration. In reality, patients must wait, complete the triage process, and then potentially wait again for registration. The data we received did not report any of the time preceding

registration, and it would have been more realistic if it starting tracking patients once they entered the emergency department.

These issues reflected a key concern that we had when verifying and validating the simulation model in that the outputs of the model were only going to be as good as the inputs. In other words, the results and recommendations we presented from our study were only as reliable as the accuracy of the model. Therefore, if we could not locate data concerning critical elements of the model, then we could not place the upmost degree of confidence in the accuracy of our conclusions.

6.2 Recommendations

Based on the data analysis, simulation model tests, and experimentation, we were able to formulate recommendations for HealthAlliance and the UMass Process Improvement team. These recommendations included nurse allocation, facility layout, changes to the simulation model, and resource adjustment to improve patient flow.

6.2.1 Data Collection & Analysis

After analyzing the hourly distribution data for patients in the emergency department, we were able to calculate the average number of patients within the emergency department for each hour. In addition, we were able to calculate the minimum number of nurses required to satisfy a 4:1 patient to nurse ratio. Based on the figures shown in Appendix K HealthAlliance may want to investigate with a slightly modified staffing model, staffing 1 less nurse between the hours of 7 AM and 9 AM in order to better handle the increased patient flow between 2 PM and 5 PM.

When developing a new facility layout, the analyst should pay particular attention to the positioning of mental health rooms. Based off of interview results, we discovered that mental health rooms cause a disturbance to the emergency department. The current location of these mental health rooms is in the center of the emergency department, affecting not only treatment rooms 3 through 8 but also treatment rooms 14-16. A location for the mental health rooms that reduces the disturbance to the emergency department while minimizing the flow cost of the layout would be very beneficial to the HealthAlliance Emergency Department.

6.2.2 Testing the Arena Simulation Model

After validating the model, we identified ways to improve the simulation model so it more realistically represented the Emergency Department at HealthAlliance. The pattern of patients entering the system could be more realistic by implementing a schedule based on the day-to-day patterns we found in data collection. Additionally, instead of constant times for patient entry into the system and a set amount of time spent at the various emergency department processes, the times could be changed to a stochastic distribution. The easiest way to do stochastic times is by selecting a triangular distribution, where the minimum, mean, and maximum times are set at each module. Although this may not be a perfect representation of the entry and flow of patients, it would be more accurate than a constant, non-changing time. To determine a more exact time distribution, one can input a set of times (e.g. the time that patients spend at a process or the times that patients enter the system) into an ASCII file and create a histogram in the Input Analyzer of Arena. The user can then use the "Best Fit" option to identify the best distribution for the module.

The test matrices can also be used in the future. The Process Improvement team can rerun the tests after modifying the simulation model to ensure that it runs without bugs and as an accurate depiction of the HealthAlliance Emergency Department. Additionally, the current test conditions could be used as a basis when creating additional test conditions in the future.

Steps could be taken to combat the problem of ensuring the validity of the model. The recommended approach would be to observe patients from the moment that they walk into the emergency department to their initial interaction with registration. The times we record for each process between these parameters could then be implemented into the model and fitted along distributions over a period of several runs. However, if members of the Process Improvement team were unable to observe this period of time prior to registration and had no way of receiving this information, they could rely on fairly arbitrary assumptions or guesses known as "ad hoc data." In this scenario, they could choose deterministic values for inputs like time delays and run a sensitivity analysis over a range of values to see if the system's performance changed significantly. If it did, then they could adjust that value accordingly. For unknown inputs like patient arrival times, probability distributions would be most appropriate. By using patient interarrival time data from similar hospitals, they could supplement distributions into the model

for this previously unknown factor. In the end, however, observing and recording the process times of the real system will always provide the best alternative.

6.2.3 Experimental Design

The OptQuest for Arena application seeks a combination of defined inputs that optimizes an objective. Using an input structure focused on the utilization of beds, nurses, physicians, and lab tests, we used OptQuest to determine what combination of these variables would allow for the most patients to flow through the Health Alliance Emergency Department in a given week. The input structure, as shown in Table 11, assumes a maximum of 40 rooms for the ED and 26 staff members per shift.

Table 11: Recommended Control Combinations

Controls			
Control Name	Best Value	Control Name	Best Value
Bed 1	1	Bed 5	2
Bed 10	1	Bed 6	1
Bed 11	2	Bed 7	2
Bed 12	1	Bed 8	2
Bed 13	1	Bed 9	1
Bed 14	1	MD 1	2
Bed 15	1	MD 2	1
Bed 16	2	MD 3	2
Bed 17	1	MD 4	1
Bed 18	1	MD 5	2
Bed 2	2	Nurse 1	2
Bed 20	1	Nurse 2	1
Bed 21	1	Nurse 3	1
Bed 22	1	Nurse 4	1
Bed 23	1	Nurse 5	2
Bed 24	2	Tech 1	2
Bed 25	2	Tech 2	1
Bed 3	2	Tech 3	2
Bed 4	2		

6.3 Final Remarks

Over the course of several months, we have gained invaluable real world experience by having the opportunity to apply our academic knowledge to the Emergency Department at HealthAlliance. We were exposed to a large corporate culture and interactions among professionals. We helped the UMass Process Improvement team to evaluate the patient flow at HealthAlliance and identified areas for improvement. We greatly benefited from this project and the insight provided by our sponsor.

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Appendix A: Glossary of Terms

- **Bottleneck:** A limiting factor on the rate of an operation
- **Continuous improvement:** "an ongoing effort to improve products, services or processes"; can be ongoing or breakthrough (American Society for Quality, 2010).
- **Current state model:** "Version of a value stream map that shows how things work today (Hadfield, 2006)."
- **Discrete event simulation:** "A simulation in terms of events, in which the highest-priority (least time) event is removed from an event queue and executed, which may have the effect of scheduling future events (Novak)."
- **Future state model:** "Version of a value stream map that shows how things can, should, or will work in the future (Hadfield, 2006)."
- **FMEA:** "Failure Modes and Effects Analysis. A method for brainstorming and analyzing potential defects or errors in a system, for the sake of prioritizing improvement activities (Graban, 2009)."
- **Lean:** "An overall methodology that seeks to minimize the resources required for production by eliminating waste (non-value added activities) that inflate costs, lead times and inventory requirements, and emphasizing the use of preventive maintenance , quality improvement programs, pull systems and flexible work forces and production facilities (QAD Inc., 2010)."
- **Lean healthcare:** "The application of the Toyota Production System tools and concepts to the healthcare industry (Hadfield, 2006)."
- **Markov processes:** A method to improve patient flow.
- **Non-value-added activity:** "[An action or activity] in a process, procedure, or service that do not add value to the external customer… Not profitable activities (6 Sigma Statistical Process Control , 2005)." Should be reduced.
- **Object-oriented programming:** "[A] method of programming that depends on sets of data objects, each capable of responding to a group of commands targeted at it (NCSA, 1995)."
- **Patient flow:** The systematic process of attending to patients, from the time they walk into a medical facility to the time they check out for discharge. Patient flow includes both medical and administrative functions, which may often overlap.
- **PCDA:** An acronym for Plan-Do-Check-Act. A lean tool and continuous improvement model (American Society for Quality, 2010).
- **Queuing analysis:** A method to improve patient flow.
- Simulation
- **Spaghetti Diagram:** "A pictorial representation of an employee or product movement through a physical area (Hadfield, 2006)."
- **Time Study:** "A structured process of directly observing and measuring work in order to establish the time and effort required for completion (Ideal Media LLC, 2008)."
- **Value-added activity:** A process or operation that increases the worth of a good or service as perceived by the internal or external customer, as opposed to an operation that may simply incur costs due to the performance of an activity (Bridgefield Group Inc., 2006).

- **Value Stream Mapping (VSM**): A quality improvement tool that documents the steps in a process, the activities that take place, the information required for the process to be completed, the time required for each process and step, and the amount of waiting time between each process step (Graban, 2009) (Hadfield, 2006).
- **Waste:** Something that does not add value to the product or service from the perspective of the customer and anything for which the customer is not willing to pay (Hadfield, 2006).
- **What If analysis: "**The simulation of the outcome of various scenarios and alternatives when changes to the inputs and parameters is done."

Appendix B: Process Flow Map

```
                    ┌─────────────────┐
                    │ Patient arrives │
                    └────────┬────────┘
                             │
                             ▼
Yes                      ◇ Enters via
 ◄───────────────────────  ED
                           ambulance ◇
                             │
                             │ No
                             ▼
                    ┌─────────────────┐
                    │ Patient signs in│
                    └────────┬────────┘
                             │
                             ▼
                    ┌─────────────────┐
                    │     Triage      │
                    └────────┬────────┘
                             │
                             ▼
          ◇ Are          Yes   ┌──────────────┐      ◇ Shows signs    Yes
            symptoms   ───────►│Enter Backroom│─────►  of poor       ─────►
            severe? ◇          └──────────────┘        symptoms? ◇
                             │                                 │ No
                             │ No                              
                             ▼                                 
                    ┌─────────────────┐◄──────────────────────┘
                    │  Waiting Room   │
                    └────────┬────────┘
                             │
                             ▼
                    ┌─────────────────┐
                    │    Insurance    │
                    │  Registration   │
                    └────────┬────────┘
                             │
                             ▼
                    ┌─────────────────┐
                    │  Waiting Room   │
                    └────────┬────────┘
                             │
                             ▼
                    ┌─────────────────┐
 ──────────────────►│Patient enters ED│◄───────────────
                    └─────────────────┘
```

45
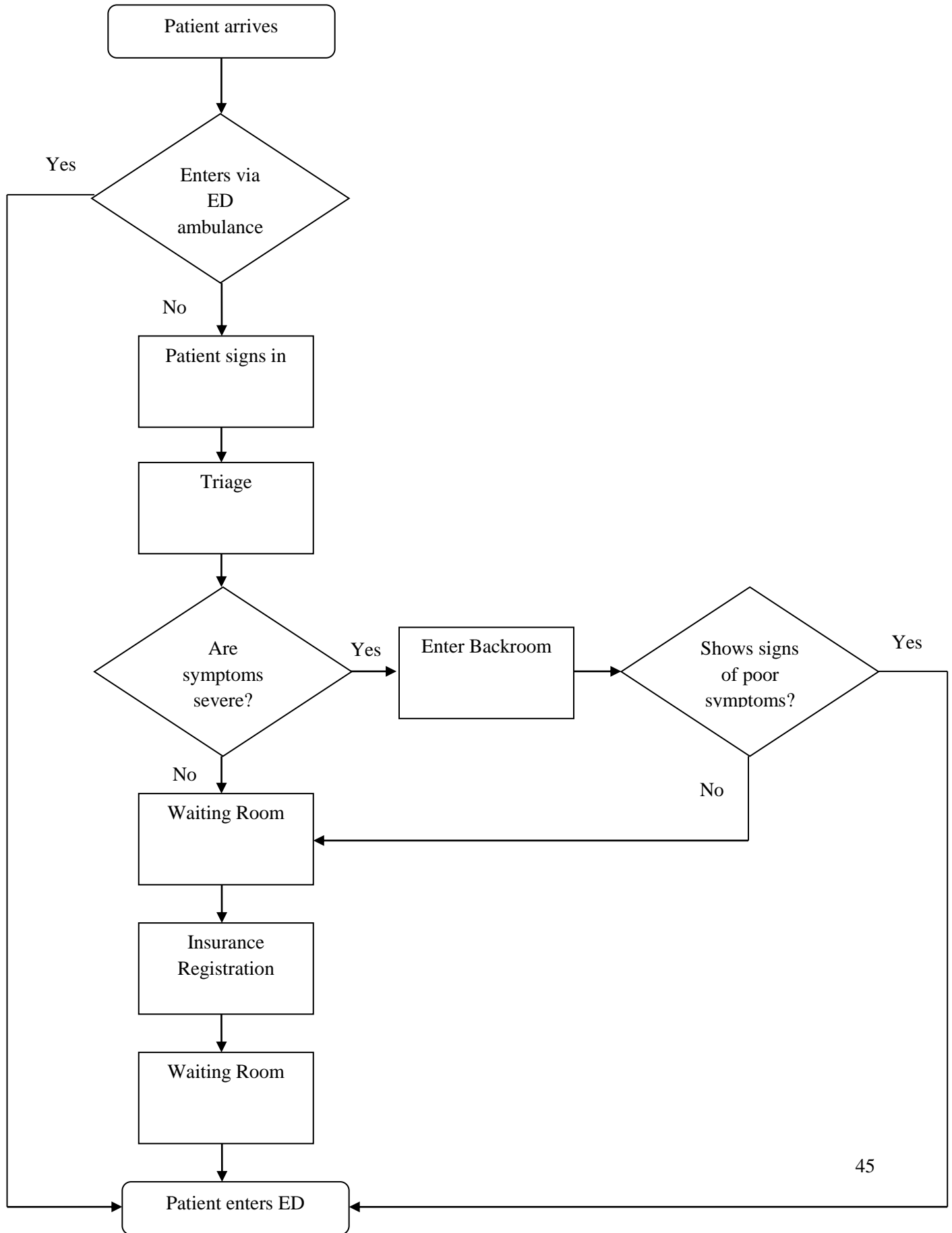
Appendix C: Consent Form for Interviews

This consent form outlines my rights as a participant in the study of patient flow and emergency department operations conducted by Worcester Polytechnic students (Carl Anderson, Chris Butcher, and Amanda Moreno), in conjunction with the Process Improvement team of UMass Memorial.

The interview will assess the roles, responsibilities, and affects that employees have within the Emergency Department at HealthAlliance. It should take about 5 to 10 minutes in time.

I understand that:

1. Participation in this study is entirely voluntary.
2. I may decline to answer any question that I am asked without providing an explanation of my decision.
3. It is my right to end the interview at any time.
4. My name and identifying information will remain confidential in any publications or discussions.
5. The data gathered in this study will be kept confidential and will be transcribed by hand and then stored in an encrypted computer file.

I affirm that I have read this consent form and understand the intent and purpose of this interview. I have been offered a copy of this form to keep for my records. I have been given the opportunity to ask questions and clarifications.

_____

(Signature of Interview Participant)

_____

(Printed name of Interview Participant)

_____

(Date)

"You may decline to participate in this study. You may end your participation in this study at any time. Maintaining your anonymity is a priority and every practical precaution will be taken to disguise your identity. There will not be any identifying information on audiotapes or transcripts of this interview. I will not allow anyone other than the research advisor to hear any audiotape of your voice or review a transcript of this interview. All materials generated from your interview (e.g., [notes] and transcripts) will remain in my direct physical possession."[1]

_____

(Signatures of Interviewers and Date)

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[1] www.cc.gatech.edu/classes/AY2003/cs6455.../example_consent.doc

Appendix D: Interview Questions

General

1. When do you first interact with the patient? In what other processes do you interact with the patients?
    a. How long does each process take?
        i. Is the process time consistent from patient to patient?
        ii. If it is not consistent, what causes variability in this process?
    b. What task(s) do you perform the most?
2. Do you also interact with the patient's visit indirectly (e.g. not face-to-face)?

Charge Nurse

1. How does the staffing model change throughout the week (day by day)?
    a. What is the physician-to-nurse ratio?
    b. What is the nurse-to-patient ratio?
2. How many rooms/beds are there? (To our understanding there are 25 rooms and 27 available beds.)
3. How do you determine room selection?
4. How are mental health patients classified?
    a. How many rooms/beds are reserved for mental health patients?
    b. What additional resources or training is required for mental health patients?
5. Is there ever a time in which someone comes through the ambulance door but there are no open beds for the patient?
    a. If so, what happens? What do you do in this situation?

Triage Nurse

1. Do you have data on distribution of patients of each acuity level?
2. How do you determine whether patients go back to waiting room after triage or straight to exam room?
3. Who takes patient to the waiting room/exam room? (Is it you or someone else?)
    a. If someone else does it, how do you notify that person where/when the patient is ready to go?
        i. How long does it take for that person to get the notification and pick up the patient?
4. How long does it take for a patient to go through triage?
    a. Is the process time consistent from patient to patient? (Does the time differ depending on acuity level? Does the time differ even among differ types of patients within the same acuity?)
        i. What causes these differences in time?

      b. How many triage nurses are there? Does this number change (e.g. according to time of day, day of week, weekend vs. weekday)?

5. How many triage rooms are there?
      a. If there are multiple rooms, are all of the rooms staffed?
           i. Are the rooms fully staffed during certain days/times but unstaffed at other times?
          ii. If a triage room is unstaffed, how is the room used?

Radiologist

1. What types of services do you perform for ED patients (e.g. X-ray, MRI, CT scans, etc.)?
      a. How long does it take to perform each kind of service?
2. How do you know when a digital imaging (DI) service is needed? (Are you notified via pager, Soarian, another computer system, etc?)
      a. How long does it take to respond to these requests?
      b. How often do requests come in?
      c. How often does each kind of examination come in? (For example, if x-rays the most common, by roughly how much?)
3. How are patients transported to diagnostic imaging?
      a. Who transports patients here?
      b. Are portable machines ever used so that you examine the patient outside of diagnostic imaging?
           i. If so, how long does this process take compared to the patient receiving an examination at diagnostic imaging?
4. When a patient is transported to DI, does the patient usually receive DI service right away?
      a. If no, what are the wait times?
5. How many of each type of patients from ED do you usually have? (How many level 1 patients need x-ray, how many level 2 patients need CT, etc.?)
6. Do you have DATA on:
      a. Each type of request?
      b. Response time?
      c. Service time (broken down by type of service)?
      d. Queue time?
      e. Staffing?
      f. Etc?
7. How often do the machines or equipment fail to work?
      a. What happens in this situation?

Nurse

1. What are the typical tasks you have to do for each type of patient? (Please feel free to break down the tasks in a manner that is most sensible to you, whether by acuity level, conditions present, etc.)
   a. If it is easiest to break down the tasks by acuity level, what are the typical tasks performed for each acuity level?
   b. If it is easiest to break down the tasks by condition:
      i. What are the most common conditions?
      ii. What are the typical tasks for each condition?
      iii. How long does it take for each task?
      iv. Do you ever need to delay performing a task due to limited resources (because another staff member is using the resource you need)?
   c. Who draws the patient blood? (Do you, the phlebotomist, or another staff member do this?)
      i. If you draw the patient's blood:
         1. How much time does it take to draw blood for regular patients?
         2. How much time does it take to draw blood for "hard stick" patients?
      ii. If a phlebotomist draws the patient's blood:
         1. What is the process of notifying the phlebotomist?
         2. How long does it take for phlebotomist to get to the patient in the ED?
            a. Does it vary by time of day, day of week etc?

Physicians

1. How many ED physicians are on staff at a given time?
2. What information do you document?
   a. How long does each piece of information take?
   b. Is information documentation/gathering done simultaneously with other processes?
   c. Is any information documented by multiple people or at multiple times?
3. Do patients with varying acuity levels require varying levels of care?
   a. If yes, what are the potential differences?

Housekeeping Employee

1. How are you informed that a room is ready to be cleaned/turned down?
2. What do you need to do when preparing a room for a new patient?
   a. How long does this process take?
   b. Is there anything that would cause process time variation?

3. Where are the cleaning materials and supplies located?
4. Do you dispense of the soiled linens in a container within each room, or is there a location within the ED?

Appendix E: Summary of Interviews and Observations

Staffing Nurse

- Nursing shifts: 7am-3pm, 7am-7pm, 9am-7pm, 10am-10pm, 11am-11pm, 1pm-1am, 3pm-3am, 7pm-7am.
- Scheduling is the same every day.
- There are 25 rooms and 27 beds. Occasionally have beds in the hallway.
- Room selection is based on equipment needed, or if the patient needs to be close to a nurse, etc.
- Mental health patients have an acuity system based on symptoms. There is a risk assessment also.
    - 3 rooms reserved for mental health (17, 18, 19).
    - Sitters are needed for certain mental health patients. No special training.
- Often times when beds aren't available, they use the hallway.

Head Nurse

- The shifts are staggered. Start with 6 nurses, as 2 more at 9am, 10am, and 11am. Add 1 nurse at 1pm. 5 nurses are left at 3am.
- There is always a floater nurse and a breaker nurse.
- They can have up to 6 beds in hallways.
- Room selection is based on acuity level, equipment needed.
- Rooms 1-4, 6-8, and 9-11 have heart monitors in them for patients that require them.
- There is a risk screening tool for Psych patients (computer program). They use the risk assessment if the screening number is greater than 6.
- 75% of psych patients need a sitter.
- When a trauma patient comes in, all available personnel converge to accomplish every task ASAP.

Physician

- First encounters patient after the nurse assigns them a room. Patient goes through triage (nursing assessment) and registration first.
- Reviews the patients chart prior to speaking with them. Every doctor has their own method.
- The day begins with 1 physician, by 1pm there are 3 on duty.
- Amount of care changes based off of acuity level. There is a correlation between time required and acuity level. It takes roughly 10-20 minutes to review a patient's medical history.
- Acuity level is documented by the nurse at triage.

- Physicians will return to non psych patients after the initial visit to discuss either discharge or further treatment.

Housekeeping

- Everyone assists in changing the sheets. Takes roughly 2 minutes.
- Every room is supposed to be completely cleaned at least once per day. Takes up to 10 minutes.

Triage Nurse

- Distribution data can be found in the computer.
- Symptoms are what determine whether a patient goes into the ER or returns to the waiting room. 10% of patients go right into the ER.
- If a patient is in the waiting room, a nurse will notify them when it is their turn to enter the emergency department. A nurse may select a chart when they are free or if the charge nurse directs them to do so.
- Triage takes roughly 5 minutes.
  - Age and acuity level have a big impact on triage time. The younger a patient is, the longer they take.
  - Occasionally 2 nurse's may be doing triage simultaneously, in which case room 25 on B side will; be used as a second triage station.
- The triage area is restocked during downtime, and they try to ensure that adequate supplies are always available. Unusual items can sometimes be difficult to find.

Director of Radiology

- Dept. of Radiology covers the entire hospital, not just the emergency department.
- There are 6 technicians and 3 radiologists on duty during the day.
- If a machine is not available 24/7, then people are on call.
- Scan time can depend on if any prep is involved, such as the consumption of contrast solution. A CT scan, for example, would only take 10minutes due to the lack of prep time needed.
- The transportation staff or aids will transport patients. Someone from radiology will bring the patient back. It mostly depends on which department is the least busy when determining if radiology will go and get the patient.
- There are 4 stand-alone x-ray machines, as well as 2 portable x-ray machines.
- The average time spent in radiology is 15 minutes. The body part that is being scanned can alter the time spent scanning.
- Radiology will always take an emergency department patient with no waiting or delay.
- 40-50% of the patients who come through radiology are from the emergency department.

Appendix F: Simulation Test Matrices

Allowable Conditions

Table 12: Test Matrix for Allowable Conditions

Condition	Category	How it will be identified	Run 1	Run 2	Run 3
Follows correct order (e.g. checkin->triage->registration)	Order/Flow	Evaluate order and logic of modules before running simulation model. Trace patients at random to track movements through system. (Run>Run Control>Highlight Active Module) [Use AVI Capture to record video so it is easier to review movements.]	Pass	Pass	Pass
Follows correct order (e.g. released/discharged before leaving system)	Order/Flow	Evaluate order and logic of modules before running simulation model. Trace patients at random to track movements through system. (Run>Run Control>Highlight Active Module) [Use AVI Capture to record video so it is easier to review movements.]	Pass	Pass	Pass
Continuous entry of patients into the system	Flow/Entry	Graph patient/entity entry. Ensure that there are no large gaps indicating no entry in the graph	Pass	Pass	Pass
Patient leaves system	Flow/Entry	Check that Number In of Patient Arrival = WIP of Patient Arrival + Number Out of Patient Arrival. (Ensure they are the same or within 1%)	Pass	Pass	Pass

Non-Allowable Conditions

Condition	Category	How it will be identified	Run 1	Run 2	Run 3
Incorrect sequence (e.g. discharge -> triage)	Order/Flow	Evaluate order and logic of modules before running simulation model. Trace patients at random to track movements through system. (Run>Run Control>Highlight Active Module) [Use AVI Capture to record video so it is easier to review movements.]	Pass	Pass	Pass
Incorrect sequence (e.g. discharge -> registration)	Order/Flow	Evaluate order and logic of modules before running simulation model. Trace patients at random to track movements through system. (Run>Run Control>Highlight Active Module) [Use AVI Capture to record video so it is easier to review movements.]	Pass	Pass	Pass
Incorrect sequence (e.g. discharge -> tech)	Order/Flow	Evaluate order and logic of modules before running simulation model. Trace patients at random to track movements through system. (Run>Run Control>Highlight Active Module) [Use AVI Capture to record video so it is easier to review movements.]	Pass	Pass	Pass
Incorrect sequence (e.g. discharge -> MD eval)	Order/Flow	Evaluate order and logic of modules before running simulation model. Trace patients at random to track movements through system. (Run>Run Control>Highlight Active Module) [Use AVI Capture to record video so it is easier to review movements.]	Pass	Pass	Pass
Incorrect sequence (e.g. discharge -> seize room)	Order/Flow	Evaluate order and logic of modules before running simulation model. Trace patients at random to track movements through system. (Run>Run Control>Highlight Active Module) [Use AVI Capture to record video so it is easier to review movements.]	Pass	Pass	Pass
Incorrect sequence (e.g. tech -> seize room)	Order/Flow	Evaluate order and logic of modules before running simulation model. Trace patients at random to track movements through system. (Run>Run Control>Highlight Active Module) [Use AVI Capture to record video so it is easier to review movements.]	Pass	Pass	Pass

Incorrect sequence (e.g. MD eval -> seize room)	Order/Flow	Evaluate order and logic of modules before running simulation model. Trace patients at random to track movements through system. (Run>Run Control>Highlight Active Module) [Use AVI Capture to record video so it is easier to review movements.]	Pass	Pass	Pass
Incorrect sequence (e.g. tech -> triage)	Order/Flow	Evaluate order and logic of modules before running simulation model. Trace patients at random to track movements through system. (Run>Run Control>Highlight Active Module) [Use AVI Capture to record video so it is easier to review movements.]	Pass	Pass	Pass
Incorrect sequence (e.g. MD eval -> triage)	Order/Flow	Evaluate order and logic of modules before running simulation model. Trace patients at random to track movements through system. (Run>Run Control>Highlight Active Module) [Use AVI Capture to record video so it is easier to review movements.]	Pass	Pass	Pass
Incorrect sequence (e.g. MD eval -> registration)	Order/Flow	Evaluate order and logic of modules before running simulation model. Trace patients at random to track movements through system. (Run>Run Control>Highlight Active Module) [Use AVI Capture to record video so it is easier to review movements.]	Pass	Pass	Pass
Incorrect sequence (e.g. registration -> triage)	Order/Flow	Evaluate order and logic of modules before running simulation model. Trace patients at random to track movements through system. (Run>Run Control>Highlight Active Module) [Use AVI Capture to record video so it is easier to review movements.]	Pass	Pass	Pass
Do not have 50 patients entering system at once	Flow/Entry	Check "Entities per Arrival" in the Create module for Patients. Generate a graph showing patients entering system and ensure that number of patients in graph rise evenly and that there is not a large influx at a given point in time. [Click Plot button. Select Add button. For expression, choose "Build Expression and then Basic Process Variables>Entity>Number In with Entity Type: Patient Arrival.]	Pass	Pass	Pass

Patient spends no more than 0.5 hour in triage	Times/Queue	Check delay parameters on process module. Include Process in Statistics Collection & check Run Report to ensure the Maximum does not exceed designated limit. (Category by Replication>Process>Time per Entity>Total Time per Entity>Triage Area) [Can also create a table showing entity time at process and ensure that time at any given point does not exceed designated limit.]	Pass	Pass	Pass
Patient spends no more than 0.5 hour in registration	Times/Queue	Check delay parameters on process module. Include Process in Statistics Collection & check Run Report to ensure the Maximum does not exceed designated limit. (Category by Replication>Process>Time per Entity>Total Time per Entity>Registration and Insurance) [Can also create a table showing entity time at process and ensure that time at any given point does not exceed designated limit.]	Pass	Pass	Pass
Patient spends no more than 0.5 hour in bedside registration	Times/Queue	Check delay parameters on process module. Include Process in Statistics Collection & check Run Report to ensure the Maximum does not exceed designated limit. (Category by Replication>Process>Time per Entity>Total Time per Entity>Bedside Registration Side A) [Can also create a table showing entity time at process and ensure that time at any given point does not exceed designated limit.]	Pass	Pass	Pass
Patient spends no more than 0.5 hour in CT Scan	Times/Queue	Check delay parameters on process module. Include Process in Statistics Collection & check Run Report to ensure the Maximum does not exceed designated limit. (Category by Replication>Process>Time per Entity>Total Time per Entity>CT Scan) [Can also create a table showing entity time at process and ensure that time at any given point does not exceed designated limit.]	Pass	Pass	Pass

Patient spends no more than 0.5 hour in MRI	Times/Queue	Check delay parameters on process module. Include Process in Statistics Collection & check Run Report to ensure the Maximum does not exceed designated limit. (Category by Replication>Process>Time per Entity>Total Time per Entity>MRI) [Can also create a table showing entity time at process and ensure that time at any given point does not exceed designated limit.]	Pass	Pass	Pass
Patient spends no more than 0.5 hour in Xray	Times/Queue	Check delay parameters on process module. Include Process in Statistics Collection & check Run Report to ensure the Maximum does not exceed designated limit. (Category by Replication>Process>Time per Entity>Total Time per Entity>Xrays) [Can also create a table showing entity time at process and ensure that time at any given point does not exceed designated limit.]	Pass	Pass	Pass
Patient spends no more than 0.5 hour in MD Exam on side B	Times/Queue	Check delay parameters on process module. Include Process in Statistics Collection & check Run Report to ensure the Maximum does not exceed designated limit. (Category by Replication>Process>Time per Entity>Total Time per Entity>MD Exam on side B) [Can also create a table showing entity time at process and ensure that time at any given point does not exceed designated limit.]	Pass	Pass	Pass
Patient spends no more than 1 hour in Physical Exam A	Times/Queue	Check delay parameters on process module. Include Process in Statistics Collection & check Run Report to ensure the Maximum does not exceed designated limit. (Category by Replication>Process>Time per Entity>Total Time per Entity>Physical Examination A) [Can also create a table showing entity time at process and ensure that time at any given point does not exceed designated limit.]	Pass	Pass	Pass

Patient spends no more than 1 hour in Second MD Exam on B side	Times/Queue	Check delay parameters on process module. Include Process in Statistics Collection & check Run Report to ensure the Maximum does not exceed designated limit. (Category by Replication>Process>Time per Entity>Total Time per Entity>Second MD Exam on B side) [Can also create a table showing entity time at process and ensure that time at any given point does not exceed designated limit.]	Pass	Pass	Pass
Patient spends no more than 1 hour in Second Physician Exam	Times/Queue	Check delay parameters on process module. Include Process in Statistics Collection & check Run Report to ensure the Maximum does not exceed designated limit. (Category by Replication>Process>Time per Entity>Total Time per Entity>Second Physician Exam) [Can also create a table showing entity time at process and ensure that time at any given point does not exceed designated limit.]	Pass	Pass	Pass
Patient spends no more than 1 hour in 24 Hour Eval by Lipton Section 12	Times/Queue	Check delay parameters on process module. Include Process in Statistics Collection & check Run Report to ensure the Maximum does not exceed designated limit. (Category by Replication>Process>Time per Entity>Total Time per Entity>24 Hour Eval by Lipton Section 12) [Can also create a table showing entity time at process and ensure that time at any given point does not exceed designated limit.]	Pass	Pass	Pass
Patient spends no more than 1 hour in 24 Hour Eval by MD Section 12	Times/Queue	Check delay parameters on process module. Include Process in Statistics Collection & check Run Report to ensure the Maximum does not exceed designated limit. (Category by Replication>Process>Time per Entity>Total Time per Entity>24 Hour Eval by MD Section 12) [Can also create a table showing entity time at process and ensure that time at any given point does not exceed designated limit.]	Pass	Pass	Pass

Patient spends no more than 0.5 hour in RN tests and Labs A	Times/Queue	Check delay parameters on process module. Include Process in Statistics Collection & check Run Report to ensure the Maximum does not exceed designated limit. (Category by Replication>Process>Time per Entity>Total Time per Entity>RN tests and Labs A) [Can also create a table showing entity time at process and ensure that time at any given point does not exceed designated limit.]	Pass	Pass	Pass
No more than 1 bed per patient	Resource Allocation	Check resouces lists under the process and seize modules.	Pass	Pass	Pass
No more than 2 nurses per patient	Resource Allocation	Check resouces lists under the process and seize modules.	Pass	Pass	Pass
No more than 1 doctor (MD) per patient	Resource Allocation	Check resouces lists under the process and seize modules.	Pass	Pass	Pass
No more than 1 MRI tech per patient	Resource Allocation	Check resouces lists under the process and seize modules.	Pass	Pass	Pass
No more than 1 portable x-ray machine per patient	Resource Allocation	Check resouces lists under the process and seize modules.	Pass	Pass	Pass
No more than 1 x-ray tech per patient	Resource Allocation	Check resouces lists under the process and seize modules.	Pass	Pass	Pass
No more than 1 registration nurse per patient	Resource Allocation	Check resouces lists under the process and seize modules.	Pass	Pass	Pass
No more than 1 CT machine per patient	Resource Allocation	Check resouces lists under the process and seize modules.	Pass	Pass	Pass
No more than 1 CT tech per patient	Resource Allocation	Check resouces lists under the process and seize modules.	Pass	Pass	Pass
No more than 1 sitter per patient	Resource Allocation	Check resouces lists under the process and seize modules.	Pass	Pass	Pass
No more than 1 EKG machine per patient	Resource Allocation	Check resouces lists under the process and seize modules.	Pass	Pass	Pass
Sitter with non-mental health patient	Resource Allocation	Check resouces lists under the process and seize modules.	Pass	Pass	Pass
No more than 10 minutes per patient in "Call Radiology" queue	Queue/Flow	Include Queues in Statistics Collection & check Run Report to ensure that Maximum does not exceed designated limit. (Category by Replication>Queue>Time>Call Radiology.Queue) [Can also create a table showing Time in Queue at module and ensure that time at any given point does not exceed designated limit.]	Pass	Pass	Pass

No more than 1 hour per patient in "Second Physician Examination" queue	Queue/Flow	Include Queues in Statistics Collection & check Run Report to ensure that Maximum does not exceed designated limit. (Category by Replication>Queue>Time>Second Physician Examination.Queue) [Can also create a table showing Time in Queue at module and ensure that time at any given point does not exceed designated limit.]	Pass	Pass	Pass
No more than 10 minutes per patient in "Call for Transport" queue	Queue/Flow	Include Queues in Statistics Collection & check Run Report to ensure that Maximum does not exceed designated limit. (Category by Replication>Queue>Time>Call for Transport.Queue) [Can also create a table showing Time in Queue at module and ensure that time at any given point does not exceed designated limit.]	Pass	Pass	Pass
No more than 10 minutes per patient in "Radiologist to come to ED" queue	Queue/Flow	Include Queues in Statistics Collection & check Run Report to ensure that Maximum does not exceed designated limit. (Category by Replication>Queue>Time>Radiologist to come to ED.Queue) [Can also create a table showing Time in Queue at module and ensure that time at any given point does not exceed designated limit.]	Pass	Pass	Pass
No more than 10 minutes per patient in "Seize Physician A" queue	Queue/Flow	Include Queues in Statistics Collection & check Run Report to ensure that Maximum does not exceed designated limit. (Category by Replication>Queue>Time>Seize Physician A.Queue) [Can also create a table showing Time in Queue at module and ensure that time at any given point does not exceed designated limit.]	Pass	Pass	Pass
No more than 10 minutes per patient in "Call Admitting MD" queue	Queue/Flow	Include Queues in Statistics Collection & check Run Report to ensure that Maximum does not exceed designated limit. (Category by Replication>Queue>Time>Call Admitting MD.Queue) [Can also create a table showing Time in Queue at module and ensure that time at any given point does not exceed designated limit.]	Pass	Pass	Pass

No more than 10 minutes per patient in "Call radiology B side" queue	Queue/Flow	Include Queues in Statistics Collection & check Run Report to ensure that Maximum does not exceed designated limit. (Category by Replication>Queue>Time>Call Radiology B side.Queue) [Can also create a table showing Time in Queue at module and ensure that time at any given point does not exceed designated limit.]	Pass	Pass	Pass
No more than 20 minutes per patient in "Bedside Registration side A" queue	Queue/Flow	Include Queues in Statistics Collection & check Run Report to ensure that Maximum does not exceed designated limit. (Category by Replication>Queue>Time>Bedside Registration side A.Queue) [Can also create a table showing Time in Queue at module and ensure that time at any given point does not exceed designated limit.]	Pass	Pass	Pass
No more than 1 hour per patient in "RN Tests and Labs A" queue	Queue/Flow	Include Queues in Statistics Collection & check Run Report to ensure that Maximum does not exceed designated limit. (Category by Replication>Queue>Time>RN Tests and Labs A.Queue) [Can also create a table showing Time in Queue at module and ensure that time at any given point does not exceed designated limit.]	Pass	Pass	Pass
No more than 15 minutes per patient in "24 Hour Eval by MD Section 12" queue	Queue/Flow	Include Queues in Statistics Collection & check Run Report to ensure that Maximum does not exceed designated limit. (Category by Replication>Queue>Time>24 Hour Eval by MD Section 12.Queue) [Can also create a table showing Time in Queue at module and ensure that time at any given point does not exceed designated limit.]	Pass	Pass	Pass
No more than 10 minutes per patient in "Seize Side B Room & Transport Nurse" queue	Queue/Flow	Include Queues in Statistics Collection & check Run Report to ensure that Maximum does not exceed designated limit. (Category by Replication>Queue>Time>Seize Side B Room & Transport Nurse.Queue) [Can also create a table showing Time in Queue at module and ensure that time at any given point does not exceed designated limit.]	Pass	Pass	Pass

No more than 10 minutes per patient in "Seize MD for side B" queue	Queue/Flow	Include Queues in Statistics Collection & check Run Report to ensure that Maximum does not exceed designated limit. (Category by Replication>Queue>Time>Seize MD for side B.Queue) [Can also create a table showing Time in Queue at module and ensure that time at any given point does not exceed designated limit.]	Pass	Pass	Pass
No more than 1 hour per patient in "Second MD Exam on Side B" queue	Queue/Flow	Include Queues in Statistics Collection & check Run Report to ensure that Maximum does not exceed designated limit. (Category by Replication>Queue>Time>Second MD Exam on Side B.Queue) [Can also create a table showing Time in Queue at module and ensure that time at any given point does not exceed designated limit.]	Pass	Pass	Pass
No more than 10 minutes per patient in "Nurse helps patients leave" queue	Queue/Flow	Include Queues in Statistics Collection & check Run Report to ensure that Maximum does not exceed designated limit. (Category by Replication>Queue>Time>Nurse helps patients leave.Queue) [Can also create a table showing Time in Queue at module and ensure that time at any given point does not exceed designated limit.]	Pass	Pass	Pass
No more than 10 minutes per patient in "Strip Side B room" queue	Queue/Flow	Include Queues in Statistics Collection & check Run Report to ensure that Maximum does not exceed designated limit. (Category by Replication>Queue>Time>Strip Side B room.Queue) [Can also create a table showing Time in Queue at module and ensure that time at any given point does not exceed designated limit.]	Pass	Pass	Pass
No more than 30 minutes per patient in "Clean Side B room" queue	Queue/Flow	Include Queues in Statistics Collection & check Run Report to ensure that Maximum does not exceed designated limit. (Category by Replication>Queue>Time>Clean Side B room.Queue) [Can also create a table showing Time in Queue at module and ensure that time at any given point does not exceed designated limit.]	Pass	Pass	Pass

No more than 10 minutes per patient in "Seize Side A Room & Transport Nurse" queue	Queue/Flow	Include Queues in Statistics Collection & check Run Report to ensure that Maximum does not exceed designated limit. (Category by Replication>Queue>Time>Seize side A Room.Queue) [Can also create a table showing Time in Queue at module and ensure that time at any given point does not exceed designated limit.]	Pass	Pass	Pass
No more than 10 minutes per patient in "Seize MRI Tech & Nurse" queue	Queue/Flow	Include Queues in Statistics Collection & check Run Report to ensure that Maximum does not exceed designated limit. (Category by Replication>Queue>Time>Seize MRI Tech and Nurse.Queue) [Can also create a table showing Time in Queue at module and ensure that time at any given point does not exceed designated limit.]	Pass	Pass	Pass
No more than 10 minutes per patient in "Seize CT Tech & Nurse" queue	Queue/Flow	Include Queues in Statistics Collection & check Run Report to ensure that Maximum does not exceed designated limit. (Category by Replication>Queue>Time>Seize CT Tech and Nurse.Queue) [Can also create a table showing Time in Queue at module and ensure that time at any given point does not exceed designated limit.]	Pass	Pass	Pass
No more than 10 minutes per patient in "Get Nurse" queue	Queue/Flow	Include Queues in Statistics Collection & check Run Report to ensure that Maximum does not exceed designated limit. (Category by Replication>Queue>Time>Get Nurse.Queue) [Can also create a table showing Time in Queue at module and ensure that time at any given point does not exceed designated limit.]	Pass	Pass	Pass
No more than 10 minutes per patient in "Strip Side A room" queue	Queue/Flow	Include Queues in Statistics Collection & check Run Report to ensure that Maximum does not exceed designated limit. (Category by Replication>Queue>Time>Strip Side A room.Queue) [Can also create a table showing Time in Queue at module and ensure that time at any given point does not exceed designated limit.]	Pass	Pass	Pass

No more than 30 minutes per patient in "Clean Side A room" queue	Queue/Flow	Include Queues in Statistics Collection & check Run Report to ensure that Maximum does not exceed designated limit. (Category by Replication>Queue>Time>Clean Side A room.Queue) [Can also create a table showing Time in Queue at module and ensure that time at any given point does not exceed designated limit.]	Pass	Pass	Pass

Appendix G: Simulation Model Run Reports

We have included the Category Overview and Category by Replications run reports from the simulation model.

Values Across All Replications

Unnamed Project

Replications: 3   Time Units: Hours

Key Performance Indicators

System   Average
Number Out   6,096

Values Across All Replications

Unnamed Project

<div style="text-align:center">

Category Overview

</div>

Replications: 3   Time Units: Hours

Entity

Time

VA Time

	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Patient Arrival	0.1884	0.01	0.1847	0.1902	0.00	1.5198

NVA Time

	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Patient Arrival	0.03700458	0.00	0.03660670	0.03727540	0.00	0.2000

Wait Time

	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Patient Arrival	0.01036887	0.00	0.01019281	0.01055949	0.00	0.8580

Transfer Time

	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Patient Arrival	0.03970172	0.00	0.03934987	0.03991275	0.02083333	0.08750000

Other Time

	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Patient Arrival	0.01926200	0.00	0.01840238	0.01987368	0.00	0.8333

Total Time

	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Patient Arrival	0.2985	0.01	0.2934	0.3016	0.03333333	3.1671

Other

Number In

	Average	Half Width	Minimum Average	Maximum Average
Entity 1	0.00	0.00	0.00	0.00
Patient Arrival	5465.33	85.06	5429.00	5497.00
Patient_Accuity_1	0.00	0.00	0.00	0.00

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Values Across All Replications

Unnamed Project

Replications: 3   Time Units: Hours   ## Category Overview

Entity

Other

Number Out

	Average	Half Width	Minimum Average	Maximum Average
Entity 1	0.00	0.00	0.00	0.00
Patient Arrival	4463.67	180.77	4381.00	4518.00
Patient_Accuity_1	0.00	0.00	0.00	0.00

WIP

	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Entity 1	0.00	0.00	0.00	0.00	0.00	0.00
Patient Arrival	957.09	36.77	940.19	967.73	423.00	1473.00
Patient_Accuity_1	0.00	0.00	0.00	0.00	0.00	0.00

Values Across All Replications

Unnamed Project

Replications: 3   **Time Units:** Hours

Category Overview

Process

Time per Entity

VA Time Per Entity	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
24 Hour Eval by Lipton Section 12	0.5077	0.02	0.5002	0.5127	0.2516	0.9721
24 Hour Eval by MD Section 12	0.4972	0.03	0.4897	0.5111	0.2507	0.9791
Bedside registration side A	0.0989	0.01	0.0973	0.1014	0.03770500	0.1630
Call Admitting MD	0.03365310	0.00	0.03338810	0.03382827	0.01680406	0.04948487
CT Scan	0.2482	0.01	0.2445	0.2502	0.1721	0.3283
Discharge Notes B side	0.05808526	0.00	0.05795903	0.05829210	0.03450979	0.08257766
Infrared input by secretary	0.03327752	0.00	0.03247891	0.03394881	0.01681836	0.04900901
MD Exam on Side B	0.1914	0.00	0.1898	0.1931	0.1379	0.2477
MD to MD talk	0.05819699	0.00	0.05702135	0.05940455	0.03501825	0.08232055
MRI	0.2493	0.01	0.2467	0.2511	0.1716	0.3310
Nurse Does Discharge	0.1667	0.00	0.1667	0.1667	0.1667	0.1667
Nurse helps patient leave	0.05631013	0.00	0.05567554	0.05710360	0.03485044	0.08235046
Physician Examination A	0.1923	0.00	0.1913	0.1931	0.1338	0.2489
Pull IV	0.03344819	0.00	0.03311759	0.03388650	0.01764118	0.04954912
Registration and Insurance	0.1003	0.00	0.0993	0.1014	0.03451495	0.1640
RN RN discussion	0.1221	0.01	0.1187	0.1244	0.05191687	0.1970
RN tests and Labs A	0.2081	0.00	0.2075	0.2089	0.1677	0.2481
Second MD Exam on B Side	0.05934286	0.00	0.05891729	0.05996091	0.03667968	0.08144113
Second Physician Examination	0.05807542	0.00	0.05776847	0.05835610	0.03415529	0.08303006
Tests and Labs on Side B	0.2088	0.00	0.2079	0.2098	0.1675	0.2491
Triage Area	0.1245	0.00	0.1242	0.1247	0.08382497	0.1658
Xrays	0.2073	0.00	0.2068	0.2077	0.1677	0.2495
Xrays Bedside	0.2080	0.00	0.2067	0.2092	0.1724	0.2487

NVA Time Per Entity	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Clean Side A Room	0.1667	0.00	0.1667	0.1667	0.1667	0.1667
Clean Side B Room	0.1667	0.00	0.1667	0.1667	0.1667	0.1667
Strip Side A Room	0.03333333	0.00	0.03333333	0.03333333	0.03333333	0.03333333
Strip Side B Room	0.03333333	0.00	0.03333333	0.03333333	0.03333333	0.03333333

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Values Across All Replications

Unnamed Project

Replications:	3	Time Units:	Hours

Category Overview

Process

Time per Entity

Wait Time Per Entity	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
24 Hour Eval by MD Section 12	0.01105179	0.00	0.01023586	0.01163849	0.00	0.1887
Bedside registration side A	0.00	0.00	0.00	0.00	0.00	0.00
Call Admitting MD	0.00	0.00	0.00	0.00	0.00	0.00
Clean Side A Room	0.03606506	0.00	0.03408196	0.03795311	0.00	0.4091
Clean Side B Room	0.03328977	0.01	0.03040358	0.03752955	0.00	0.3658
Infrared input by secretary	0.00	0.00	0.00	0.00	0.00	0.00
MD to MD talk	0.01517664	0.01	0.01079497	0.01974987	0.00	0.5993
Nurse helps patient leave	0.00	0.00	0.00	0.00	0.00	0.00
RN RN discussion	0.01709976	0.02	0.01226148	0.02522080	0.00	0.2625
RN tests and Labs A	0.00	0.00	0.00	0.00	0.00	0.00
Second MD Exam on B Side	0.01692054	0.03	0.00956254	0.03032173	0.00	0.7156
Second Physician Examination	0.01683269	0.00	0.01551085	0.01839217	0.00	0.8374
Strip Side A Room	0.00001057	0.00	0.00	0.00003171	0.00	0.01918685
Strip Side B Room	0.00	0.00	0.00	0.00	0.00	0.00
Tests and Labs on Side B	0.00	0.00	0.00	0.00	0.00	0.00

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Values Across All Replications

Unnamed Project

Category Overview

Replications: 3   Time Units: Hours

Process

Time per Entity

Total Time Per Entity	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
24 Hour Eval by Lipton Section 12	0.5077	0.02	0.5002	0.5127	0.2516	0.9721
24 Hour Eval by MD Section 12	0.5082	0.03	0.5010	0.5213	0.2520	0.9791
Bedside registration side A	0.0989	0.01	0.0973	0.1014	0.03770500	0.1630
Call Admitting MD	0.03365310	0.00	0.03338810	0.03382827	0.01680406	0.04948487
Clean Side A Room	0.2027	0.00	0.2007	0.2046	0.1667	0.5758
Clean Side B Room	0.2000	0.01	0.1971	0.2042	0.1667	0.5325
CT Scan	0.2482	0.01	0.2445	0.2502	0.1721	0.3283
Discharge Notes B side	0.05808526	0.00	0.05795903	0.05829210	0.03450979	0.08257766
Infrared input by secretary	0.03327752	0.00	0.03247891	0.03394881	0.01681836	0.04900901
MD Exam on Side B	0.1914	0.00	0.1898	0.1931	0.1379	0.2477
MD to MD talk	0.07337364	0.01	0.06781631	0.07791495	0.03501825	0.6810
MRI	0.2493	0.01	0.2467	0.2511	0.1716	0.3310
Nurse Does Discharge	0.1667	0.00	0.1667	0.1667	0.1667	0.1667
Nurse helps patient leave	0.05631013	0.00	0.05567554	0.05710360	0.03485044	0.08235046
Physician Examination A	0.1923	0.00	0.1913	0.1931	0.1338	0.2489
Pull IV	0.03344819	0.00	0.03311759	0.03388650	0.01764118	0.04954912
Registration and Insurance	0.1003	0.00	0.0993	0.1014	0.03451495	0.1640
RN RN discussion	0.1392	0.01	0.1366	0.1439	0.05191687	0.4083
RN tests and Labs A	0.2081	0.00	0.2075	0.2089	0.1677	0.2481
Second MD Exam on B Side	0.07626340	0.03	0.06847983	0.0903	0.03667968	0.7696
Second Physician Examination	0.07490811	0.00	0.07361254	0.07674827	0.03415529	0.8751
Strip Side A Room	0.03334390	0.00	0.03333333	0.03336505	0.03333333	0.05252019
Strip Side B Room	0.03333333	0.00	0.03333333	0.03333333	0.03333333	0.03333333
Tests and Labs on Side B	0.2088	0.00	0.2079	0.2098	0.1675	0.2491
Triage Area	0.1245	0.00	0.1242	0.1247	0.08382497	0.1658
Xrays	0.2073	0.00	0.2068	0.2077	0.1677	0.2495
Xrays Bedside	0.2080	0.00	0.2067	0.2092	0.1724	0.2487

Accumulated Time

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Values Across All Replications

Unnamed Project

Category Overview

Replications: 3   Time Units: Hours

Process

Accumulated Time

Accum VA Time	Average	Half Width	Minimum Average	Maximum Average
24 Hour Eval by Lipton Section 12	53.2582	12.59	49.4878	59.0209
24 Hour Eval by MD Section 12	52.2942	17.32	47.6056	60.3066
Bedside registration MH	0.00	0.00	0.00	0.00
Bedside registration side A	14.1363	5.19	11.8574	15.9548
Call Admitting MD	5.6304	0.54	5.3787	5.7761
Clerk calls for Lipton	0.00	0.00	0.00	0.00
CT Scan	37.8608	18.07	29.5789	43.2142
Discharge Notes B side	26.0219	1.36	25.5599	26.6241
ED Infrared input by secretary	0.00	0.00	0.00	0.00
ED MD Admitting MD talk	0.00	0.00	0.00	0.00
EKG for patient	0.00	0.00	0.00	0.00
Hook up to telemetry and blood pressure	0.00	0.00	0.00	0.00
Infrared input by secretary	5.5798	0.67	5.3448	5.8731
MD Exam on Side B	98.2045	6.47	96.0203	101.09
MD to MD talk	9.7396	1.28	9.2482	10.2770
Medical Clearance	0.00	0.00	0.00	0.00
MRI	39.2397	9.07	35.0267	41.5083
Nurse Does Discharge	74.7222	3.91	73.5000	76.5000
Nurse fills out Mental Health papers	0.00	0.00	0.00	0.00
Nurse fills out MH papers	0.00	0.00	0.00	0.00
Nurse helps patient leave	28.8671	1.90	28.1161	29.6479
Nurse Nurse discussion	0.00	0.00	0.00	0.00
Patient put in room and changed into HA attire	0.00	0.00	0.00	0.00
Patient put in room and clothes changed	0.00	0.00	0.00	0.00
Physician Examination A	118.11	5.61	115.80	120.31
Pull IV	14.9873	1.24	14.6049	15.5539
Registration and Insurance	124.79	3.47	123.40	126.19
Remove Clothes and insert catheter	0.00	0.00	0.00	0.00
RN RN discussion	20.4423	3.13	18.9867	21.1966
RN tests and Labs A	127.89	6.47	125.31	130.52
RN tests and Labs Critical	0.00	0.00	0.00	0.00
Second MD Exam on B Side	7.2009	1.75	6.3882	7.6592
Second Physician Examination	35.7564	2.20	34.8344	36.6041

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Values Across All Replications

Unnamed Project

Category Overview

Replications: 3   Time Units: Hours

Process

Accumulated Time

Accum VA Time	Average	Half Width	Minimum Average	Maximum Average
Sitter and Nurse review paperwork	0.00	0.00	0.00	0.00
Sitter and Nurse review paperwork during registration	0.00	0.00	0.00	0.00
Tests and Labs on Side B	107.13	6.92	104.97	110.28
Triage Area	204.79	5.62	203.46	207.41
Xrays	49.4595	21.13	41.5416	58.4480
Xrays Bedside	7.5535	2.04	6.9021	8.4767

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Unnamed Project

Replications:	3	Time Units:	Hours

Category Overview

Process

Accumulated Time

Accum NVA Time	Average	Half Width	Minimum Average	Maximum Average
Clean MH Room	0.00	0.00	0.00	0.00
Clean Side A Room	102.56	5.24	100.67	104.83
Clean Side B Room	85.4444	5.50	84.1667	88.0000
Clean Trauma Room	0.00	0.00	0.00	0.00
Clerk Call Admitting MD	0.00	0.00	0.00	0.00
Lipton Assessment	0.00	0.00	0.00	0.00
Strip MH Room	0.00	0.00	0.00	0.00
Strip Side A Room	20.5222	1.01	20.1667	20.9667
Strip Side B Room	17.0889	1.10	16.8333	17.6000
Strip Trauma Room	0.00	0.00	0.00	0.00
Trauma Patient gets bed	0.00	0.00	0.00	0.00

Values Across All Replications

Unnamed Project

| Replications: | 3 | Time Units: | Hours |

Category Overview

Process

Accumulated Time

Accum Wait Time	Average	Half Width	Minimum Average	Maximum Average
24 Hour Eval by MD Section 12	1.1550	0.11	1.1281	1.2078
Bedside registration MH	0.00	0.00	0.00	0.00
Bedside registration side A	0.00	0.00	0.00	0.00
Call Admitting MD	0.00	0.00	0.00	0.00
Clean MH Room	0.00	0.00	0.00	0.00
Clean Side A Room	22.1869	2.79	20.8922	22.9237
Clean Side B Room	17.0991	5.92	15.3538	19.8156
Clean Trauma Room	0.00	0.00	0.00	0.00
Clerk Call Admitting MD	0.00	0.00	0.00	0.00
Clerk calls for Lipton	0.00	0.00	0.00	0.00
ED Infrared input by secretary	0.00	0.00	0.00	0.00
ED MD Admitting MD talk	0.00	0.00	0.00	0.00
Infrared input by secretary	0.00	0.00	0.00	0.00
MD to MD talk	2.5226	1.63	1.8351	3.1402
Medical Clearance	0.00	0.00	0.00	0.00
Nurse fills out MH papers	0.00	0.00	0.00	0.00
Nurse helps patient leave	0.00	0.00	0.00	0.00
Nurse Nurse discussion	0.00	0.00	0.00	0.00
RN RN discussion	2.8321	2.61	2.0845	4.0353
RN tests and Labs A	0.00	0.00	0.00	0.00
Second MD Exam on B Side	2.0795	3.75	1.1748	3.8205
Second Physician Examination	10.3571	2.03	9.7718	11.2928
Strip MH Room	0.00	0.00	0.00	0.00
Strip Side A Room	0.00639562	0.03	0.00	0.01918685
Strip Side B Room	0.00	0.00	0.00	0.00
Strip Trauma Room	0.00	0.00	0.00	0.00
Tests and Labs on Side B	0.00	0.00	0.00	0.00

Unnamed Project

Replications: 3   Time Units: Hours   ## Category Overview

Process

Other

Values Across All Replications

Unnamed Project

					Category Overview

Replications: 3   Time Units: Hours

Process

Other

Number In	Average	Half Width	Minimum Average	Maximum Average
24 Hour Eval by Lipton Section 12	105.00	28.22	97.0000	118.00
24 Hour Eval by MD Section 12	105.00	28.22	97.0000	118.00
Bedside registration MH	0.00	0.00	0.00	0.00
Bedside registration side A	143.00	53.46	121.00	164.00
Call Admitting MD	167.67	18.81	159.00	173.00
Clean MH Room	0.00	0.00	0.00	0.00
Clean Side A Room	615.67	30.36	605.00	629.00
Clean Side B Room	512.67	32.99	505.00	528.00
Clean Trauma Room	0.00	0.00	0.00	0.00
Clerk Call Admitting MD	0.00	0.00	0.00	0.00
Clerk calls for Lipton	0.00	0.00	0.00	0.00
CT Scan	152.33	68.55	121.00	173.00
Discharge Notes B side	448.00	23.96	441.00	459.00
ED Infrared input by secretary	0.00	0.00	0.00	0.00
ED MD Admitting MD talk	0.00	0.00	0.00	0.00
EKG for patient	0.00	0.00	0.00	0.00
Hook up to telemetry and blood pressure	0.00	0.00	0.00	0.00
Infrared input by secretary	167.67	16.91	160.00	173.00
Lipton Assessment	0.00	0.00	0.00	0.00
MD Exam on Side B	513.00	32.30	505.00	528.00
MD to MD talk	167.33	18.31	159.00	173.00
Medical Clearance	0.00	0.00	0.00	0.00
MRI	157.33	33.08	142.00	166.00
Nurse Does Discharge	448.00	23.96	441.00	459.00
Nurse fills out Mental Health papers	0.00	0.00	0.00	0.00
Nurse fills out MH papers	0.00	0.00	0.00	0.00
Nurse helps patient leave	512.67	32.99	505.00	528.00
Nurse Nurse discussion	0.00	0.00	0.00	0.00
Patient put in room and changed into HA attire	0.00	0.00	0.00	0.00
Patient put in room and clothes changed	0.00	0.00	0.00	0.00
Physician Examination A	614.67	32.80	603.00	629.00
Pull IV	448.00	23.96	441.00	459.00
Registration and Insurance	1244.33	33.73	1230.00	1257.00

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Unnamed Project

Category Overview

Replications: 3   Time Units: Hours

Process

Other

Number In	Average	Half Width	Minimum Average	Maximum Average
Remove Clothes and insert catheter	0.00	0.00	0.00	0.00
RN RN discussion	167.33	15.97	160.00	172.00
RN tests and Labs A	614.67	30.36	604.00	628.00
RN tests and Labs Critical	0.00	0.00	0.00	0.00
Second MD Exam on B Side	121.33	29.11	108.00	130.00
Second Physician Examination	615.33	33.91	603.00	630.00
Sitter and Nurse review paperwork	0.00	0.00	0.00	0.00
Sitter and Nurse review paperwork during registration	0.00	0.00	0.00	0.00
Strip MH Room	0.00	0.00	0.00	0.00
Strip Side A Room	615.67	30.36	605.00	629.00
Strip Side B Room	512.67	32.99	505.00	528.00
Strip Trauma Room	0.00	0.00	0.00	0.00
Tests and Labs on Side B	513.00	32.30	505.00	528.00
Trauma Patient gets bed	0.00	0.00	0.00	0.00
Triage Area	1645.00	46.01	1631.00	1666.00
Xrays	238.67	102.35	200.00	282.00
Xrays Bedside	36.0000	10.83	33.0000	41.0000

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Values Across All Replications

Unnamed Project

Replications: 3   Time Units: Hours

Category Overview

Process

Other

Number Out	Average	Half Width	Minimum Average	Maximum Average
24 Hour Eval by Lipton Section 12	105.00	28.22	97.0000	118.00
24 Hour Eval by MD Section 12	105.00	28.22	97.0000	118.00
Bedside registration MH	0.00	0.00	0.00	0.00
Bedside registration side A	143.00	53.46	121.00	164.00
Call Admitting MD	167.33	18.31	159.00	173.00
Clean MH Room	0.00	0.00	0.00	0.00
Clean Side A Room	615.33	31.46	604.00	629.00
Clean Side B Room	512.67	32.99	505.00	528.00
Clean Trauma Room	0.00	0.00	0.00	0.00
Clerk Call Admitting MD	0.00	0.00	0.00	0.00
Clerk calls for Lipton	0.00	0.00	0.00	0.00
CT Scan	152.33	68.55	121.00	173.00
Discharge Notes B side	448.00	23.96	441.00	459.00
ED Infrared input by secretary	0.00	0.00	0.00	0.00
ED MD Admitting MD talk	0.00	0.00	0.00	0.00
EKG for patient	0.00	0.00	0.00	0.00
Hook up to telemetry and blood pressure	0.00	0.00	0.00	0.00
Infrared input by secretary	167.67	16.91	160.00	173.00
Lipton Assessment	0.00	0.00	0.00	0.00
MD Exam on Side B	513.00	32.30	505.00	528.00
MD to MD talk	167.33	18.31	159.00	173.00
Medical Clearance	0.00	0.00	0.00	0.00
MRI	157.33	33.08	142.00	166.00
Nurse Does Discharge	448.33	23.48	441.00	459.00
Nurse fills out Mental Health papers	0.00	0.00	0.00	0.00
Nurse fills out MH papers	0.00	0.00	0.00	0.00
Nurse helps patient leave	512.67	32.99	505.00	528.00
Nurse Nurse discussion	0.00	0.00	0.00	0.00
Patient put in room and changed into HA attire	0.00	0.00	0.00	0.00
Patient put in room and clothes changed	0.00	0.00	0.00	0.00
Physician Examination A	614.33	33.91	602.00	629.00
Pull IV	448.00	23.96	441.00	459.00
Registration and Insurance	1244.33	32.33	1231.00	1257.00

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Values Across All Replications

Unnamed Project

Replications:	3	Time Units:	Hours	

Category Overview

Process

Other

Number Out	Average	Half Width	Minimum Average	Maximum Average
Remove Clothes and insert catheter	0.00	0.00	0.00	0.00
RN RN discussion	167.33	15.97	160.00	172.00
RN tests and Labs A	614.67	32.80	603.00	629.00
RN tests and Labs Critical	0.00	0.00	0.00	0.00
Second MD Exam on B Side	121.33	29.11	108.00	130.00
Second Physician Examination	615.67	33.73	603.00	630.00
Sitter and Nurse review paperwork	0.00	0.00	0.00	0.00
Sitter and Nurse review paperwork during registration	0.00	0.00	0.00	0.00
Strip MH Room	0.00	0.00	0.00	0.00
Strip Side A Room	615.67	30.36	605.00	629.00
Strip Side B Room	512.67	32.99	505.00	528.00
Strip Trauma Room	0.00	0.00	0.00	0.00
Tests and Labs on Side B	513.00	32.30	505.00	528.00
Trauma Patient gets bed	0.00	0.00	0.00	0.00
Triage Area	1645.00	46.01	1631.00	1666.00
Xrays	238.67	102.35	200.00	282.00
Xrays Bedside	36.3333	10.34	33.0000	41.0000

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Values Across All Replications

Unnamed Project

Replications: 3   Time Units: Hours   **Category Overview**

Queue

Time

Unnamed Project

Category Overview

Replications: 3   Time Units: Hours

Queue

Time

Waiting Time	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
24 Hour Eval by MD Section 12.Queue	0.01105179	0.00	0.01023586	0.01163849	0.00	0.1887
Batch 5.Queue	0.02150295	0.00	0.02087448	0.02212326	0.00	0.1129
Batch 6.Queue	0.1049	0.02	0.0987	0.1123	0.00	0.6556
Bedside registration side A.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Call Admitting MD.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Call for Transport.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Call Radiology B side.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Call Radiology.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Clean Side A Room.Queue	0.03604415	0.00	0.03408196	0.03789037	0.00	0.4091
Clean Side B Room.Queue	0.03328977	0.01	0.03040358	0.03752955	0.00	0.3658
Get Nurse.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Infrared input by secretary.Queue	0.00	0.00	0.00	0.00	0.00	0.00
MD to MD talk.Queue	0.01517664	0.01	0.01079497	0.01974987	0.00	0.5993
Nurse helps patient leave.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Radiologist to come to ED.Queue	0.00	0.00	0.00	0.00	0.00	0.00
RN RN discussion.Queue	0.01709976	0.02	0.01226148	0.02522080	0.00	0.2625
RN tests and Labs A.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Second MD Exam on B Side.Queue	0.01692054	0.03	0.00956254	0.03032173	0.00	0.7156
Second Physician Examination.Queue	0.01683456	0.00	0.01551085	0.01839780	0.00	0.8374
Seize CT Tech and Nurse.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Seize MDfor Side B.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Seize MRI tech and Nurse.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Seize Physician A.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Seize Registration and Insurance.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Seize Side A Room and Transport Nurse.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Seize Side B Room and Transport Nurse.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Seize Triage Nurse.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Strip Side A Room.Queue	0.00001057	0.00	0.00	0.00003171	0.00	0.01918685
Strip Side B Room.Queue	0.00	0.00	0.00	0.00	0.00	0.00

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Values Across All Replications

Unnamed Project

| Replications: | 3 | Time Units: | Hours |

Category Overview

Queue

Time

Waiting Time	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Tests and Labs on Side B.Queue	0.00	0.00	0.00	0.00	0.00	0.00

Other

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Values Across All Replications

Unnamed Project

Category Overview

Replications: 3   Time Units: Hours

Queue

Other

Number Waiting	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
24 Hour Eval by MD Section 12.Queue	0.00240616	0.00	0.00235021	0.00251632	0.00	1.0000
Arrange for Sitter.Queue	0.6667	1.43	0.00	1.0000	0.00	1.0000
Batch 11.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Batch 4.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Batch 5.Queue	0.01279446	0.00	0.01084519	0.01426423	0.00	2.0000
Batch 6.Queue	0.04612295	0.02	0.03990712	0.05521628	0.00	3.0000
Batch 7.Queue	5.3333	1.43	5.0000	6.0000	5.0000	6.0000
Bedside registration MH.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Bedside registration side A.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Call Admitting MD.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Call for ED Transport.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Call for Transport.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Call Radiology B side.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Call Radiology.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Call transport for Trauma.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Call transport to Helicopter.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Clean MH Room.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Clean Side A Room.Queue	0.04622266	0.01	0.04352550	0.04775766	0.00	3.0000
Clean Side B Room.Queue	0.03562304	0.01	0.03198710	0.04128251	0.00	2.0000
Clean Trauma Room.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Clerk Call Admitting MD.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Clerk calls for Lipton.Queue	0.00	0.00	0.00	0.00	0.00	0.00
ED Infrared input by secretary.Queue	0.00	0.00	0.00	0.00	0.00	0.00
ED MD Admitting MD talk.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Get Nurse.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Infrared input by secretary.Queue	0.00	0.00	0.00	0.00	0.00	0.00
MD to MD talk.Queue	0.00525541	0.00	0.00382322	0.00654214	0.00	1.0000
Medical Clearance.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Nurse fills out MH papers.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Nurse helps patient leave.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Nurse Nurse discussion.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Radiologist to come to ED.Queue	0.00	0.00	0.00	0.00	0.00	0.00

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Values Across All Replications

Unnamed Project

Replications: 3   Time Units: Hours

Category Overview

Queue

Other

Number Waiting	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
RN RN discussion.Queue	0.00590021	0.01	0.00434261	0.00840693	0.00	1.0000
RN tests and Labs A.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Second MD Exam on B Side.Queue	0.00433224	0.01	0.00244741	0.00795945	0.00	1.0000
Second Physician Examination.Queue	0.02156701	0.00	0.02035799	0.02349553	0.00	3.0000
Seize CT Tech and Nurse.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Seize EKG and Tech.Queue	389.28	86.39	349.41	413.28	148.00	624.00
Seize EKG.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Seize MDfor Side B.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Seize Mental Health nurse.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Seize Mental Health Room and Nurse.Queue	102.63	27.16	90.3816	111.40	42.0000	172.00
Seize MRI tech and Nurse.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Seize Physician A.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Seize Registration and Insurance.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Seize Room for Mental Health.Queue	39.9222	9.37	37.1092	44.2075	15.0000	64.0000
Seize Room.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Seize Side A Room and Transport Nurse.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Seize Side B Room and Transport Nurse.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Seize Trauma Bed.Queue	209.94	43.48	193.95	228.64	92.0000	349.00
Seize Triage Nurse.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Strip MH Room.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Strip Side A Room.Queue	0.00001332	0.00	0.00	0.00003997	0.00	1.0000
Strip Side B Room.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Strip Trauma Room.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Tests and Labs on Side B.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Triage.Queue	0.00	0.00	0.00	0.00	0.00	0.00

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Unnamed Project

Replications: 3   Time Units: Hours

Category Overview

Resource

Usage

Values Across All Replications

Unnamed Project

Category Overview

Replications: 3   Time Units: Hours

Resource

Usage

Instantaneous Utilization	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Bed 1	0.00	0.00	0.00	0.00	0.00	0.00
Bed 10	0.1936	0.01	0.1909	0.1990	0.00	1.0000
Bed 11	0.1897	0.03	0.1782	0.1979	0.00	1.0000
Bed 12	0.1875	0.01	0.1824	0.1927	0.00	1.0000
Bed 13	0.1890	0.01	0.1842	0.1927	0.00	1.0000
Bed 14	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Bed 15	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Bed 16	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Bed 17	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Bed 18	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Bed 2	0.00	0.00	0.00	0.00	0.00	0.00
Bed 20	0.1516	0.00	0.1495	0.1533	0.00	1.0000
Bed 21	0.1478	0.01	0.1434	0.1506	0.00	1.0000
Bed 22	0.1480	0.01	0.1452	0.1528	0.00	1.0000
Bed 23	0.1509	0.02	0.1449	0.1597	0.00	1.0000
Bed 24	0.1501	0.02	0.1435	0.1568	0.00	1.0000
Bed 25	0.1487	0.02	0.1440	0.1575	0.00	1.0000
Bed 3	0.00	0.00	0.00	0.00	0.00	0.00
Bed 4	0.1869	0.02	0.1778	0.1918	0.00	1.0000
Bed 5	0.1880	0.01	0.1826	0.1927	0.00	1.0000
Bed 6	0.1860	0.01	0.1816	0.1917	0.00	1.0000
Bed 7	0.1854	0.01	0.1819	0.1876	0.00	1.0000
Bed 8	0.1864	0.01	0.1827	0.1906	0.00	1.0000
Bed 9	0.1865	0.02	0.1780	0.1953	0.00	1.0000
Charge Nurse	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Cleaning Staff	0.3917	0.01	0.3852	0.3962	0.00	1.0000
Clerk 1	0.01135786	0.00	0.01099780	0.01175694	0.00	1.0000
Clerk 2	0.01202225	0.00	0.01134276	0.01251240	0.00	1.0000
CT Machine 1	0.04759175	0.02	0.03729530	0.05684732	0.00	1.0000
CT Machine 2	0.04186356	0.02	0.03273024	0.04766438	0.00	1.0000
CT Tech 1	0.04815676	0.02	0.03825179	0.05718310	0.00	1.0000
CT Tech 2	0.05187726	0.03	0.04017652	0.05858108	0.00	1.0000
ED Transport	0.00581019	0.00	0.00555556	0.00597222	0.00	0.4000
EKG Machine 1	0.00	0.00	0.00	0.00	0.00	0.00
EKG Machine 2	0.00	0.00	0.00	0.00	0.00	0.00
EKG Machine 3	0.00	0.00	0.00	0.00	0.00	0.00
Float Nurse	0.1685	0.01	0.1648	0.1704	0.00	1.0000

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Model Filename: R:\MQP\Model 12-11-10

Unnamed Project

Replications: 3   Time Units: Hours

Category Overview

Resource

Usage

Instantaneous Utilization	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
MD 1	0.1491	0.02	0.1394	0.1555	0.00	1.0000
MD 2	0.1504	0.04	0.1395	0.1694	0.00	1.0000
MD 3	0.1398	0.02	0.1301	0.1466	0.00	1.0000
MD 4	0.1519	0.01	0.1465	0.1561	0.00	1.0000
MD 5	0.1325	0.01	0.1290	0.1363	0.00	1.0000
Mental Health Group Room	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
MRI Machine 1	0.04583532	0.01	0.04046226	0.04872363	0.00	1.0000
MRI Machine 2	0.04682739	0.01	0.04237106	0.04924208	0.00	1.0000
MRI Tech 1	0.05345544	0.01	0.04998330	0.05660134	0.00	1.0000
MRI Tech 2	0.05013319	0.02	0.04271114	0.05479629	0.00	1.0000
Nurse 1	0.4637	1.15	0.1918	1.0000	0.00	1.0000
Nurse 2	0.2064	0.17	0.1647	0.2859	0.00	1.0000
Nurse 3	0.1719	0.06	0.1534	0.1987	0.00	1.0000
Nurse 4	0.1649	0.03	0.1570	0.1800	0.00	1.0000
Nurse 5	0.1556	0.02	0.1485	0.1603	0.00	1.0000
Portable Xray 1	0.01621234	0.01	0.01345836	0.01792018	0.00	1.0000
Portable Xray 2	0.01197439	0.01	0.00890636	0.01463751	0.00	1.0000
Radiologist	0.00	0.00	0.00	0.00	0.00	0.00
Registration 1	0.1466	0.01	0.1423	0.1494	0.00	1.0000
Registration 2	0.1428	0.01	0.1394	0.1453	0.00	1.0000
Sitter 1	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Sitter 2	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Tech 1	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Tech 2	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Tech 3	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Triage Nurse	0.4409	0.01	0.4380	0.4466	0.00	1.0000
Xray Machine 1	0.02941772	0.02	0.02333379	0.03820571	0.00	1.0000
Xray Machine 2	0.03366297	0.01	0.03098019	0.03763439	0.00	1.0000
Xray Machine 3	0.02556608	0.02	0.01860536	0.03245276	0.00	1.0000
Xray Machine 4	0.03110148	0.02	0.02088037	0.03831710	0.00	1.0000
Xray Tech 1	0.02791355	0.02	0.02005758	0.03366081	0.00	1.0000
Xray Tech 2	0.03205102	0.02	0.02352442	0.04210373	0.00	1.0000
Xray Tech 3	0.02662213	0.00	0.02512357	0.02786468	0.00	1.0000
Xray Tech 4	0.02803869	0.01	0.02358798	0.03166788	0.00	1.0000
Xray Tech 5	0.02278005	0.02	0.01433101	0.02967580	0.00	1.0000
Xray Tech 6	0.02710363	0.02	0.01990919	0.03080427	0.00	1.0000

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Values Across All Replications

Unnamed Project

Category Overview

Replications: 3   Time Units: Hours

Resource

Usage

Number Busy	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Bed 1	0.00	0.00	0.00	0.00	0.00	0.00
Bed 10	0.1936	0.01	0.1909	0.1990	0.00	1.0000
Bed 11	0.1897	0.03	0.1782	0.1979	0.00	1.0000
Bed 12	0.1875	0.01	0.1824	0.1927	0.00	1.0000
Bed 13	0.1890	0.01	0.1842	0.1927	0.00	1.0000
Bed 14	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Bed 15	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Bed 16	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Bed 17	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Bed 18	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Bed 2	0.00	0.00	0.00	0.00	0.00	0.00
Bed 20	0.1516	0.00	0.1495	0.1533	0.00	1.0000
Bed 21	0.1478	0.01	0.1434	0.1506	0.00	1.0000
Bed 22	0.1480	0.01	0.1452	0.1528	0.00	1.0000
Bed 23	0.1509	0.02	0.1449	0.1597	0.00	1.0000
Bed 24	0.1501	0.02	0.1435	0.1568	0.00	1.0000
Bed 25	0.1487	0.02	0.1440	0.1575	0.00	1.0000
Bed 3	0.00	0.00	0.00	0.00	0.00	0.00
Bed 4	0.1869	0.02	0.1778	0.1918	0.00	1.0000
Bed 5	0.1880	0.01	0.1826	0.1927	0.00	1.0000
Bed 6	0.1860	0.01	0.1816	0.1917	0.00	1.0000
Bed 7	0.1854	0.01	0.1819	0.1876	0.00	1.0000
Bed 8	0.1864	0.01	0.1827	0.1906	0.00	1.0000
Bed 9	0.1865	0.02	0.1780	0.1953	0.00	1.0000
Charge Nurse	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Cleaning Staff	0.3917	0.01	0.3852	0.3962	0.00	1.0000
Clerk 1	0.01135786	0.00	0.01099780	0.01175694	0.00	1.0000
Clerk 2	0.01202225	0.00	0.01134276	0.01251240	0.00	1.0000
CT Machine 1	0.04759175	0.02	0.03729530	0.05684732	0.00	1.0000
CT Machine 2	0.04186356	0.02	0.03273024	0.04766438	0.00	1.0000
CT Tech 1	0.04815676	0.02	0.03825179	0.05718310	0.00	1.0000
CT Tech 2	0.05187726	0.03	0.04017652	0.05858108	0.00	1.0000
ED Transport	0.02905093	0.00	0.02777778	0.02986111	0.00	2.0000
EKG Machine 1	0.00	0.00	0.00	0.00	0.00	0.00
EKG Machine 2	0.00	0.00	0.00	0.00	0.00	0.00
EKG Machine 3	0.00	0.00	0.00	0.00	0.00	0.00
Float Nurse	0.1685	0.01	0.1648	0.1704	0.00	1.0000

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Unnamed Project

Replications:	3	Time Units:	Hours

Category Overview

Resource

Usage

Number Busy	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
MD 1	0.1491	0.02	0.1394	0.1555	0.00	1.0000
MD 2	0.1504	0.04	0.1395	0.1694	0.00	1.0000
MD 3	0.1398	0.02	0.1301	0.1466	0.00	1.0000
MD 4	0.1519	0.01	0.1465	0.1561	0.00	1.0000
MD 5	0.1325	0.01	0.1290	0.1363	0.00	1.0000
Mental Health Group Room	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
MRI Machine 1	0.04583532	0.01	0.04046226	0.04872363	0.00	1.0000
MRI Machine 2	0.04682739	0.01	0.04237106	0.04924208	0.00	1.0000
MRI Tech 1	0.05345544	0.01	0.04998330	0.05660134	0.00	1.0000
MRI Tech 2	0.05013319	0.02	0.04271114	0.05479629	0.00	1.0000
Nurse 1	0.4637	1.15	0.1918	1.0000	0.00	1.0000
Nurse 2	0.2064	0.17	0.1647	0.2859	0.00	1.0000
Nurse 3	0.1719	0.06	0.1534	0.1987	0.00	1.0000
Nurse 4	0.1649	0.03	0.1570	0.1800	0.00	1.0000
Nurse 5	0.1556	0.02	0.1485	0.1603	0.00	1.0000
Portable Xray 1	0.01621234	0.01	0.01345836	0.01792018	0.00	1.0000
Portable Xray 2	0.01197439	0.01	0.00890636	0.01463751	0.00	1.0000
Radiologist	0.00	0.00	0.00	0.00	0.00	0.00
Registration 1	0.1466	0.01	0.1423	0.1494	0.00	1.0000
Registration 2	0.1428	0.01	0.1394	0.1453	0.00	1.0000
Sitter 1	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Sitter 2	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Tech 1	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Tech 2	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Tech 3	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Triage Nurse	0.4409	0.01	0.4380	0.4466	0.00	1.0000
Xray Machine 1	0.02941772	0.02	0.02333379	0.03820571	0.00	1.0000
Xray Machine 2	0.03366297	0.01	0.03098019	0.03763439	0.00	1.0000
Xray Machine 3	0.02556608	0.02	0.01860536	0.03245276	0.00	1.0000
Xray Machine 4	0.03110148	0.02	0.02088037	0.03831710	0.00	1.0000
Xray Tech 1	0.02791355	0.02	0.02005758	0.03366081	0.00	1.0000
Xray Tech 2	0.03205102	0.02	0.02352442	0.04210373	0.00	1.0000
Xray Tech 3	0.02662213	0.00	0.02512357	0.02786468	0.00	1.0000
Xray Tech 4	0.02803869	0.01	0.02358798	0.03166788	0.00	1.0000
Xray Tech 5	0.02278005	0.02	0.01433101	0.02967580	0.00	1.0000
Xray Tech 6	0.02710363	0.02	0.01990919	0.03080427	0.00	1.0000

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Values Across All Replications

Unnamed Project

Category Overview

Replications:　3　　Time Units:　Hours

Resource

Usage

Number Scheduled	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Bed 1	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Bed 10	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Bed 11	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Bed 12	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Bed 13	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Bed 14	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Bed 15	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Bed 16	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Bed 17	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Bed 18	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Bed 2	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Bed 20	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Bed 21	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Bed 22	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Bed 23	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Bed 24	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Bed 25	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Bed 3	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Bed 4	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Bed 5	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Bed 6	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Bed 7	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Bed 8	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Bed 9	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Charge Nurse	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Cleaning Staff	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Clerk 1	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Clerk 2	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
CT Machine 1	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
CT Machine 2	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
CT Tech 1	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
CT Tech 2	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
ED Transport	5.0000	0.00	5.0000	5.0000	5.0000	5.0000
EKG Machine 1	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
EKG Machine 2	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
EKG Machine 3	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Float Nurse	1.0000	0.00	1.0000	1.0000	1.0000	1.0000

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Unnamed Project

Category Overview

Replications: 3   Time Units: Hours

Resource

Usage

Number Scheduled	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
MD 1	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
MD 2	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
MD 3	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
MD 4	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
MD 5	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Mental Health Group Room	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
MRI Machine 1	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
MRI Machine 2	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
MRI Tech 1	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
MRI Tech 2	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Nurse 1	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Nurse 2	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Nurse 3	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Nurse 4	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Nurse 5	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Portable Xray 1	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Portable Xray 2	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Radiologist	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Registration 1	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Registration 2	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Sitter 1	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Sitter 2	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Tech 1	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Tech 2	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Tech 3	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Triage Nurse	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Xray Machine 1	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Xray Machine 2	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Xray Machine 3	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Xray Machine 4	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Xray Tech 1	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Xray Tech 2	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Xray Tech 3	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Xray Tech 4	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Xray Tech 5	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Xray Tech 6	1.0000	0.00	1.0000	1.0000	1.0000	1.0000

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Values Across All Replications

Unnamed Project

Replications:	3	Time Units:	Hours

Category Overview

Resource

Usage

Scheduled Utilization	Average	Half Width	Minimum Average	Maximum Average
Bed 1	0.00	0.00	0.00	0.00
Bed 10	0.1936	0.01	0.1909	0.1990
Bed 11	0.1897	0.03	0.1782	0.1979
Bed 12	0.1875	0.01	0.1824	0.1927
Bed 13	0.1890	0.01	0.1842	0.1927
Bed 14	1.0000	0.00	1.0000	1.0000
Bed 15	1.0000	0.00	1.0000	1.0000
Bed 16	1.0000	0.00	1.0000	1.0000
Bed 17	1.0000	0.00	1.0000	1.0000
Bed 18	1.0000	0.00	1.0000	1.0000
Bed 2	0.00	0.00	0.00	0.00
Bed 20	0.1516	0.00	0.1495	0.1533
Bed 21	0.1478	0.01	0.1434	0.1506
Bed 22	0.1480	0.01	0.1452	0.1528
Bed 23	0.1509	0.02	0.1449	0.1597
Bed 24	0.1501	0.02	0.1435	0.1568
Bed 25	0.1487	0.02	0.1440	0.1575
Bed 3	0.00	0.00	0.00	0.00
Bed 4	0.1869	0.02	0.1778	0.1918
Bed 5	0.1880	0.01	0.1826	0.1927
Bed 6	0.1860	0.01	0.1816	0.1917
Bed 7	0.1854	0.01	0.1819	0.1876
Bed 8	0.1864	0.01	0.1827	0.1906
Bed 9	0.1865	0.02	0.1780	0.1953
Charge Nurse	1.0000	0.00	1.0000	1.0000
Cleaning Staff	0.3917	0.01	0.3852	0.3962
Clerk 1	0.01135786	0.00	0.01099780	0.01175694
Clerk 2	0.01202225	0.00	0.01134276	0.01251240
CT Machine 1	0.04759175	0.02	0.03729530	0.05684732
CT Machine 2	0.04186356	0.02	0.03273024	0.04766438
CT Tech 1	0.04815676	0.02	0.03825179	0.05718310
CT Tech 2	0.05187726	0.03	0.04017652	0.05858108
ED Transport	0.00581019	0.00	0.00555556	0.00597222
EKG Machine 1	0.00	0.00	0.00	0.00
EKG Machine 2	0.00	0.00	0.00	0.00
EKG Machine 3	0.00	0.00	0.00	0.00
Float Nurse	0.1685	0.01	0.1648	0.1704

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Values Across All Replications

Unnamed Project

Replications: 3   Time Units: Hours

Category Overview

Resource

Usage

Scheduled Utilization	Average	Half Width	Minimum Average	Maximum Average
MD 1	0.1491	0.02	0.1394	0.1555
MD 2	0.1504	0.04	0.1395	0.1694
MD 3	0.1398	0.02	0.1301	0.1466
MD 4	0.1519	0.01	0.1465	0.1561
MD 5	0.1325	0.01	0.1290	0.1363
Mental Health Group Room	1.0000	0.00	1.0000	1.0000
MRI Machine 1	0.04583532	0.01	0.04046226	0.04872363
MRI Machine 2	0.04682739	0.01	0.04237106	0.04924208
MRI Tech 1	0.05345544	0.01	0.04998330	0.05660134
MRI Tech 2	0.05013319	0.02	0.04271114	0.05479629
Nurse 1	0.4637	1.15	0.1918	1.0000
Nurse 2	0.2064	0.17	0.1647	0.2859
Nurse 3	0.1719	0.06	0.1534	0.1987
Nurse 4	0.1649	0.03	0.1570	0.1800
Nurse 5	0.1556	0.02	0.1485	0.1603
Portable Xray 1	0.01621234	0.01	0.01345836	0.01792018
Portable Xray 2	0.01197439	0.01	0.00890636	0.01463751
Radiologist	0.00	0.00	0.00	0.00
Registration 1	0.1466	0.01	0.1423	0.1494
Registration 2	0.1428	0.01	0.1394	0.1453
Sitter 1	1.0000	0.00	1.0000	1.0000
Sitter 2	1.0000	0.00	1.0000	1.0000
Tech 1	1.0000	0.00	1.0000	1.0000
Tech 2	1.0000	0.00	1.0000	1.0000
Tech 3	1.0000	0.00	1.0000	1.0000
Triage Nurse	0.4409	0.01	0.4380	0.4466
Xray Machine 1	0.02941772	0.02	0.02333379	0.03820571
Xray Machine 2	0.03366297	0.01	0.03098019	0.03763439
Xray Machine 3	0.02556608	0.02	0.01860536	0.03245276
Xray Machine 4	0.03110148	0.02	0.02088037	0.03831710
Xray Tech 1	0.02791355	0.02	0.02005758	0.03366081
Xray Tech 2	0.03205102	0.02	0.02352442	0.04210373
Xray Tech 3	0.02662213	0.00	0.02512357	0.02786468
Xray Tech 4	0.02803869	0.01	0.02358798	0.03166788
Xray Tech 5	0.02278005	0.02	0.01433101	0.02967580
Xray Tech 6	0.02710363	0.02	0.01990919	0.03080427

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Values Across All Replications

Unnamed Project

| Replications: | 3 | Time Units: | Hours |

Category Overview

Resource

Usage

Total Number Seized	Average	Half Width	Minimum Average	Maximum Average
Bed 1	0.00	0.00	0.00	0.00
Bed 10	61.6667	2.87	61.0000	63.0000
Bed 11	62.0000	2.48	61.0000	63.0000
Bed 12	62.0000	2.48	61.0000	63.0000
Bed 13	61.3333	3.79	60.0000	63.0000
Bed 14	0.00	0.00	0.00	0.00
Bed 15	0.00	0.00	0.00	0.00
Bed 16	0.00	0.00	0.00	0.00
Bed 17	0.00	0.00	0.00	0.00
Bed 18	0.00	0.00	0.00	0.00
Bed 2	0.00	0.00	0.00	0.00
Bed 20	85.6667	5.17	84.0000	88.0000
Bed 21	85.6667	5.17	84.0000	88.0000
Bed 22	85.0000	4.30	84.0000	87.0000
Bed 23	85.3333	5.74	84.0000	88.0000
Bed 24	85.3333	5.74	84.0000	88.0000
Bed 25	85.6667	5.17	84.0000	88.0000
Bed 3	0.00	0.00	0.00	0.00
Bed 4	61.3333	3.79	60.0000	63.0000
Bed 5	61.3333	3.79	60.0000	63.0000
Bed 6	61.0000	2.48	60.0000	62.0000
Bed 7	61.0000	2.48	60.0000	62.0000
Bed 8	61.3333	3.79	60.0000	63.0000
Bed 9	61.6667	2.87	61.0000	63.0000
Charge Nurse	0.00	0.00	0.00	0.00
Cleaning Staff	1128.33	40.39	1110.00	1141.00
Clerk 1	164.00	11.38	159.00	168.00
Clerk 2	171.33	24.51	160.00	178.00
CT Machine 1	80.3333	38.67	64.0000	95.0000
CT Machine 2	72.0000	32.49	57.0000	81.0000
CT Tech 1	74.0000	36.09	59.0000	88.0000
CT Tech 2	78.3333	35.34	62.0000	88.0000
ED Transport	167.33	15.97	160.00	172.00
EKG Machine 1	0.00	0.00	0.00	0.00
EKG Machine 2	0.00	0.00	0.00	0.00
EKG Machine 3	0.00	0.00	0.00	0.00
Float Nurse	1508.33	41.60	1489.00	1518.00

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Values Across All Replications

Unnamed Project

				Category Overview
Replications:	3	Time Units:	Hours	

Resource

Usage

Total Number Seized	Average	Half Width	Minimum Average	Maximum Average
MD 1	434.00	73.15	417.00	468.00
MD 2	431.67	67.82	413.00	463.00
MD 3	427.00	8.61	423.00	429.00
MD 4	437.00	47.40	417.00	455.00
MD 5	407.00	58.42	383.00	430.00
Mental Health Group Room	0.00	0.00	0.00	0.00
MRI Machine 1	78.3333	17.97	70.0000	83.0000
MRI Machine 2	78.6667	14.56	72.0000	83.0000
MRI Tech 1	81.3333	12.50	76.0000	86.0000
MRI Tech 2	75.6667	21.13	66.0000	82.0000
Nurse 1	865.67	1,862.66	0.00	1309.00
Nurse 2	991.67	1,223.00	698.00	1560.00
Nurse 3	695.33	324.20	618.00	846.00
Nurse 4	611.00	107.58	586.00	661.00
Nurse 5	591.00	2.48	590.00	592.00
Portable Xray 1	20.6667	7.99	17.0000	23.0000
Portable Xray 2	15.3333	10.04	11.0000	19.0000
Radiologist	0.00	0.00	0.00	0.00
Registration 1	705.33	58.49	681.00	728.00
Registration 2	682.00	28.65	670.00	693.00
Sitter 1	0.00	0.00	0.00	0.00
Sitter 2	0.00	0.00	0.00	0.00
Tech 1	0.00	0.00	0.00	0.00
Tech 2	0.00	0.00	0.00	0.00
Tech 3	0.00	0.00	0.00	0.00
Triage Nurse	1645.00	46.01	1631.00	1666.00
Xray Machine 1	58.6667	38.03	47.0000	76.0000
Xray Machine 2	66.6667	18.97	60.0000	75.0000
Xray Machine 3	51.0000	34.78	37.0000	65.0000
Xray Machine 4	62.3333	44.60	42.0000	76.0000
Xray Tech 1	46.0000	31.03	32.0000	56.0000
Xray Tech 2	52.6667	40.16	38.0000	70.0000
Xray Tech 3	44.6667	5.17	43.0000	47.0000
Xray Tech 4	46.6667	15.18	40.0000	52.0000
Xray Tech 5	39.0000	32.58	25.0000	51.0000
Xray Tech 6	45.6667	25.13	34.0000	52.0000

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Unnamed Project

Replications: 3   Time Units: Hours

Category Overview

User Specified

Counter

Count	Average	Half Width	Minimum Average	Maximum Average
Record 24	0.00	0.00	0.00	0.00
Record Errors	0.00	0.00	0.00	0.00
Record Errors6	0.00	0.00	0.00	0.00

Unnamed Project

Replication 1   Start Time: 240.00   Stop Time: 720.00   Time Units: Hours

Entity

Time

VA Time	Average	Half Width	Minimum	Maximum
Patient Arrival	0.1902	0.005469579	0	1.5198

NVA Time	Average	Half Width	Minimum	Maximum
Patient Arrival	0.03727540	0.001066500	0	0.2000

Wait Time	Average	Half Width	Minimum	Maximum
Patient Arrival	0.01055949	0.001431835	0	0.8555

Transfer Time	Average	Half Width	Minimum	Maximum
Patient Arrival	0.03991275	(Correlated)	0.02083333	0.08750000

Other Time	Average	Half Width	Minimum	Maximum
Patient Arrival	0.01987368	0.003257768	0	0.8333

Total Time	Average	Half Width	Minimum	Maximum
Patient Arrival	0.3016	0.009667247	0.03333333	3.1671

Other

Number In	Value
Entity 1	0
Patient Arrival	5,470
Patient_Accuity_1	0

Number Out	Value
Entity 1	0
Patient Arrival	4,492
Patient_Accuity_1	0

Unnamed Project

Replication 1   Start Time: 240.00   Stop Time: 720.00   Time Units: Hours

Entity

Other

Category by Replication

WIP	Average	Half Width	Minimum	Maximum
Entity 1	0	(Insufficient)	0	0
Patient Arrival	963.36	(Correlated)	487.00	1,468.00
Patient_Accuity_1	0	(Insufficient)	0	0

Process

Time per Entity

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Unnamed Project

Replication 1	Start Time:	240.00	Stop Time:	720.00	Time Units: Hours

Process

Time per Entity

Category by Replication

VA Time Per Entity	Average	Half Width	Minimum	Maximum
24 Hour Eval by Lipton Section 12	0.5127	(Insufficient)	0.2517	0.9721
24 Hour Eval by MD Section 12	0.4897	(Insufficient)	0.2604	0.9502
Bedside registration side A	0.1014	(Insufficient)	0.04845303	0.1630
Call Admitting MD	0.03338810	(Insufficient)	0.01898758	0.04948487
CT Scan	0.2445	(Insufficient)	0.1780	0.3176
Discharge Notes B side	0.05795903	0.000873475	0.03507364	0.08176577
Infrared input by secretary	0.03394881	(Insufficient)	0.01787578	0.04900901
MD Exam on Side B	0.1915	0.001900379	0.1381	0.2472
MD to MD talk	0.05940455	(Insufficient)	0.03508045	0.08232055
MRI	0.2501	(Insufficient)	0.1755	0.3310
Nurse Does Discharge	0.1667	(Correlated)	0.1667	0.1667
Nurse helps patient leave	0.05615126	0.000931033	0.03485044	0.08208889
Physician Examination A	0.1931	0.002101772	0.1373	0.2462
Pull IV	0.03311759	0.000777684	0.01796179	0.04954912
Registration and Insurance	0.1014	0.001271121	0.03592031	0.1640
RN RN discussion	0.1232	(Insufficient)	0.05968313	0.1875
RN tests and Labs A	0.2089	0.001539729	0.1697	0.2480
Second MD Exam on B Side	0.05891729	(Insufficient)	0.03745308	0.08026245
Second Physician Examination	0.05835610	0.000698941	0.03415529	0.08303006
Tests and Labs on Side B	0.2089	0.001368035	0.1675	0.2467
Triage Area	0.1242	0.000974243	0.08407051	0.1650
Xrays	0.2073	(Insufficient)	0.1699	0.2487
Xrays Bedside	0.2067	(Insufficient)	0.1724	0.2487

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Unnamed Project

Replication 1   Start Time: 240.00   Stop Time: 720.00   Time Units: Hours

Process

Category by Replication

Time per Entity

NVA Time Per Entity	Average	Half Width	Minimum	Maximum
Clean Side A Room	0.1667	(Correlated)	0.1667	0.1667
Clean Side B Room	0.1667	(Correlated)	0.1667	0.1667
Strip Side A Room	0.03333333	(Correlated)	0.03333333	0.03333333
Strip Side B Room	0.03333333	(Correlated)	0.03333333	0.03333333

Wait Time Per Entity	Average	Half Width	Minimum	Maximum
24 Hour Eval by MD Section 12	0.01128101	(Insufficient)	0	0.1796
Bedside registration side A	0	(Insufficient)	0	0
Call Admitting MD	0	(Insufficient)	0	0
Clean Side A Room	0.03408196	0.005678711	0	0.3766
Clean Side B Room	0.03752955	0.006092092	0	0.3276
Infrared input by secretary	0	(Insufficient)	0	0
MD to MD talk	0.01498509	(Insufficient)	0	0.5428
Nurse helps patient leave	0	0.000000000	0	0
RN RN discussion	0.01381700	(Insufficient)	0	0.2296
RN tests and Labs A	0	0.000000000	0	0
Second MD Exam on B Side	0.00956254	(Insufficient)	0	0.4085
Second Physician Examination	0.01839217	0.005652218	0	0.8249
Strip Side A Room	0	0.000000000	0	0
Strip Side B Room	0	0.000000000	0	0
Tests and Labs on Side B	0	0.000000000	0	0

101

Unnamed Project

| Replication 1 | Start Time: | 240.00 | Stop Time: | 720.00 | Time Units: | Hours |

Process

Category by Replication

Time per Entity

Total Time Per Entity	Average	Half Width	Minimum	Maximum
24 Hour Eval by Lipton Section 12	0.5127	(Insufficient)	0.2517	0.9721
24 Hour Eval by MD Section 12	0.5010	(Insufficient)	0.2604	0.9528
Bedside registration side A	0.1014	(Insufficient)	0.04845303	0.1630
Call Admitting MD	0.03338810	(Insufficient)	0.01898758	0.04948487
Clean Side A Room	0.2007	0.005678711	0.1667	0.5433
Clean Side B Room	0.2042	0.006092092	0.1667	0.4943
CT Scan	0.2445	(Insufficient)	0.1780	0.3176
Discharge Notes B side	0.05795903	0.000873475	0.03507364	0.08176577
Infrared input by secretary	0.03394881	(Insufficient)	0.01787578	0.04900901
MD Exam on Side B	0.1915	0.001900379	0.1381	0.2472
MD to MD talk	0.07438965	(Insufficient)	0.03508045	0.5929
MRI	0.2501	(Insufficient)	0.1755	0.3310
Nurse Does Discharge	0.1667	(Correlated)	0.1667	0.1667
Nurse helps patient leave	0.05615126	0.000931033	0.03485044	0.08208889
Physician Examination A	0.1931	0.002101772	0.1373	0.2462
Pull IV	0.03311759	0.000777684	0.01796179	0.04954912
Registration and Insurance	0.1014	0.001271121	0.03592031	0.1640
RN RN discussion	0.1371	(Insufficient)	0.05968313	0.4083
RN tests and Labs A	0.2089	0.001539729	0.1697	0.2480
Second MD Exam on B Side	0.06847983	(Insufficient)	0.03745308	0.4532
Second Physician Examination	0.07674827	0.005470676	0.03415529	0.8659
Strip Side A Room	0.03333333	(Correlated)	0.03333333	0.03333333
Strip Side B Room	0.03333333	(Correlated)	0.03333333	0.03333333
Tests and Labs on Side B	0.2089	0.001368035	0.1675	0.2467
Triage Area	0.1242	0.000974243	0.08407051	0.1650

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Unnamed Project

Replication 1   Start Time: 240.00   Stop Time: 720.00   Time Units: Hours

Process

Time per Entity

Category by Replication

Total Time Per Entity	Average	Half Width	Minimum	Maximum
Xrays	0.2073	(Insufficient)	0.1699	0.2487
Xrays Bedside	0.2067	(Insufficient)	0.1724	0.2487

Accumulated Time

103

Unnamed Project

Replication 1   Start Time: 240.00   Stop Time: 720.00   Time Units: Hours

Process

Category by Replication

Accumulated Time

Accum VA Time	Value
24 Hour Eval by Lipton Section 12	51.2658
24 Hour Eval by MD Section 12	48.9703
Bedside registration MH	0
Bedside registration side A	14.5967
Call Admitting MD	5.7761
Clerk calls for Lipton	0
CT Scan	29.5789
Discharge Notes B side	25.5599
ED Infrared input by secretary	0
ED MD Admitting MD talk	0
EKG for patient	0
Hook up to telemetry and blood pressure	0
Infrared input by secretary	5.8731
MD Exam on Side B	101.09
MD to MD talk	10.2770
Medical Clearance	0
MRI	41.5083
Nurse Does Discharge	73.5000
Nurse fills out Mental Health papers	0
Nurse fills out MH papers	0
Nurse helps patient leave	29.6479
Nurse Nurse discussion	0
Patient put in room and changed into HA attire	0

104

Unnamed Project

Replication 1   Start Time: 240.00   Stop Time: 720.00   Time Units: Hours

Process

Accumulated Time

Category by Replication

Accum VA Time	Value
Patient put in room and clothes changed	0
Physician Examination A	118.21
Pull IV	14.6049
Registration and Insurance	126.19
Remove Clothes and insert catheter	0
RN RN discussion	21.1966
RN tests and Labs A	127.84
RN tests and Labs Critical	0
Second MD Exam on B Side	7.6592
Second Physician Examination	35.8306
Sitter and Nurse review paperwork	0
Sitter and Nurse review paperwork during registration	0
Tests and Labs on Side B	110.28
Triage Area	203.51
Xrays	58.4480
Xrays Bedside	8.4767

105

Unnamed Project

Replication 1

Start Time:	240.00	Stop Time:	720.00	Time Units:	Hours

Process

Category by Replication

Accumulated Time

Accum NVA Time	Value
Clean MH Room	0
Clean Side A Room	102.17
Clean Side B Room	88.0000
Clean Trauma Room	0
Clerk Call Admitting MD	0
Lipton Assessment	0
Strip MH Room	0
Strip Side A Room	20.4333
Strip Side B Room	17.6000
Strip Trauma Room	0
Trauma Patient gets bed	0

106

Unnamed Project

Replication 1

Start Time:	240.00	
Stop Time:	720.00	
Time Units:	Hours	

Process

Category by Replication

Accumulated Time

Accum Wait Time	Value
24 Hour Eval by MD Section 12	1.1281
Bedside registration MH	0
Bedside registration side A	0
Call Admitting MD	0
Clean MH Room	0
Clean Side A Room	20.8922
Clean Side B Room	19.8156
Clean Trauma Room	0
Clerk Call Admitting MD	0
Clerk calls for Lipton	0
ED Infrared input by secretary	0
ED MD Admitting MD talk	0
Infrared input by secretary	0
MD to MD talk	2.5924
Medical Clearance	0
Nurse fills out MH papers	0
Nurse helps patient leave	0
Nurse Nurse discussion	0
RN RN discussion	2.3765
RN tests and Labs A	0
Second MD Exam on B Side	1.2431
Second Physician Examination	11.2928
Strip MH Room	0
Strip Side A Room	0
Strip Side B Room	0

107

Unnamed Project

Replication 1

Start Time: 240.00 Stop Time: 720.00 Time Units: Hours

Process

Category by Replication

Accumulated Time

Accum Wait Time	Value
Strip Trauma Room	0
Tests and Labs on Side B	0

Other

108

Unnamed Project

Replication 1   Start Time: 240.00   Stop Time: 720.00   Time Units: Hours

Process

Other

Category by Replication

Number In	Value
24 Hour Eval by Lipton Section 12	100
24 Hour Eval by MD Section 12	100
Bedside registration MH	0
Bedside registration side A	144
Call Admitting MD	173
Clean MH Room	0
Clean Side A Room	613
Clean Side B Room	528
Clean Trauma Room	0
Clerk Call Admitting MD	0
Clerk calls for Lipton	0
CT Scan	121
Discharge Notes B side	441
ED Infrared input by secretary	0
ED MD Admitting MD talk	0
EKG for patient	0
Hook up to telemetry and blood pressure	0
Infrared input by secretary	173
Lipton Assessment	0
MD Exam on Side B	528
MD to MD talk	173
Medical Clearance	0
MRI	166
Nurse Does Discharge	441

109

Unnamed Project

Replication 1

Start Time:	240.00	Stop Time:	720.00	Time Units:	Hours

Process

Category by Replication

Other

Number In	Value
Nurse fills out Mental Health papers	0
Nurse fills out MH papers	0
Nurse helps patient leave	528
Nurse Nurse discussion	0
Patient put in room and changed into HA attire	0
Patient put in room and clothes changed	0
Physician Examination A	612
Pull IV	441
Registration and Insurance	1,246
Remove Clothes and insert catheter	0
RN RN discussion	172
RN tests and Labs A	612
RN tests and Labs Critical	0
Second MD Exam on B Side	130
Second Physician Examination	613
Sitter and Nurse review paperwork	0
Sitter and Nurse review paperwork during registration	0
Strip MH Room	0
Strip Side A Room	613
Strip Side B Room	528
Strip Trauma Room	0
Tests and Labs on Side B	528

110

Unnamed Project

Replication 1 Start Time: 240.00 Stop Time: 720.00 Time Units: Hours

Process

Category by Replication

Other

Number In	Value
Trauma Patient gets bed	0
Triage Area	1,638
Xrays	282
Xrays Bedside	41

111

Unnamed Project

Replication 1	Start Time:	240.00	Stop Time:	720.00	Time Units: Hours

Process

Other

Category by Replication

Number Out	Value
24 Hour Eval by Lipton Section 12	100
24 Hour Eval by MD Section 12	100
Bedside registration MH	0
Bedside registration side A	144
Call Admitting MD	173
Clean MH Room	0
Clean Side A Room	613
Clean Side B Room	528
Clean Trauma Room	0
Clerk Call Admitting MD	0
Clerk calls for Lipton	0
CT Scan	121
Discharge Notes B side	441
ED Infrared input by secretary	0
ED MD Admitting MD talk	0
EKG for patient	0
Hook up to telemetry and blood pressure	0
Infrared input by secretary	173
Lipton Assessment	0
MD Exam on Side B	528
MD to MD talk	173
Medical Clearance	0
MRI	166
Nurse Does Discharge	441

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Unnamed Project

Replication 1

Start Time: 240.00   Stop Time: 720.00   Time Units: Hours

Process

Other

Category by Replication

Number Out	Value
Nurse fills out Mental Health papers	0
Nurse fills out MH papers	0
Nurse helps patient leave	528
Nurse Nurse discussion	0
Patient put in room and changed into HA attire	0
Patient put in room and clothes changed	0
Physician Examination A	612
Pull IV	441
Registration and Insurance	1,245
Remove Clothes and insert catheter	0
RN RN discussion	172
RN tests and Labs A	612
RN tests and Labs Critical	0
Second MD Exam on B Side	130
Second Physician Examination	614
Sitter and Nurse review paperwork	0
Sitter and Nurse review paperwork during registration	0
Strip MH Room	0
Strip Side A Room	613
Strip Side B Room	528
Strip Trauma Room	0
Tests and Labs on Side B	528

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Unnamed Project

Replication 1   Start Time: 240.00   Stop Time: 720.00   Time Units: Hours

Process

Other

Category by Replication

Number Out	Value
Trauma Patient gets bed	0
Triage Area	1,638
Xrays	282
Xrays Bedside	41

Queue

Time

114

Unnamed Project

Replication 1	Start Time:	240.00	Stop Time:	720.00	Time Units: Hours

Queue

Category by Replication

Time

Waiting Time	Average	Half Width	Minimum	Maximum
24 Hour Eval by MD Section 12.Queue	0.01128101	(Insufficient)	0	0.1796
Batch 5.Queue	0.02212326	(Insufficient)	0	0.1129
Batch 6.Queue	0.1038	(Insufficient)	0	0.6321
Bedside registration side A.Queue	0	(Insufficient)	0	0
Call Admitting MD.Queue	0	(Insufficient)	0	0
Call for Transport.Queue	0	(Insufficient)	0	0
Call Radiology B side.Queue	0	(Insufficient)	0	0
Call Radiology.Queue	0	(Insufficient)	0	0
Clean Side A Room.Queue	0.03408196	0.005678711	0	0.3766
Clean Side B Room.Queue	0.03752955	0.006092092	0	0.3276
Get Nurse.Queue	0	0.000000000	0	0
Infrared input by secretary.Queue	0	(Insufficient)	0	0
MD to MD talk.Queue	0.01498509	(Insufficient)	0	0.5428
Nurse helps patient leave.Queue	0	0.000000000	0	0
Radiologist to come to ED.Queue	0	(Insufficient)	0	0
RN RN discussion.Queue	0.01381700	(Insufficient)	0	0.2296
RN tests and Labs A.Queue	0	0.000000000	0	0
Second MD Exam on B Side.Queue	0.00956254	(Insufficient)	0	0.4085
Second Physician Examination.Queue	0.01839780	0.005782226	0	0.8249
Seize CT Tech and Nurse.Queue	0	(Insufficient)	0	0
Seize MDfor Side B.Queue	0	0.000000000	0	0

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Unnamed Project

Replication 1   Start Time: 240.00   Stop Time: 720.00   Time Units: Hours

Queue

Category by Replication

Time

Waiting Time	Average	Half Width	Minimum	Maximum
Seize MRI tech and Nurse.Queue	0	(Insufficient)	0	0
Seize Physician A.Queue	0	0.000000000	0	0
Seize Registration and Insurance.Queue	0	0.000000000	0	0
Seize Side A Room and Transport Nurse.Queue	0	0.000000000	0	0
Seize Side B Room and Transport Nurse.Queue	0	0.000000000	0	0
Seize Triage Nurse.Queue	0	0.000000000	0	0
Strip Side A Room.Queue	0	0.000000000	0	0
Strip Side B Room.Queue	0	0.000000000	0	0
Tests and Labs on Side B.Queue	0	0.000000000	0	0

Other

116

Unnamed Project

Replication 1	Start Time:	240.00	Stop Time:	720.00	Time Units:	Hours

Queue

Other

Category by Replication

Number Waiting	Average	Half Width	Minimum	Maximum
24 Hour Eval by MD Section 12.Queue	0.00235021	(Insufficient)	0	1.0000
Arrange for Sitter.Queue	1.0000	(Insufficient)	1.0000	1.0000
Batch 11.Queue	0	(Insufficient)	0	0
Batch 4.Queue	0	(Insufficient)	0	0
Batch 5.Queue	0.01327396	(Insufficient)	0	2.0000
Batch 6.Queue	0.04324546	(Insufficient)	0	3.0000
Batch 7.Queue	5.0000	(Insufficient)	5.0000	5.0000
Bedside registration MH.Queue	0	(Insufficient)	0	0
Bedside registration side A.Queue	0	(Insufficient)	0	0
Call Admitting MD.Queue	0	(Insufficient)	0	0
Call for ED Transport.Queue	0	(Insufficient)	0	0
Call for Transport.Queue	0	(Insufficient)	0	0
Call Radiology B side.Queue	0	(Insufficient)	0	0
Call Radiology.Queue	0	(Insufficient)	0	0
Call transport for Trauma.Queue	0	(Insufficient)	0	0
Call transport to Helicopter.Queue	0	(Insufficient)	0	0
Clean MH Room.Queue	0	(Insufficient)	0	0
Clean Side A Room.Queue	0.04352550	0.008283675	0	2.0000
Clean Side B Room.Queue	0.04128251	0.008008272	0	2.0000
Clean Trauma Room.Queue	0	(Insufficient)	0	0
Clerk Call Admitting MD.Queue	0	(Insufficient)	0	0
Clerk calls for Lipton.Queue	0	(Insufficient)	0	0

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Unnamed Project

Replication 1	Start Time:	240.00	Stop Time:	720.00	Time Units:	Hours

Queue

Other

Category by Replication

Number Waiting	Average	Half Width	Minimum	Maximum
ED Infrared input by secretary.Queue	0	(Insufficient)	0	0
ED MD Admitting MD talk.Queue	0	(Insufficient)	0	0
Get Nurse.Queue	0	(Insufficient)	0	0
Infrared input by secretary.Queue	0	(Insufficient)	0	0
MD to MD talk.Queue	0.00540088	(Insufficient)	0	1.0000
Medical Clearance.Queue	0	(Insufficient)	0	0
Nurse fills out MH papers.Queue	0	(Insufficient)	0	0
Nurse helps patient leave.Queue	0	(Insufficient)	0	0
Nurse Nurse discussion.Queue	0	(Insufficient)	0	0
Radiologist to come to ED.Queue	0	(Insufficient)	0	0
RN RN discussion.Queue	0.00495109	(Insufficient)	0	1.0000
RN tests and Labs A.Queue	0	(Insufficient)	0	0
Second MD Exam on B Side.Queue	0.00258985	(Insufficient)	0	1.0000
Second Physician Examination.Queue	0.02349553	(Insufficient)	0	3.0000
Seize CT Tech and Nurse.Queue	0	(Insufficient)	0	0
Seize EKG and Tech.Queue	405.16	(Correlated)	213.00	605.00
Seize EKG.Queue	0	(Insufficient)	0	0
Seize MDfor Side B.Queue	0	(Insufficient)	0	0
Seize Mental Health nurse.Queue	0	(Insufficient)	0	0
Seize Mental Health Room and Nurse.Queue	90.3816	(Insufficient)	42.0000	148.00

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Unnamed Project

Replication 1

Start Time: 240.00   Stop Time: 720.00   Time Units: Hours

Queue

Category by Replication

Other

Number Waiting	Average	Half Width	Minimum	Maximum
Seize MRI tech and Nurse.Queue	0	(Insufficient)	0	0
Seize Physician A.Queue	0	(Insufficient)	0	0
Seize Registration and Insurance.Queue	0	(Insufficient)	0	0
Seize Room for Mental Health.Queue	37.1092	(Insufficient)	15.0000	62.0000
Seize Room.Queue	0	(Insufficient)	0	0
Seize Side A Room and Transport Nurse.Queue	0	(Insufficient)	0	0
Seize Side B Room and Transport Nurse.Queue	0	(Insufficient)	0	0
Seize Trauma Bed.Queue	228.64	(Insufficient)	114.00	349.00
Seize Triage Nurse.Queue	0	(Insufficient)	0	0
Strip MH Room.Queue	0	(Insufficient)	0	0
Strip Side A Room.Queue	0	(Insufficient)	0	0
Strip Side B Room.Queue	0	(Insufficient)	0	0
Strip Trauma Room.Queue	0	(Insufficient)	0	0
Tests and Labs on Side B.Queue	0	(Insufficient)	0	0
Triage.Queue	0	(Insufficient)	0	0

Resource

Usage

119

Unnamed Project

Replication 1

Start Time:	240.00	Stop Time:	720.00	Time Units: Hours

Resource

Category by Replication

Usage

Instantaneous Utilization	Average	Half Width	Minimum	Maximum
Bed 1	0	(Insufficient)	0	0
Bed 10	0.1990	(Insufficient)	0	1.0000
Bed 11	0.1979	(Insufficient)	0	1.0000
Bed 12	0.1875	(Insufficient)	0	1.0000
Bed 13	0.1902	(Insufficient)	0	1.0000
Bed 14	1.0000	(Insufficient)	1.0000	1.0000
Bed 15	1.0000	(Insufficient)	1.0000	1.0000
Bed 16	1.0000	(Insufficient)	1.0000	1.0000
Bed 17	1.0000	(Insufficient)	1.0000	1.0000
Bed 18	1.0000	(Insufficient)	1.0000	1.0000
Bed 2	0	(Insufficient)	0	0
Bed 20	0.1533	(Insufficient)	0	1.0000
Bed 21	0.1495	(Insufficient)	0	1.0000
Bed 22	0.1528	(Insufficient)	0	1.0000
Bed 23	0.1597	(Insufficient)	0	1.0000
Bed 24	0.1568	(Insufficient)	0	1.0000
Bed 25	0.1575	(Insufficient)	0	1.0000
Bed 3	0	(Insufficient)	0	0
Bed 4	0.1918	(Insufficient)	0	1.0000
Bed 5	0.1927	(Insufficient)	0	1.0000
Bed 6	0.1816	(Insufficient)	0	1.0000
Bed 7	0.1819	(Insufficient)	0	1.0000
Bed 8	0.1827	(Insufficient)	0	1.0000
Bed 9	0.1861	(Insufficient)	0	1.0000
Charge Nurse	1.0000	(Insufficient)	1.0000	1.0000
Cleaning Staff	0.3962	0.016184055	0	1.0000
Clerk 1	0.01175694	0.002224736	0	1.0000

120

Unnamed Project

Replication 1

Start Time:	240.00	Stop Time:	720.00	Time Units: Hours

Resource

Category by Replication

Usage

Instantaneous Utilization	Average	Half Width	Minimum	Maximum
Clerk 2	0.01251240	0.002543323	0	1.0000
CT Machine 1	0.03729530	(Insufficient)	0	1.0000
CT Machine 2	0.03273024	(Insufficient)	0	1.0000
CT Tech 1	0.03825179	(Insufficient)	0	1.0000
CT Tech 2	0.04017652	(Insufficient)	0	1.0000
ED Transport	0.00597222	0.000928510	0	0.4000
EKG Machine 1	0	(Insufficient)	0	0
EKG Machine 2	0	(Insufficient)	0	0
EKG Machine 3	0	(Insufficient)	0	0
Float Nurse	0.1704	0.014096754	0	1.0000
MD 1	0.1394	0.013656282	0	1.0000
MD 2	0.1694	0.014595303	0	1.0000
MD 3	0.1301	0.018311211	0	1.0000
MD 4	0.1561	0.021226329	0	1.0000
MD 5	0.1290	0.015961836	0	1.0000
Mental Health Group Room	1.0000	(Insufficient)	1.0000	1.0000
MRI Machine 1	0.04872363	(Insufficient)	0	1.0000
MRI Machine 2	0.04924208	(Insufficient)	0	1.0000
MRI Tech 1	0.05660134	(Insufficient)	0	1.0000
MRI Tech 2	0.05289215	(Insufficient)	0	1.0000
Nurse 1	0.1994	0.015621215	0	1.0000
Nurse 2	0.1686	0.015729319	0	1.0000
Nurse 3	0.1534	0.014367137	0	1.0000
Nurse 4	0.1570	(Correlated)	0	1.0000
Nurse 5	0.1603	0.014899643	0	1.0000
Portable Xray 1	0.01725849	(Insufficient)	0	1.0000
Portable Xray 2	0.01463751	(Insufficient)	0	1.0000

121

Unnamed Project

Replication 1
Start Time: 240.00   Stop Time: 720.00   Time Units: Hours

Resource

Category by Replication

Usage

Instantaneous Utilization	Average	Half Width	Minimum	Maximum
Radiologist	0	(Insufficient)	0	0
Registration 1	0.1482	0.012289742	0	1.0000
Registration 2	0.1453	0.009283630	0	1.0000
Sitter 1	1.0000	(Insufficient)	1.0000	1.0000
Sitter 2	1.0000	(Insufficient)	1.0000	1.0000
Tech 1	1.0000	(Insufficient)	1.0000	1.0000
Tech 2	1.0000	(Insufficient)	1.0000	1.0000
Tech 3	1.0000	(Insufficient)	1.0000	1.0000
Triage Nurse	0.4382	0.009416875	0	1.0000
Xray Machine 1	0.03820571	(Insufficient)	0	1.0000
Xray Machine 2	0.03237434	(Insufficient)	0	1.0000
Xray Machine 3	0.03245276	(Insufficient)	0	1.0000
Xray Machine 4	0.03831710	(Insufficient)	0	1.0000
Xray Tech 1	0.03366081	(Insufficient)	0	1.0000
Xray Tech 2	0.04210373	(Insufficient)	0	1.0000
Xray Tech 3	0.02512357	(Insufficient)	0	1.0000
Xray Tech 4	0.03166788	(Insufficient)	0	1.0000
Xray Tech 5	0.02967580	(Insufficient)	0	1.0000
Xray Tech 6	0.03059744	(Insufficient)	0	1.0000

122

Unnamed Project   Replications: 3

Replication 1   Start Time: 240.00   Stop Time: 720.00   Time Units: Hours

Resource

Category by Replication

Usage

Number Busy	Average	Half Width	Minimum	Maximum
Bed 1	0	(Insufficient)	0	0
Bed 10	0.1990	(Insufficient)	0	1.0000
Bed 11	0.1979	(Insufficient)	0	1.0000
Bed 12	0.1875	(Insufficient)	0	1.0000
Bed 13	0.1902	(Insufficient)	0	1.0000
Bed 14	1.0000	(Insufficient)	1.0000	1.0000
Bed 15	1.0000	(Insufficient)	1.0000	1.0000
Bed 16	1.0000	(Insufficient)	1.0000	1.0000
Bed 17	1.0000	(Insufficient)	1.0000	1.0000
Bed 18	1.0000	(Insufficient)	1.0000	1.0000
Bed 2	0	(Insufficient)	0	0
Bed 20	0.1533	(Insufficient)	0	1.0000
Bed 21	0.1495	(Insufficient)	0	1.0000
Bed 22	0.1528	(Insufficient)	0	1.0000
Bed 23	0.1597	(Insufficient)	0	1.0000
Bed 24	0.1568	(Insufficient)	0	1.0000
Bed 25	0.1575	(Insufficient)	0	1.0000
Bed 3	0	(Insufficient)	0	0
Bed 4	0.1918	(Insufficient)	0	1.0000
Bed 5	0.1927	(Insufficient)	0	1.0000
Bed 6	0.1816	(Insufficient)	0	1.0000
Bed 7	0.1819	(Insufficient)	0	1.0000
Bed 8	0.1827	(Insufficient)	0	1.0000
Bed 9	0.1861	(Insufficient)	0	1.0000
Charge Nurse	1.0000	(Insufficient)	1.0000	1.0000
Cleaning Staff	0.3962	0.016184055	0	1.0000
Clerk 1	0.01175694	0.002224736	0	1.0000

123

Unnamed Project

Replication 1	Start Time:	240.00	Stop Time:	720.00	Time Units:	Hours

Resource

Category by Replication

Usage

Number Busy	Average	Half Width	Minimum	Maximum
Clerk 2	0.01251240	0.002543323	0	1.0000
CT Machine 1	0.03729530	(Insufficient)	0	1.0000
CT Machine 2	0.03273024	(Insufficient)	0	1.0000
CT Tech 1	0.03825179	(Insufficient)	0	1.0000
CT Tech 2	0.04017652	(Insufficient)	0	1.0000
ED Transport	0.02986111	0.004642551	0	2.0000
EKG Machine 1	0	(Insufficient)	0	0
EKG Machine 2	0	(Insufficient)	0	0
EKG Machine 3	0	(Insufficient)	0	0
Float Nurse	0.1704	0.014096754	0	1.0000
MD 1	0.1394	0.013656282	0	1.0000
MD 2	0.1694	0.014595303	0	1.0000
MD 3	0.1301	0.018311211	0	1.0000
MD 4	0.1561	0.021226329	0	1.0000
MD 5	0.1290	0.015961836	0	1.0000
Mental Health Group Room	1.0000	(Insufficient)	1.0000	1.0000
MRI Machine 1	0.04872363	(Insufficient)	0	1.0000
MRI Machine 2	0.04924208	(Insufficient)	0	1.0000
MRI Tech 1	0.05660134	(Insufficient)	0	1.0000
MRI Tech 2	0.05289215	(Insufficient)	0	1.0000
Nurse 1	0.1994	0.015621215	0	1.0000
Nurse 2	0.1686	0.015729319	0	1.0000
Nurse 3	0.1534	0.014367137	0	1.0000
Nurse 4	0.1570	(Correlated)	0	1.0000
Nurse 5	0.1603	0.014899643	0	1.0000
Portable Xray 1	0.01725849	(Insufficient)	0	1.0000
Portable Xray 2	0.01463751	(Insufficient)	0	1.0000

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Unnamed Project

Replication 1   Start Time: 240.00   Stop Time: 720.00   Time Units: Hours

Resource

Category by Replication

Usage

Number Busy	Average	Half Width	Minimum	Maximum
Radiologist	0	(Insufficient)	0	0
Registration 1	0.1482	0.012289742	0	1.0000
Registration 2	0.1453	0.009283630	0	1.0000
Sitter 1	1.0000	(Insufficient)	1.0000	1.0000
Sitter 2	1.0000	(Insufficient)	1.0000	1.0000
Tech 1	1.0000	(Insufficient)	1.0000	1.0000
Tech 2	1.0000	(Insufficient)	1.0000	1.0000
Tech 3	1.0000	(Insufficient)	1.0000	1.0000
Triage Nurse	0.4382	0.009416875	0	1.0000
Xray Machine 1	0.03820571	(Insufficient)	0	1.0000
Xray Machine 2	0.03237434	(Insufficient)	0	1.0000
Xray Machine 3	0.03245276	(Insufficient)	0	1.0000
Xray Machine 4	0.03831710	(Insufficient)	0	1.0000
Xray Tech 1	0.03366081	(Insufficient)	0	1.0000
Xray Tech 2	0.04210373	(Insufficient)	0	1.0000
Xray Tech 3	0.02512357	(Insufficient)	0	1.0000
Xray Tech 4	0.03166788	(Insufficient)	0	1.0000
Xray Tech 5	0.02967580	(Insufficient)	0	1.0000
Xray Tech 6	0.03059744	(Insufficient)	0	1.0000

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Unnamed Project

Replication 1

Start Time:	240.00	Stop Time:	720.00	Time Units: Hours

Resource

Category by Replication

Usage

Number Scheduled	Average	Half Width	Minimum	Maximum
Bed 1	1.0000	(Insufficient)	1.0000	1.0000
Bed 10	1.0000	(Insufficient)	1.0000	1.0000
Bed 11	1.0000	(Insufficient)	1.0000	1.0000
Bed 12	1.0000	(Insufficient)	1.0000	1.0000
Bed 13	1.0000	(Insufficient)	1.0000	1.0000
Bed 14	1.0000	(Insufficient)	1.0000	1.0000
Bed 15	1.0000	(Insufficient)	1.0000	1.0000
Bed 16	1.0000	(Insufficient)	1.0000	1.0000
Bed 17	1.0000	(Insufficient)	1.0000	1.0000
Bed 18	1.0000	(Insufficient)	1.0000	1.0000
Bed 2	1.0000	(Insufficient)	1.0000	1.0000
Bed 20	1.0000	(Insufficient)	1.0000	1.0000
Bed 21	1.0000	(Insufficient)	1.0000	1.0000
Bed 22	1.0000	(Insufficient)	1.0000	1.0000
Bed 23	1.0000	(Insufficient)	1.0000	1.0000
Bed 24	1.0000	(Insufficient)	1.0000	1.0000
Bed 25	1.0000	(Insufficient)	1.0000	1.0000
Bed 3	1.0000	(Insufficient)	1.0000	1.0000
Bed 4	1.0000	(Insufficient)	1.0000	1.0000
Bed 5	1.0000	(Insufficient)	1.0000	1.0000
Bed 6	1.0000	(Insufficient)	1.0000	1.0000
Bed 7	1.0000	(Insufficient)	1.0000	1.0000
Bed 8	1.0000	(Insufficient)	1.0000	1.0000
Bed 9	1.0000	(Insufficient)	1.0000	1.0000
Charge Nurse	1.0000	(Insufficient)	1.0000	1.0000
Cleaning Staff	1.0000	(Insufficient)	1.0000	1.0000
Clerk 1	1.0000	(Insufficient)	1.0000	1.0000

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Unnamed Project

Replication 1

Start Time:	240.00	Stop Time:	720.00	Time Units: Hours

Resource

Usage

Category by Replication

Number Scheduled	Average	Half Width	Minimum	Maximum
Clerk 2	1.0000	(Insufficient)	1.0000	1.0000
CT Machine 1	1.0000	(Insufficient)	1.0000	1.0000
CT Machine 2	1.0000	(Insufficient)	1.0000	1.0000
CT Tech 1	1.0000	(Insufficient)	1.0000	1.0000
CT Tech 2	1.0000	(Insufficient)	1.0000	1.0000
ED Transport	5.0000	(Insufficient)	5.0000	5.0000
EKG Machine 1	1.0000	(Insufficient)	1.0000	1.0000
EKG Machine 2	1.0000	(Insufficient)	1.0000	1.0000
EKG Machine 3	1.0000	(Insufficient)	1.0000	1.0000
Float Nurse	1.0000	(Insufficient)	1.0000	1.0000
MD 1	1.0000	(Insufficient)	1.0000	1.0000
MD 2	1.0000	(Insufficient)	1.0000	1.0000
MD 3	1.0000	(Insufficient)	1.0000	1.0000
MD 4	1.0000	(Insufficient)	1.0000	1.0000
MD 5	1.0000	(Insufficient)	1.0000	1.0000
Mental Health Group Room	1.0000	(Insufficient)	1.0000	1.0000
MRI Machine 1	1.0000	(Insufficient)	1.0000	1.0000
MRI Machine 2	1.0000	(Insufficient)	1.0000	1.0000
MRI Tech 1	1.0000	(Insufficient)	1.0000	1.0000
MRI Tech 2	1.0000	(Insufficient)	1.0000	1.0000
Nurse 1	1.0000	(Insufficient)	1.0000	1.0000
Nurse 2	1.0000	(Insufficient)	1.0000	1.0000
Nurse 3	1.0000	(Insufficient)	1.0000	1.0000
Nurse 4	1.0000	(Insufficient)	1.0000	1.0000
Nurse 5	1.0000	(Insufficient)	1.0000	1.0000
Portable Xray 1	1.0000	(Insufficient)	1.0000	1.0000
Portable Xray 2	1.0000	(Insufficient)	1.0000	1.0000

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Unnamed Project

Replication 1

Start Time:	240.00	Stop Time:	720.00	Time Units:	Hours

Resource

Category by Replication

Usage

Number Scheduled	Average	Half Width	Minimum	Maximum
Radiologist	1.0000	(Insufficient)	1.0000	1.0000
Registration 1	1.0000	(Insufficient)	1.0000	1.0000
Registration 2	1.0000	(Insufficient)	1.0000	1.0000
Sitter 1	1.0000	(Insufficient)	1.0000	1.0000
Sitter 2	1.0000	(Insufficient)	1.0000	1.0000
Tech 1	1.0000	(Insufficient)	1.0000	1.0000
Tech 2	1.0000	(Insufficient)	1.0000	1.0000
Tech 3	1.0000	(Insufficient)	1.0000	1.0000
Triage Nurse	1.0000	(Insufficient)	1.0000	1.0000
Xray Machine 1	1.0000	(Insufficient)	1.0000	1.0000
Xray Machine 2	1.0000	(Insufficient)	1.0000	1.0000
Xray Machine 3	1.0000	(Insufficient)	1.0000	1.0000
Xray Machine 4	1.0000	(Insufficient)	1.0000	1.0000
Xray Tech 1	1.0000	(Insufficient)	1.0000	1.0000
Xray Tech 2	1.0000	(Insufficient)	1.0000	1.0000
Xray Tech 3	1.0000	(Insufficient)	1.0000	1.0000
Xray Tech 4	1.0000	(Insufficient)	1.0000	1.0000
Xray Tech 5	1.0000	(Insufficient)	1.0000	1.0000
Xray Tech 6	1.0000	(Insufficient)	1.0000	1.0000

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Unnamed Project   Replications: 3

Replication 1   Start Time: 240.00   Stop Time: 720.00   Time Units: Hours

Resource

Category by Replication

Usage

Scheduled Utilization	Value
Bed 1	0
Bed 10	0.1990
Bed 11	0.1979
Bed 12	0.1875
Bed 13	0.1902
Bed 14	1.0000
Bed 15	1.0000
Bed 16	1.0000
Bed 17	1.0000
Bed 18	1.0000
Bed 2	0
Bed 20	0.1533
Bed 21	0.1495
Bed 22	0.1528
Bed 23	0.1597
Bed 24	0.1568
Bed 25	0.1575
Bed 3	0
Bed 4	0.1918
Bed 5	0.1927
Bed 6	0.1816
Bed 7	0.1819
Bed 8	0.1827
Bed 9	0.1861
Charge Nurse	1.0000
Cleaning Staff	0.3962
Clerk 1	0.01175694

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Unnamed Project

Replication 1   Start Time: 240.00   Stop Time: 720.00   Time Units: Hours

Resource

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Category by Replication

</div>

Usage

Scheduled Utilization	Value
Clerk 2	0.01251240
CT Machine 1	0.03729530
CT Machine 2	0.03273024
CT Tech 1	0.03825179
CT Tech 2	0.04017652
ED Transport	0.00597222
EKG Machine 1	0
EKG Machine 2	0
EKG Machine 3	0
Float Nurse	0.1704
MD 1	0.1394
MD 2	0.1694
MD 3	0.1301
MD 4	0.1561
MD 5	0.1290
Mental Health Group Room	1.0000
MRI Machine 1	0.04872363
MRI Machine 2	0.04924208
MRI Tech 1	0.05660134
MRI Tech 2	0.05289215
Nurse 1	0.1994
Nurse 2	0.1686
Nurse 3	0.1534
Nurse 4	0.1570
Nurse 5	0.1603
Portable Xray 1	0.01725849
Portable Xray 2	0.01463751

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Unnamed Project

Replication 1

Start Time:	240.00	Stop Time:	720.00	Time Units:	Hours

Resource

Category by Replication

Usage

Scheduled Utilization	Value
Radiologist	0
Registration 1	0.1482
Registration 2	0.1453
Sitter 1	1.0000
Sitter 2	1.0000
Tech 1	1.0000
Tech 2	1.0000
Tech 3	1.0000
Triage Nurse	0.4382
Xray Machine 1	0.03820571
Xray Machine 2	0.03237434
Xray Machine 3	0.03245276
Xray Machine 4	0.03831710
Xray Tech 1	0.03366081
Xray Tech 2	0.04210373
Xray Tech 3	0.02512357
Xray Tech 4	0.03166788
Xray Tech 5	0.02967580
Xray Tech 6	0.03059744

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Unnamed Project

Replication 1	Start Time:	240.00	Stop Time:	720.00	Time Units: Hours

Resource

Category by Replication

Usage

Total Number Seized	Value
Bed 1	0
Bed 10	61.0000
Bed 11	62.0000
Bed 12	62.0000
Bed 13	61.0000
Bed 14	0
Bed 15	0
Bed 16	0
Bed 17	0
Bed 18	0
Bed 2	0
Bed 20	88.0000
Bed 21	88.0000
Bed 22	87.0000
Bed 23	88.0000
Bed 24	88.0000
Bed 25	88.0000
Bed 3	0
Bed 4	61.0000
Bed 5	61.0000
Bed 6	61.0000
Bed 7	61.0000
Bed 8	61.0000
Bed 9	61.0000
Charge Nurse	0
Cleaning Staff	1,141.00
Clerk 1	168.00

132

Unnamed Project

Replication 1

Start Time:	240.00	Stop Time:	720.00	Time Units: Hours

Resource

Category by Replication

Usage

Total Number Seized	Value
Clerk 2	178.00
CT Machine 1	64.0000
CT Machine 2	57.0000
CT Tech 1	59.0000
CT Tech 2	62.0000
ED Transport	172.00
EKG Machine 1	0
EKG Machine 2	0
EKG Machine 3	0
Float Nurse	1,518.00
MD 1	417.00
MD 2	463.00
MD 3	429.00
MD 4	417.00
MD 5	430.00
Mental Health Group Room	0
MRI Machine 1	82.0000
MRI Machine 2	83.0000
MRI Tech 1	86.0000
MRI Tech 2	79.0000
Nurse 1	1,309.00
Nurse 2	717.00
Nurse 3	622.00
Nurse 4	586.00
Nurse 5	591.00
Portable Xray 1	22.0000
Portable Xray 2	19.0000

133

Unnamed Project

Replication 1

Start Time:	240.00	Stop Time:	720.00	Time Units: Hours

Resource

Category by Replication

Usage

Total Number Seized	Value
Radiologist	0
Registration 1	707.00
Registration 2	683.00
Sitter 1	0
Sitter 2	0
Tech 1	0
Tech 2	0
Tech 3	0
Triage Nurse	1,638.00
Xray Machine 1	76.0000
Xray Machine 2	65.0000
Xray Machine 3	65.0000
Xray Machine 4	76.0000
Xray Tech 1	56.0000
Xray Tech 2	70.0000
Xray Tech 3	43.0000
Xray Tech 4	52.0000
Xray Tech 5	51.0000
Xray Tech 6	51.0000

System

Other

Number Out	Value
System	6,122

User Specified

134

Unnamed Project

Replication 1   Start Time: 240.00   Stop Time: 720.00   Time Units: Hours

User Specified

Category by Replication

Counter

Count	Value
Record 24	0
Record Errors	0
Record Errors6	0

Replication 2   Start Time: 240.00   Stop Time: 720.00   Time Units: Hours

Entity

Time

VA Time	Average	Half Width	Minimum	Maximum
Patient Arrival	0.1847	0.004776503	0	1.4772

NVA Time	Average	Half Width	Minimum	Maximum
Patient Arrival	0.03660670	0.000913856	0	0.2000

Wait Time	Average	Half Width	Minimum	Maximum
Patient Arrival	0.01019281	0.001299383	0	0.8580

Transfer Time	Average	Half Width	Minimum	Maximum
Patient Arrival	0.03934987	0.000495981	0.02083333	0.08750000

Other Time	Average	Half Width	Minimum	Maximum
Patient Arrival	0.01840238	0.002657777	0	0.8333

Total Time	Average	Half Width	Minimum	Maximum
Patient Arrival	0.2934	0.008739686	0.03333333	3.0377

Other

135

Unnamed Project

Replication 2   Start Time: 240.00   Stop Time: 720.00   Time Units: Hours

Entity

Category by Replication

Other

Number In	Value
Entity 1	0
Patient Arrival	5,429
Patient_Acuity_1	0

Number Out	Value
Entity 1	0
Patient Arrival	4,381
Patient_Acuity_1	0

WIP	Average	Half Width	Minimum	Maximum
Entity 1	0	(Insufficient)	0	0
Patient Arrival	940.19	(Correlated)	423.00	1,473.00
Patient_Acuity_1	0	(Insufficient)	0	0

Process

Time per Entity

136

Unnamed Project

Replication 2	Start Time:	240.00	Stop Time:	720.00	Time Units: Hours

Process

Category by Replication

Time per Entity

VA Time Per Entity	Average	Half Width	Minimum	Maximum
24 Hour Eval by Lipton Section 12	0.5002	(Insufficient)	0.2516	0.9444
24 Hour Eval by MD Section 12	0.5111	(Insufficient)	0.2520	0.9791
Bedside registration side A	0.0980	(Insufficient)	0.04214520	0.1506
Call Admitting MD	0.03382827	(Insufficient)	0.01835304	0.04834093
CT Scan	0.2498	(Insufficient)	0.1721	0.3201
Discharge Notes B side	0.05829210	0.000940929	0.03450979	0.08257766
Infrared input by secretary	0.03340486	(Insufficient)	0.01681836	0.04766540
MD Exam on Side B	0.1898	0.002450824	0.1379	0.2446
MD to MD talk	0.05816508	(Insufficient)	0.03501825	0.08194282
MRI	0.2467	(Insufficient)	0.1717	0.3206
Nurse Does Discharge	0.1667	(Correlated)	0.1667	0.1667
Nurse helps patient leave	0.05567554	0.001105534	0.03519600	0.08235046
Physician Examination A	0.1924	0.001810825	0.1338	0.2487
Pull IV	0.03334048	0.000659111	0.01764118	0.04941625
Registration and Insurance	0.1002	0.001745669	0.03524996	0.1632
RN RN discussion	0.1187	(Insufficient)	0.05572266	0.1970
RN tests and Labs A	0.2078	0.001087524	0.1677	0.2481
Second MD Exam on B Side	0.05915038	(Insufficient)	0.03667968	0.08144113
Second Physician Examination	0.05776847	0.000861987	0.03514187	0.08266386
Tests and Labs on Side B	0.2098	(Correlated)	0.1712	0.2491
Triage Area	0.1247	0.000802990	0.08382497	0.1653
Xrays	0.2077	(Insufficient)	0.1714	0.2495
Xrays Bedside	0.2092	(Insufficient)	0.1732	0.2376

137

Unnamed Project

Replication 2	Start Time:	240.00	Stop Time:	720.00	Time Units: Hours

Process

Category by Replication

Time per Entity

NVA Time Per Entity	Average	Half Width	Minimum	Maximum
Clean Side A Room	0.1667	(Correlated)	0.1667	0.1667
Clean Side B Room	0.1667	(Correlated)	0.1667	0.1667
Strip Side A Room	0.03333333	(Correlated)	0.03333333	0.03333333
Strip Side B Room	0.03333333	(Correlated)	0.03333333	0.03333333

Wait Time Per Entity	Average	Half Width	Minimum	Maximum
24 Hour Eval by MD Section 12	0.01023586	(Insufficient)	0	0.1815
Bedside registration side A	0	(Insufficient)	0	0
Call Admitting MD	0	(Insufficient)	0	0
Clean Side A Room	0.03795311	0.007034592	0	0.4091
Clean Side B Room	0.03040358	(Correlated)	0	0.3658
Infrared input by secretary	0	(Insufficient)	0	0
MD to MD talk	0.01974987	(Insufficient)	0	0.5993
Nurse helps patient leave	0	0.000000000	0	0
RN RN discussion	0.02522080	(Insufficient)	0	0.2579
RN tests and Labs A	0	0.000000000	0	0
Second MD Exam on B Side	0.01087736	(Insufficient)	0	0.1722
Second Physician Examination	0.01659503	0.005479448	0	0.7554
Strip Side A Room	0.00003171	0.000066117	0	0.01918685
Strip Side B Room	0	0.000000000	0	0
Tests and Labs on Side B	0	0.000000000	0	0

138

Unnamed Project

Replication 2	Start Time:	240.00	Stop Time:	720.00	Time Units: Hours

Process

Category by Replication

Time per Entity

Total Time Per Entity	Average	Half Width	Minimum	Maximum
24 Hour Eval by Lipton Section 12	0.5002	(Insufficient)	0.2516	0.9444
24 Hour Eval by MD Section 12	0.5213	(Insufficient)	0.2520	0.9791
Bedside registration side A	0.0980	(Insufficient)	0.04214520	0.1506
Call Admitting MD	0.03382827	(Insufficient)	0.01835304	0.04834093
Clean Side A Room	0.2046	0.007034592	0.1667	0.5758
Clean Side B Room	0.1971	(Correlated)	0.1667	0.5325
CT Scan	0.2498	(Insufficient)	0.1721	0.3201
Discharge Notes B side	0.05829210	0.000940929	0.03450979	0.08257766
Infrared input by secretary	0.03340486	(Insufficient)	0.01681836	0.04766540
MD Exam on Side B	0.1898	0.002450824	0.1379	0.2446
MD to MD talk	0.07791495	(Insufficient)	0.03501825	0.6810
MRI	0.2467	(Insufficient)	0.1717	0.3206
Nurse Does Discharge	0.1667	(Correlated)	0.1667	0.1667
Nurse helps patient leave	0.05567554	0.001105534	0.03519600	0.08235046
Physician Examination A	0.1924	0.001810825	0.1338	0.2487
Pull IV	0.03334048	0.000659111	0.01764118	0.04941625
Registration and Insurance	0.1002	0.001745669	0.03524996	0.1632
RN RN discussion	0.1439	(Insufficient)	0.06228584	0.3727
RN tests and Labs A	0.2078	0.001087524	0.1677	0.2481
Second MD Exam on B Side	0.07002774	(Insufficient)	0.03667968	0.2445
Second Physician Examination	0.07436350	0.005586693	0.03514187	0.8216
Strip Side A Room	0.03336505	0.000066117	0.03333333	0.05252019
Strip Side B Room	0.03333333	(Correlated)	0.03333333	0.03333333
Tests and Labs on Side B	0.2098	(Correlated)	0.1712	0.2491
Triage Area	0.1247	0.000802990	0.08382497	0.1653

139

Unnamed Project

Replication 2

Start Time:	240.00	Stop Time:	720.00	Time Units:	Hours

Process

Category by Replication

Time per Entity

Total Time Per Entity	Average	Half Width	Minimum	Maximum
Xrays	0.2077	(Insufficient)	0.1714	0.2495
Xrays Bedside	0.2092	(Insufficient)	0.1732	0.2376

Accumulated Time

140

Unnamed Project

Replication 2 Start Time: 240.00 Stop Time: 720.00 Time Units: Hours

Process

Category by Replication

Accumulated Time

Accum VA Time	Value
24 Hour Eval by Lipton Section 12	59.0209
24 Hour Eval by MD Section 12	60.3066
Bedside registration MH	0
Bedside registration side A	11.8574
Call Admitting MD	5.3787
Clerk calls for Lipton	0
CT Scan	43.2142
Discharge Notes B side	25.8817
ED Infrared input by secretary	0
ED MD Admitting MD talk	0
EKG for patient	0
Hook up to telemetry and blood pressure	0
Infrared input by secretary	5.3448
MD Exam on Side B	96.0203
MD to MD talk	9.2482
Medical Clearance	0
MRI	35.0267
Nurse Does Discharge	74.1667
Nurse fills out Mental Health papers	0
Nurse fills out MH papers	0
Nurse helps patient leave	28.1161
Nurse Nurse discussion	0
Patient put in room and changed into HA attire	0

141

Unnamed Project

Replication 2

Start Time: 240.00   Stop Time: 720.00   Time Units: Hours

Process

Accumulated Time

Category by Replication

Accum VA Time	Value
Patient put in room and clothes changed	0
Physician Examination A	115.80
Pull IV	14.8032
Registration and Insurance	123.40
Remove Clothes and insert catheter	0
RN RN discussion	18.9867
RN tests and Labs A	125.31
RN tests and Labs Critical	0
Second MD Exam on B Side	6.3882
Second Physician Examination	34.8344
Sitter and Nurse review paperwork	0
Sitter and Nurse review paperwork during registration	0
Tests and Labs on Side B	106.15
Triage Area	203.46
Xrays	41.5416
Xrays Bedside	6.9021

142

Unnamed Project

Replication 2   Start Time: 240.00   Stop Time: 720.00   Time Units: Hours

Process

Category by Replication

Accumulated Time

Accum NVA Time	Value
Clean MH Room	0
Clean Side A Room	100.67
Clean Side B Room	84.1667
Clean Trauma Room	0
Clerk Call Admitting MD	0
Lipton Assessment	0
Strip MH Room	0
Strip Side A Room	20.1667
Strip Side B Room	16.8333
Strip Trauma Room	0
Trauma Patient gets bed	0

143

Unnamed Project   Replications: 3

Replication 2   Start Time: 240.00   Stop Time: 720.00   Time Units: Hours

Process

Category by Replication

Accumulated Time

Accum Wait Time	Value
24 Hour Eval by MD Section 12	1.2078
Bedside registration MH	0
Bedside registration side A	0
Call Admitting MD	0
Clean MH Room	0
Clean Side A Room	22.9237
Clean Side B Room	15.3538
Clean Trauma Room	0
Clerk Call Admitting MD	0
Clerk calls for Lipton	0
ED Infrared input by secretary	0
ED MD Admitting MD talk	0
Infrared input by secretary	0
MD to MD talk	3.1402
Medical Clearance	0
Nurse fills out MH papers	0
Nurse helps patient leave	0
Nurse Nurse discussion	0
RN RN discussion	4.0353
RN tests and Labs A	0
Second MD Exam on B Side	1.1748
Second Physician Examination	10.0068
Strip MH Room	0
Strip Side A Room	0.01918685
Strip Side B Room	0

144

Unnamed Project

Replication 2   Start Time: 240.00   Stop Time: 720.00   Time Units: Hours

Process

Category by Replication

Accumulated Time

Accum Wait Time	Value
Strip Trauma Room	0
Tests and Labs on Side B	0

Other

145

Unnamed Project

Replication 2

Start Time: 240.00   Stop Time: 720.00   Time Units: Hours

Process

Other

Category by Replication

Number In	Value
24 Hour Eval by Lipton Section 12	118
24 Hour Eval by MD Section 12	118
Bedside registration MH	0
Bedside registration side A	121
Call Admitting MD	159
Clean MH Room	0
Clean Side A Room	605
Clean Side B Room	505
Clean Trauma Room	0
Clerk Call Admitting MD	0
Clerk calls for Lipton	0
CT Scan	173
Discharge Notes B side	444
ED Infrared input by secretary	0
ED MD Admitting MD talk	0
EKG for patient	0
Hook up to telemetry and blood pressure	0
Infrared input by secretary	160
Lipton Assessment	0
MD Exam on Side B	506
MD to MD talk	159
Medical Clearance	0
MRI	142
Nurse Does Discharge	444

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Unnamed Project

Replication 2

Start Time: 240.00   Stop Time: 720.00   Time Units: Hours

Process

Category by Replication

Other

Number In	Value
Nurse fills out Mental Health papers	0
Nurse fills out MH papers	0
Nurse helps patient leave	505
Nurse Nurse discussion	0
Patient put in room and changed into HA attire	0
Patient put in room and clothes changed	0
Physician Examination A	603
Pull IV	444
Registration and Insurance	1,230
Remove Clothes and insert catheter	0
RN RN discussion	160
RN tests and Labs A	604
RN tests and Labs Critical	0
Second MD Exam on B Side	108
Second Physician Examination	603
Sitter and Nurse review paperwork	0
Sitter and Nurse review paperwork during registration	0
Strip MH Room	0
Strip Side A Room	605
Strip Side B Room	505
Strip Trauma Room	0
Tests and Labs on Side B	506

147

Unnamed Project   Replications: 3

Replication 2   Start Time: 240.00   Stop Time: 720.00   Time Units: Hours

Process

Category by Replication

Other

Number In	Value
Trauma Patient gets bed	0
Triage Area	1,631
Xrays	200
Xrays Bedside	33

148

Unnamed Project

Replication 2

| | Start Time: | 240.00 | Stop Time: | 720.00 | Time Units: | Hours |

Process

Category by Replication

Other

Number Out	Value
24 Hour Eval by Lipton Section 12	118
24 Hour Eval by MD Section 12	118
Bedside registration MH	0
Bedside registration side A	121
Call Admitting MD	159
Clean MH Room	0
Clean Side A Room	604
Clean Side B Room	505
Clean Trauma Room	0
Clerk Call Admitting MD	0
Clerk calls for Lipton	0
CT Scan	173
Discharge Notes B side	444
ED Infrared input by secretary	0
ED MD Admitting MD talk	0
EKG for patient	0
Hook up to telemetry and blood pressure	0
Infrared input by secretary	160
Lipton Assessment	0
MD Exam on Side B	506
MD to MD talk	159
Medical Clearance	0
MRI	142
Nurse Does Discharge	445

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Unnamed Project

Replication 2   Start Time: 240.00   Stop Time: 720.00   Time Units: Hours

Process

Category by Replication

Other

Number Out	Value
Nurse fills out Mental Health papers	0
Nurse fills out MH papers	0
Nurse helps patient leave	505
Nurse Nurse discussion	0
Patient put in room and changed into HA attire	0
Patient put in room and clothes changed	0
Physician Examination A	602
Pull IV	444
Registration and Insurance	1,231
Remove Clothes and insert catheter	0
RN RN discussion	160
RN tests and Labs A	603
RN tests and Labs Critical	0
Second MD Exam on B Side	108
Second Physician Examination	603
Sitter and Nurse review paperwork	0
Sitter and Nurse review paperwork during registration	0
Strip MH Room	0
Strip Side A Room	605
Strip Side B Room	505
Strip Trauma Room	0
Tests and Labs on Side B	506

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Unnamed Project

Replication 2	Start Time:	240.00	Stop Time:	720.00	Time Units:	Hours

Process

Category by Replication

Other

Number Out	Value
Trauma Patient gets bed	0
Triage Area	1,631
Xrays	200
Xrays Bedside	33

Queue

Time

Unnamed Project

Replication 2	Start Time:	240.00	Stop Time:	720.00	Time Units:	Hours

Queue

Time

Category by Replication

Waiting Time	Average	Half Width	Minimum	Maximum
24 Hour Eval by MD Section 12.Queue	0.01023586	(Insufficient)	0	0.1815
Batch 5.Queue	0.02151111	(Insufficient)	0	0.1083
Batch 6.Queue	0.1123	(Insufficient)	0	0.6556
Bedside registration side A.Queue	0	(Insufficient)	0	0
Call Admitting MD.Queue	0	(Insufficient)	0	0
Call for Transport.Queue	0	(Insufficient)	0	0
Call Radiology B side.Queue	0	(Insufficient)	0	0
Call Radiology.Queue	0	(Insufficient)	0	0
Clean Side A Room.Queue	0.03789037	0.007034592	0	0.4091
Clean Side B Room.Queue	0.03040358	(Correlated)	0	0.3658
Get Nurse.Queue	0	0.000000000	0	0
Infrared input by secretary.Queue	0	(Insufficient)	0	0
MD to MD talk.Queue	0.01974987	(Insufficient)	0	0.5993
Nurse helps patient leave.Queue	0	0.000000000	0	0
Radiologist to come to ED.Queue	0	(Insufficient)	0	0
RN RN discussion.Queue	0.02522080	(Insufficient)	0	0.2579
RN tests and Labs A.Queue	0	0.000000000	0	0
Second MD Exam on B Side.Queue	0.01087736	(Insufficient)	0	0.1722
Second Physician Examination.Queue	0.01659503	0.005479448	0	0.7554
Seize CT Tech and Nurse.Queue	0	(Insufficient)	0	0
Seize MDfor Side B.Queue	0	0.000000000	0	0

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Unnamed Project

Replication 2   Start Time: 240.00   Stop Time: 720.00   Time Units: Hours

Queue

Category by Replication

Time

Waiting Time	Average	Half Width	Minimum	Maximum
Seize MRI tech and Nurse.Queue	0	(Insufficient)	0	0
Seize Physician A.Queue	0	0.000000000	0	0
Seize Registration and Insurance.Queue	0	0.000000000	0	0
Seize Side A Room and Transport Nurse.Queue	0	0.000000000	0	0
Seize Side B Room and Transport Nurse.Queue	0	0.000000000	0	0
Seize Triage Nurse.Queue	0	0.000000000	0	0
Strip Side A Room.Queue	0.00003171	0.000066117	0	0.01918685
Strip Side B Room.Queue	0	0.000000000	0	0
Tests and Labs on Side B.Queue	0	0.000000000	0	0

Other

153

Unnamed Project

Replication 2

Start Time:	240.00	Stop Time:	720.00	Time Units:	Hours

Queue

Other

Category by Replication

Number Waiting	Average	Half Width	Minimum	Maximum
24 Hour Eval by MD Section 12.Queue	0.00251632	(Insufficient)	0	1.0000
Arrange for Sitter.Queue	0	(Insufficient)	0	0
Batch 11.Queue	0	(Insufficient)	0	0
Batch 4.Queue	0	(Insufficient)	0	0
Batch 5.Queue	0.01084519	(Insufficient)	0	2.0000
Batch 6.Queue	0.05521628	(Insufficient)	0	3.0000
Batch 7.Queue	6.0000	(Insufficient)	6.0000	6.0000
Bedside registration MH.Queue	0	(Insufficient)	0	0
Bedside registration side A.Queue	0	(Insufficient)	0	0
Call Admitting MD.Queue	0	(Insufficient)	0	0
Call for ED Transport.Queue	0	(Insufficient)	0	0
Call for Transport.Queue	0	(Insufficient)	0	0
Call Radiology B side.Queue	0	(Insufficient)	0	0
Call Radiology.Queue	0	(Insufficient)	0	0
Call transport for Trauma.Queue	0	(Insufficient)	0	0
Call transport to Helicopter.Queue	0	(Insufficient)	0	0
Clean MH Room.Queue	0	(Insufficient)	0	0
Clean Side A Room.Queue	0.04775766	0.009753180	0	3.0000
Clean Side B Room.Queue	0.03198710	(Insufficient)	0	2.0000
Clean Trauma Room.Queue	0	(Insufficient)	0	0
Clerk Call Admitting MD.Queue	0	(Insufficient)	0	0
Clerk calls for Lipton.Queue	0	(Insufficient)	0	0

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Unnamed Project

Replication 2	Start Time:	240.00	Stop Time:	720.00	Time Units: Hours

Queue

Other

Category by Replication

Number Waiting	Average	Half Width	Minimum	Maximum
ED Infrared input by secretary.Queue	0	(Insufficient)	0	0
ED MD Admitting MD talk.Queue	0	(Insufficient)	0	0
Get Nurse.Queue	0	(Insufficient)	0	0
Infrared input by secretary.Queue	0	(Insufficient)	0	0
MD to MD talk.Queue	0.00654214	(Insufficient)	0	1.0000
Medical Clearance.Queue	0	(Insufficient)	0	0
Nurse fills out MH papers.Queue	0	(Insufficient)	0	0
Nurse helps patient leave.Queue	0	(Insufficient)	0	0
Nurse Nurse discussion.Queue	0	(Insufficient)	0	0
Radiologist to come to ED.Queue	0	(Insufficient)	0	0
RN RN discussion.Queue	0.00840693	(Insufficient)	0	1.0000
RN tests and Labs A.Queue	0	(Insufficient)	0	0
Second MD Exam on B Side.Queue	0.00244741	(Insufficient)	0	1.0000
Second Physician Examination.Queue	0.02084751	(Insufficient)	0	1.0000
Seize CT Tech and Nurse.Queue	0	(Insufficient)	0	0
Seize EKG and Tech.Queue	349.41	(Correlated)	148.00	549.00
Seize EKG.Queue	0	(Insufficient)	0	0
Seize MDfor Side B.Queue	0	(Insufficient)	0	0
Seize Mental Health nurse.Queue	0	(Insufficient)	0	0
Seize Mental Health Room and Nurse.Queue	106.11	(Insufficient)	48.0000	169.00

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Unnamed Project

| Replication 2 | Start Time: | 240.00 | Stop Time: | 720.00 | Time Units: | Hours |

Queue

Category by Replication

Other

Number Waiting	Average	Half Width	Minimum	Maximum
Seize MRI tech and Nurse.Queue	0	(Insufficient)	0	0
Seize Physician A.Queue	0	(Insufficient)	0	0
Seize Registration and Insurance.Queue	0	(Insufficient)	0	0
Seize Room for Mental Health.Queue	38.4497	(Insufficient)	15.0000	64.0000
Seize Room.Queue	0	(Insufficient)	0	0
Seize Side A Room and Transport Nurse.Queue	0	(Insufficient)	0	0
Seize Side B Room and Transport Nurse.Queue	0	(Insufficient)	0	0
Seize Trauma Bed.Queue	207.24	(Insufficient)	92.0000	332.00
Seize Triage Nurse.Queue	0	(Insufficient)	0	0
Strip MH Room.Queue	0	(Insufficient)	0	0
Strip Side A Room.Queue	0.00003997	(Insufficient)	0	1.0000
Strip Side B Room.Queue	0	(Insufficient)	0	0
Strip Trauma Room.Queue	0	(Insufficient)	0	0
Tests and Labs on Side B.Queue	0	(Insufficient)	0	0
Triage.Queue	0	(Insufficient)	0	0

Resource

Usage

156

Unnamed Project

Replication 2

Start Time:	240.00	Stop Time:	720.00	Time Units:	Hours

Resource

Category by Replication

Usage

Instantaneous Utilization	Average	Half Width	Minimum	Maximum
Bed 1	0	(Insufficient)	0	0
Bed 10	0.1910	(Insufficient)	0	1.0000
Bed 11	0.1782	(Insufficient)	0	1.0000
Bed 12	0.1824	(Insufficient)	0	1.0000
Bed 13	0.1842	(Insufficient)	0	1.0000
Bed 14	1.0000	(Insufficient)	1.0000	1.0000
Bed 15	1.0000	(Insufficient)	1.0000	1.0000
Bed 16	1.0000	(Insufficient)	1.0000	1.0000
Bed 17	1.0000	(Insufficient)	1.0000	1.0000
Bed 18	1.0000	(Insufficient)	1.0000	1.0000
Bed 2	0	(Insufficient)	0	0
Bed 20	0.1495	(Insufficient)	0	1.0000
Bed 21	0.1434	(Insufficient)	0	1.0000
Bed 22	0.1452	(Insufficient)	0	1.0000
Bed 23	0.1449	(Insufficient)	0	1.0000
Bed 24	0.1435	(Insufficient)	0	1.0000
Bed 25	0.1440	(Insufficient)	0	1.0000
Bed 3	0	(Insufficient)	0	0
Bed 4	0.1778	(Insufficient)	0	1.0000
Bed 5	0.1826	(Insufficient)	0	1.0000
Bed 6	0.1848	(Insufficient)	0	1.0000
Bed 7	0.1866	(Insufficient)	0	1.0000
Bed 8	0.1861	(Insufficient)	0	1.0000
Bed 9	0.1780	(Insufficient)	0	1.0000
Charge Nurse	1.0000	(Insufficient)	1.0000	1.0000
Cleaning Staff	0.3852	0.014551618	0	1.0000
Clerk 1	0.01099780	(Insufficient)	0	1.0000

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Unnamed Project

Replication 2 Start Time: 240.00 Stop Time: 720.00 Time Units: Hours

Resource

Category by Replication

Usage

Instantaneous Utilization	Average	Half Width	Minimum	Maximum
Clerk 2	0.01134276	0.002133454	0	1.0000
CT Machine 1	0.05684732	(Insufficient)	0	1.0000
CT Machine 2	0.04519606	(Insufficient)	0	1.0000
CT Tech 1	0.05718310	(Insufficient)	0	1.0000
CT Tech 2	0.05687417	(Insufficient)	0	1.0000
ED Transport	0.00555556	0.000973187	0	0.4000
EKG Machine 1	0	(Insufficient)	0	0
EKG Machine 2	0	(Insufficient)	0	0
EKG Machine 3	0	(Insufficient)	0	0
Float Nurse	0.1648	0.015159972	0	1.0000
MD 1	0.1524	0.018139683	0	1.0000
MD 2	0.1422	0.015261362	0	1.0000
MD 3	0.1466	0.015256574	0	1.0000
MD 4	0.1530	0.014977251	0	1.0000
MD 5	0.1323	0.015019932	0	1.0000
Mental Health Group Room	1.0000	(Insufficient)	1.0000	1.0000
MRI Machine 1	0.04046226	(Insufficient)	0	1.0000
MRI Machine 2	0.04237106	(Insufficient)	0	1.0000
MRI Tech 1	0.04998330	(Insufficient)	0	1.0000
MRI Tech 2	0.04271114	(Insufficient)	0	1.0000
Nurse 1	1.0000	(Insufficient)	1.0000	1.0000
Nurse 2	0.2859	0.015838394	0	1.0000
Nurse 3	0.1987	0.016423380	0	1.0000
Nurse 4	0.1800	0.011874962	0	1.0000
Nurse 5	0.1485	0.014604009	0	1.0000
Portable Xray 1	0.01345836	(Insufficient)	0	1.0000
Portable Xray 2	0.01237930	(Insufficient)	0	1.0000

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Unnamed Project

Replications: 3

Replication 2	Start Time:	240.00	Stop Time:	720.00	Time Units:	Hours

Resource

Category by Replication

Usage

Instantaneous Utilization	Average	Half Width	Minimum	Maximum
Radiologist	0	(Insufficient)	0	0
Registration 1	0.1423	0.007568156	0	1.0000
Registration 2	0.1394	0.011877811	0	1.0000
Sitter 1	1.0000	(Insufficient)	1.0000	1.0000
Sitter 2	1.0000	(Insufficient)	1.0000	1.0000
Tech 1	1.0000	(Insufficient)	1.0000	1.0000
Tech 2	1.0000	(Insufficient)	1.0000	1.0000
Tech 3	1.0000	(Insufficient)	1.0000	1.0000
Triage Nurse	0.4380	0.010038983	0	1.0000
Xray Machine 1	0.02333379	(Insufficient)	0	1.0000
Xray Machine 2	0.03098019	(Insufficient)	0	1.0000
Xray Machine 3	0.02564011	(Insufficient)	0	1.0000
Xray Machine 4	0.02088037	(Insufficient)	0	1.0000
Xray Tech 1	0.02005758	(Insufficient)	0	1.0000
Xray Tech 2	0.03052489	(Insufficient)	0	1.0000
Xray Tech 3	0.02687815	(Insufficient)	0	1.0000
Xray Tech 4	0.02886020	(Insufficient)	0	1.0000
Xray Tech 5	0.01433101	(Insufficient)	0	1.0000
Xray Tech 6	0.01990919	(Insufficient)	0	1.0000

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Unnamed Project

Replication 2   Start Time: 240.00   Stop Time: 720.00   Time Units: Hours

Resource

Category by Replication

Usage

Number Busy	Average	Half Width	Minimum	Maximum
Bed 1	0	(Insufficient)	0	0
Bed 10	0.1910	(Insufficient)	0	1.0000
Bed 11	0.1782	(Insufficient)	0	1.0000
Bed 12	0.1824	(Insufficient)	0	1.0000
Bed 13	0.1842	(Insufficient)	0	1.0000
Bed 14	1.0000	(Insufficient)	1.0000	1.0000
Bed 15	1.0000	(Insufficient)	1.0000	1.0000
Bed 16	1.0000	(Insufficient)	1.0000	1.0000
Bed 17	1.0000	(Insufficient)	1.0000	1.0000
Bed 18	1.0000	(Insufficient)	1.0000	1.0000
Bed 2	0	(Insufficient)	0	0
Bed 20	0.1495	(Insufficient)	0	1.0000
Bed 21	0.1434	(Insufficient)	0	1.0000
Bed 22	0.1452	(Insufficient)	0	1.0000
Bed 23	0.1449	(Insufficient)	0	1.0000
Bed 24	0.1435	(Insufficient)	0	1.0000
Bed 25	0.1440	(Insufficient)	0	1.0000
Bed 3	0	(Insufficient)	0	0
Bed 4	0.1778	(Insufficient)	0	1.0000
Bed 5	0.1826	(Insufficient)	0	1.0000
Bed 6	0.1848	(Insufficient)	0	1.0000
Bed 7	0.1866	(Insufficient)	0	1.0000
Bed 8	0.1861	(Insufficient)	0	1.0000
Bed 9	0.1780	(Insufficient)	0	1.0000
Charge Nurse	1.0000	(Insufficient)	1.0000	1.0000
Cleaning Staff	0.3852	0.014551618	0	1.0000
Clerk 1	0.01099780	(Insufficient)	0	1.0000

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Unnamed Project

Replication 2	Start Time:	240.00	Stop Time:	720.00	Time Units: Hours

Resource

Category by Replication

Usage

Number Busy	Average	Half Width	Minimum	Maximum
Clerk 2	0.01134276	0.002133454	0	1.0000
CT Machine 1	0.05684732	(Insufficient)	0	1.0000
CT Machine 2	0.04519606	(Insufficient)	0	1.0000
CT Tech 1	0.05718310	(Insufficient)	0	1.0000
CT Tech 2	0.05687417	(Insufficient)	0	1.0000
ED Transport	0.02777778	0.004865934	0	2.0000
EKG Machine 1	0	(Insufficient)	0	0
EKG Machine 2	0	(Insufficient)	0	0
EKG Machine 3	0	(Insufficient)	0	0
Float Nurse	0.1648	0.015159972	0	1.0000
MD 1	0.1524	0.018139683	0	1.0000
MD 2	0.1422	0.015261362	0	1.0000
MD 3	0.1466	0.015256574	0	1.0000
MD 4	0.1530	0.014977251	0	1.0000
MD 5	0.1323	0.015019932	0	1.0000
Mental Health Group Room	1.0000	(Insufficient)	1.0000	1.0000
MRI Machine 1	0.04046226	(Insufficient)	0	1.0000
MRI Machine 2	0.04237106	(Insufficient)	0	1.0000
MRI Tech 1	0.04998330	(Insufficient)	0	1.0000
MRI Tech 2	0.04271114	(Insufficient)	0	1.0000
Nurse 1	1.0000	(Insufficient)	1.0000	1.0000
Nurse 2	0.2859	0.015838394	0	1.0000
Nurse 3	0.1987	0.016423380	0	1.0000
Nurse 4	0.1800	0.011874962	0	1.0000
Nurse 5	0.1485	0.014604009	0	1.0000
Portable Xray 1	0.01345836	(Insufficient)	0	1.0000
Portable Xray 2	0.01237930	(Insufficient)	0	1.0000

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Unnamed Project

Replication 2	Start Time:	240.00	Stop Time:	720.00	Time Units: Hours

Resource

Category by Replication

Usage

Number Busy	Average	Half Width	Minimum	Maximum
Radiologist	0	(Insufficient)	0	0
Registration 1	0.1423	0.007568156	0	1.0000
Registration 2	0.1394	0.011877811	0	1.0000
Sitter 1	1.0000	(Insufficient)	1.0000	1.0000
Sitter 2	1.0000	(Insufficient)	1.0000	1.0000
Tech 1	1.0000	(Insufficient)	1.0000	1.0000
Tech 2	1.0000	(Insufficient)	1.0000	1.0000
Tech 3	1.0000	(Insufficient)	1.0000	1.0000
Triage Nurse	0.4380	0.010038983	0	1.0000
Xray Machine 1	0.02333379	(Insufficient)	0	1.0000
Xray Machine 2	0.03098019	(Insufficient)	0	1.0000
Xray Machine 3	0.02564011	(Insufficient)	0	1.0000
Xray Machine 4	0.02088037	(Insufficient)	0	1.0000
Xray Tech 1	0.02005758	(Insufficient)	0	1.0000
Xray Tech 2	0.03052489	(Insufficient)	0	1.0000
Xray Tech 3	0.02687815	(Insufficient)	0	1.0000
Xray Tech 4	0.02886020	(Insufficient)	0	1.0000
Xray Tech 5	0.01433101	(Insufficient)	0	1.0000
Xray Tech 6	0.01990919	(Insufficient)	0	1.0000

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Unnamed Project

Replication 2

Start Time:	240.00	Stop Time:	720.00	Time Units: Hours

Resource

Category by Replication

Usage

Number Scheduled	Average	Half Width	Minimum	Maximum
Bed 1	1.0000	(Insufficient)	1.0000	1.0000
Bed 10	1.0000	(Insufficient)	1.0000	1.0000
Bed 11	1.0000	(Insufficient)	1.0000	1.0000
Bed 12	1.0000	(Insufficient)	1.0000	1.0000
Bed 13	1.0000	(Insufficient)	1.0000	1.0000
Bed 14	1.0000	(Insufficient)	1.0000	1.0000
Bed 15	1.0000	(Insufficient)	1.0000	1.0000
Bed 16	1.0000	(Insufficient)	1.0000	1.0000
Bed 17	1.0000	(Insufficient)	1.0000	1.0000
Bed 18	1.0000	(Insufficient)	1.0000	1.0000
Bed 2	1.0000	(Insufficient)	1.0000	1.0000
Bed 20	1.0000	(Insufficient)	1.0000	1.0000
Bed 21	1.0000	(Insufficient)	1.0000	1.0000
Bed 22	1.0000	(Insufficient)	1.0000	1.0000
Bed 23	1.0000	(Insufficient)	1.0000	1.0000
Bed 24	1.0000	(Insufficient)	1.0000	1.0000
Bed 25	1.0000	(Insufficient)	1.0000	1.0000
Bed 3	1.0000	(Insufficient)	1.0000	1.0000
Bed 4	1.0000	(Insufficient)	1.0000	1.0000
Bed 5	1.0000	(Insufficient)	1.0000	1.0000
Bed 6	1.0000	(Insufficient)	1.0000	1.0000
Bed 7	1.0000	(Insufficient)	1.0000	1.0000
Bed 8	1.0000	(Insufficient)	1.0000	1.0000
Bed 9	1.0000	(Insufficient)	1.0000	1.0000
Charge Nurse	1.0000	(Insufficient)	1.0000	1.0000
Cleaning Staff	1.0000	(Insufficient)	1.0000	1.0000
Clerk 1	1.0000	(Insufficient)	1.0000	1.0000

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Unnamed Project

Replication 2

Start Time:	240.00	Stop Time:	720.00	Time Units:	Hours

Resource

Category by Replication

Usage

Number Scheduled	Average	Half Width	Minimum	Maximum
Clerk 2	1.0000	(Insufficient)	1.0000	1.0000
CT Machine 1	1.0000	(Insufficient)	1.0000	1.0000
CT Machine 2	1.0000	(Insufficient)	1.0000	1.0000
CT Tech 1	1.0000	(Insufficient)	1.0000	1.0000
CT Tech 2	1.0000	(Insufficient)	1.0000	1.0000
ED Transport	5.0000	(Insufficient)	5.0000	5.0000
EKG Machine 1	1.0000	(Insufficient)	1.0000	1.0000
EKG Machine 2	1.0000	(Insufficient)	1.0000	1.0000
EKG Machine 3	1.0000	(Insufficient)	1.0000	1.0000
Float Nurse	1.0000	(Insufficient)	1.0000	1.0000
MD 1	1.0000	(Insufficient)	1.0000	1.0000
MD 2	1.0000	(Insufficient)	1.0000	1.0000
MD 3	1.0000	(Insufficient)	1.0000	1.0000
MD 4	1.0000	(Insufficient)	1.0000	1.0000
MD 5	1.0000	(Insufficient)	1.0000	1.0000
Mental Health Group Room	1.0000	(Insufficient)	1.0000	1.0000
MRI Machine 1	1.0000	(Insufficient)	1.0000	1.0000
MRI Machine 2	1.0000	(Insufficient)	1.0000	1.0000
MRI Tech 1	1.0000	(Insufficient)	1.0000	1.0000
MRI Tech 2	1.0000	(Insufficient)	1.0000	1.0000
Nurse 1	1.0000	(Insufficient)	1.0000	1.0000
Nurse 2	1.0000	(Insufficient)	1.0000	1.0000
Nurse 3	1.0000	(Insufficient)	1.0000	1.0000
Nurse 4	1.0000	(Insufficient)	1.0000	1.0000
Nurse 5	1.0000	(Insufficient)	1.0000	1.0000
Portable Xray 1	1.0000	(Insufficient)	1.0000	1.0000
Portable Xray 2	1.0000	(Insufficient)	1.0000	1.0000

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Unnamed Project

Replication 2	Start Time:	240.00	Stop Time:	720.00	Time Units:	Hours

Resource

Category by Replication

Usage

Number Scheduled	Average	Half Width	Minimum	Maximum
Radiologist	1.0000	(Insufficient)	1.0000	1.0000
Registration 1	1.0000	(Insufficient)	1.0000	1.0000
Registration 2	1.0000	(Insufficient)	1.0000	1.0000
Sitter 1	1.0000	(Insufficient)	1.0000	1.0000
Sitter 2	1.0000	(Insufficient)	1.0000	1.0000
Tech 1	1.0000	(Insufficient)	1.0000	1.0000
Tech 2	1.0000	(Insufficient)	1.0000	1.0000
Tech 3	1.0000	(Insufficient)	1.0000	1.0000
Triage Nurse	1.0000	(Insufficient)	1.0000	1.0000
Xray Machine 1	1.0000	(Insufficient)	1.0000	1.0000
Xray Machine 2	1.0000	(Insufficient)	1.0000	1.0000
Xray Machine 3	1.0000	(Insufficient)	1.0000	1.0000
Xray Machine 4	1.0000	(Insufficient)	1.0000	1.0000
Xray Tech 1	1.0000	(Insufficient)	1.0000	1.0000
Xray Tech 2	1.0000	(Insufficient)	1.0000	1.0000
Xray Tech 3	1.0000	(Insufficient)	1.0000	1.0000
Xray Tech 4	1.0000	(Insufficient)	1.0000	1.0000
Xray Tech 5	1.0000	(Insufficient)	1.0000	1.0000
Xray Tech 6	1.0000	(Insufficient)	1.0000	1.0000

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Unnamed Project

Replication 2   Start Time: 240.00   Stop Time: 720.00   Time Units: Hours

Resource

Category by Replication

Usage

Scheduled Utilization	Value
Bed 1	0
Bed 10	0.1910
Bed 11	0.1782
Bed 12	0.1824
Bed 13	0.1842
Bed 14	1.0000
Bed 15	1.0000
Bed 16	1.0000
Bed 17	1.0000
Bed 18	1.0000
Bed 2	0
Bed 20	0.1495
Bed 21	0.1434
Bed 22	0.1452
Bed 23	0.1449
Bed 24	0.1435
Bed 25	0.1440
Bed 3	0
Bed 4	0.1778
Bed 5	0.1826
Bed 6	0.1848
Bed 7	0.1866
Bed 8	0.1861
Bed 9	0.1780
Charge Nurse	1.0000
Cleaning Staff	0.3852
Clerk 1	0.01099780

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Unnamed Project

Replication 2	Start Time:	240.00	Stop Time:	720.00	Time Units:	Hours

Resource

Category by Replication

Usage

Scheduled Utilization	Value
Clerk 2	0.01134276
CT Machine 1	0.05684732
CT Machine 2	0.04519606
CT Tech 1	0.05718310
CT Tech 2	0.05687417
ED Transport	0.00555556
EKG Machine 1	0
EKG Machine 2	0
EKG Machine 3	0
Float Nurse	0.1648
MD 1	0.1524
MD 2	0.1422
MD 3	0.1466
MD 4	0.1530
MD 5	0.1323
Mental Health Group Room	1.0000
MRI Machine 1	0.04046226
MRI Machine 2	0.04237106
MRI Tech 1	0.04998330
MRI Tech 2	0.04271114
Nurse 1	1.0000
Nurse 2	0.2859
Nurse 3	0.1987
Nurse 4	0.1800
Nurse 5	0.1485
Portable Xray 1	0.01345836
Portable Xray 2	0.01237930

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Unnamed Project

| **Replication 2** | Start Time: | 240.00 | Stop Time: | 720.00 | Time Units: | Hours |

Resource

Category by Replication

Usage

Scheduled Utilization	Value
Radiologist	0
Registration 1	0.1423
Registration 2	0.1394
Sitter 1	1.0000
Sitter 2	1.0000
Tech 1	1.0000
Tech 2	1.0000
Tech 3	1.0000
Triage Nurse	0.4380
Xray Machine 1	0.02333379
Xray Machine 2	0.03098019
Xray Machine 3	0.02564011
Xray Machine 4	0.02088037
Xray Tech 1	0.02005758
Xray Tech 2	0.03052489
Xray Tech 3	0.02687815
Xray Tech 4	0.02886020
Xray Tech 5	0.01433101
Xray Tech 6	0.01990919

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Unnamed Project

Replication 2

Start Time:	240.00	Stop Time:	720.00	Time Units:	Hours

Resource

Category by Replication

Usage

Total Number Seized	Value
Bed 1	0
Bed 10	61.0000
Bed 11	61.0000
Bed 12	61.0000
Bed 13	60.0000
Bed 14	0
Bed 15	0
Bed 16	0
Bed 17	0
Bed 18	0
Bed 2	0
Bed 20	85.0000
Bed 21	84.0000
Bed 22	84.0000
Bed 23	84.0000
Bed 24	84.0000
Bed 25	85.0000
Bed 3	0
Bed 4	60.0000
Bed 5	60.0000
Bed 6	60.0000
Bed 7	60.0000
Bed 8	60.0000
Bed 9	61.0000
Charge Nurse	0
Cleaning Staff	1,110.00
Clerk 1	159.00

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Unnamed Project

Replication 2	Start Time:	240.00	Stop Time:	720.00	Time Units:	Hours

Resource

Category by Replication

Usage

Total Number Seized	Value
Clerk 2	160.00
CT Machine 1	95.0000
CT Machine 2	78.0000
CT Tech 1	88.0000
CT Tech 2	85.0000
ED Transport	160.00
EKG Machine 1	0
EKG Machine 2	0
EKG Machine 3	0
Float Nurse	1,489.00
MD 1	417.00
MD 2	419.00
MD 3	423.00
MD 4	455.00
MD 5	383.00
Mental Health Group Room	0
MRI Machine 1	70.0000
MRI Machine 2	72.0000
MRI Tech 1	76.0000
MRI Tech 2	66.0000
Nurse 1	0
Nurse 2	1,560.00
Nurse 3	846.00
Nurse 4	661.00
Nurse 5	590.00
Portable Xray 1	17.0000
Portable Xray 2	16.0000

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Unnamed Project

Replication 2

Start Time:	240.00	Stop Time:	720.00	Time Units:	Hours

Resource

Category by Replication

Usage

Total Number Seized	Value
Radiologist	0
Registration 1	681.00
Registration 2	670.00
Sitter 1	0
Sitter 2	0
Tech 1	0
Tech 2	0
Tech 3	0
Triage Nurse	1,631.00
Xray Machine 1	47.0000
Xray Machine 2	60.0000
Xray Machine 3	51.0000
Xray Machine 4	42.0000
Xray Tech 1	32.0000
Xray Tech 2	50.0000
Xray Tech 3	44.0000
Xray Tech 4	48.0000
Xray Tech 5	25.0000
Xray Tech 6	34.0000

System

Other

Number Out	Value
System	6,059

User Specified

1/1

Unnamed Project

Replication 2

Start Time: 240.00   Stop Time: 720.00   Time Units: Hours

User Specified

Category by Replication

Counter

Count	Value
Record 24	0
Record Errors	0
Record Errors6	0

Replication 3

Start Time: 240.00   Stop Time: 720.00   Time Units: Hours

Entity

Time

VA Time	Average	Half Width	Minimum	Maximum
Patient Arrival	0.1901	0.006059303	0	1.4881

NVA Time	Average	Half Width	Minimum	Maximum
Patient Arrival	0.03713163	0.000976392	0	0.2000

Wait Time	Average	Half Width	Minimum	Maximum
Patient Arrival	0.01035431	0.001379215	0	0.8390

Transfer Time	Average	Half Width	Minimum	Maximum
Patient Arrival	0.03984256	0.000574731	0.02083333	0.08750000

Other Time	Average	Half Width	Minimum	Maximum
Patient Arrival	0.01950993	0.003302519	0	0.8333

Total Time	Average	Half Width	Minimum	Maximum
Patient Arrival	0.3005	0.009518728	0.03333333	2.6878

Other

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Unnamed Project

Replication 3	Start Time:	240.00	Stop Time:	720.00	Time Units:	Hours

Entity

Category by Replication

Other

Number In	Value
Entity 1	0
Patient Arrival	5,497
Patient_Accuity_1	0

Number Out	Value
Entity 1	0
Patient Arrival	4,518
Patient_Accuity_1	0

WIP	Average	Half Width	Minimum	Maximum
Entity 1	0	(Insufficient)	0	0
Patient Arrival	967.73	(Correlated)	481.00	1,460.00
Patient_Accuity_1	0	(Insufficient)	0	0

Process

Time per Entity

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Unnamed Project

Replication 3	Start Time:	240.00	Stop Time:	720.00	Time Units: Hours

Process

Category by Replication

Time per Entity

VA Time Per Entity	Average	Half Width	Minimum	Maximum
24 Hour Eval by Lipton Section 12	0.5102	(Insufficient)	0.2576	0.9075
24 Hour Eval by MD Section 12	0.4908	(Insufficient)	0.2507	0.8950
Bedside registration side A	0.0973	(Insufficient)	0.03770500	0.1625
Call Admitting MD	0.03374293	(Insufficient)	0.01680406	0.04888772
CT Scan	0.2502	(Insufficient)	0.1743	0.3283
Discharge Notes B side	0.05800466	0.000927198	0.03498983	0.08252605
Infrared input by secretary	0.03247891	(Insufficient)	0.01825692	0.04823786
MD Exam on Side B	0.1931	0.002248343	0.1399	0.2477
MD to MD talk	0.05702135	(Insufficient)	0.03528432	0.07975888
MRI	0.2511	(Insufficient)	0.1716	0.3279
Nurse Does Discharge	0.1667	(Correlated)	0.1667	0.1667
Nurse helps patient leave	0.05710360	0.000785672	0.03555698	0.08207101
Physician Examination A	0.1913	0.002210602	0.1352	0.2489
Pull IV	0.03388650	0.000615257	0.01806756	0.04906817
Registration and Insurance	0.0993	0.001704307	0.03451495	0.1631
RN RN discussion	0.1244	(Insufficient)	0.05191687	0.1887
RN tests and Labs A	0.2075	0.001506399	0.1688	0.2475
Second MD Exam on B Side	0.05996091	(Insufficient)	0.03710070	0.08065546
Second Physician Examination	0.05810169	0.000849078	0.03461429	0.08257404
Tests and Labs on Side B	0.2079	0.001579762	0.1696	0.2478
Triage Area	0.1245	0.000759539	0.08469343	0.1658
Xrays	0.2068	(Insufficient)	0.1677	0.2442
Xrays Bedside	0.2080	(Insufficient)	0.1789	0.2422

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Unnamed Project

Replication 3	Start Time:	240.00	Stop Time:	720.00	Time Units:	Hours

Process

Category by Replication

Time per Entity

NVA Time Per Entity	Average	Half Width	Minimum	Maximum
Clean Side A Room	0.1667	(Correlated)	0.1667	0.1667
Clean Side B Room	0.1667	(Correlated)	0.1667	0.1667
Strip Side A Room	0.03333333	(Correlated)	0.03333333	0.03333333
Strip Side B Room	0.03333333	(Correlated)	0.03333333	0.03333333

Wait Time Per Entity	Average	Half Width	Minimum	Maximum
24 Hour Eval by MD Section 12	0.01163849	(Insufficient)	0	0.1887
Bedside registration side A	0	(Insufficient)	0	0
Call Admitting MD	0	(Insufficient)	0	0
Clean Side A Room	0.03616012	0.005871489	0	0.4007
Clean Side B Room	0.03193618	0.008040035	0	0.3429
Infrared input by secretary	0	(Insufficient)	0	0
MD to MD talk	0.01079497	(Insufficient)	0	0.1674
Nurse helps patient leave	0	0.000000000	0	0
RN RN discussion	0.01226148	(Insufficient)	0	0.2625
RN tests and Labs A	0	0.000000000	0	0
Second MD Exam on B Side	0.03032173	(Insufficient)	0	0.7156
Second Physician Examination	0.01551085	0.005681969	0	0.8374
Strip Side A Room	0	0.000000000	0	0
Strip Side B Room	0	0.000000000	0	0
Tests and Labs on Side B	0	0.000000000	0	0

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Unnamed Project   Replications: 3

Replication 3   Start Time: 240.00   Stop Time: 720.00   Time Units: Hours

Process

Category by Replication

Time per Entity

Total Time Per Entity	Average	Half Width	Minimum	Maximum
24 Hour Eval by Lipton Section 12	0.5102	(Insufficient)	0.2576	0.9075
24 Hour Eval by MD Section 12	0.5024	(Insufficient)	0.2593	0.8950
Bedside registration side A	0.0973	(Insufficient)	0.03770500	0.1625
Call Admitting MD	0.03374293	(Insufficient)	0.01680406	0.04888772
Clean Side A Room	0.2028	0.005871489	0.1667	0.5673
Clean Side B Room	0.1986	0.008040035	0.1667	0.5096
CT Scan	0.2502	(Insufficient)	0.1743	0.3283
Discharge Notes B side	0.05800466	0.000927198	0.03498983	0.08252605
Infrared input by secretary	0.03247891	(Insufficient)	0.01825692	0.04823786
MD Exam on Side B	0.1931	0.002248343	0.1399	0.2477
MD to MD talk	0.06781631	(Insufficient)	0.03528432	0.2226
MRI	0.2511	(Insufficient)	0.1716	0.3279
Nurse Does Discharge	0.1667	(Correlated)	0.1667	0.1667
Nurse helps patient leave	0.05710360	0.000785672	0.03555698	0.08207101
Physician Examination A	0.1913	0.002210602	0.1352	0.2489
Pull IV	0.03388650	0.000615257	0.01806756	0.04906817
Registration and Insurance	0.0993	0.001704307	0.03451495	0.1631
RN RN discussion	0.1366	(Insufficient)	0.05191687	0.3552
RN tests and Labs A	0.2075	0.001506399	0.1688	0.2475
Second MD Exam on B Side	0.0903	(Insufficient)	0.03710070	0.7696
Second Physician Examination	0.07361254	0.005655141	0.03461429	0.8751
Strip Side A Room	0.03333333	(Correlated)	0.03333333	0.03333333
Strip Side B Room	0.03333333	(Correlated)	0.03333333	0.03333333
Tests and Labs on Side B	0.2079	0.001579762	0.1696	0.2478
Triage Area	0.1245	0.000759539	0.08469343	0.1658

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Unnamed Project

Replication 3

Start Time:	240.00	Stop Time:	720.00	Time Units: Hours

Process

Category by Replication

Time per Entity

Total Time Per Entity	Average	Half Width	Minimum	Maximum
Xrays	0.2068	(Insufficient)	0.1677	0.2442
Xrays Bedside	0.2080	(Insufficient)	0.1789	0.2422

Accumulated Time

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Unnamed Project

Replication 3   Start Time: 240.00   Stop Time: 720.00   Time Units: Hours

Process

Category by Replication

Accumulated Time

Accum VA Time	Value
24 Hour Eval by Lipton Section 12	49.4878
24 Hour Eval by MD Section 12	47.6056
Bedside registration MH	0
Bedside registration side A	15.9548
Call Admitting MD	5.7363
Clerk calls for Lipton	0
CT Scan	40.7892
Discharge Notes B side	26.6241
ED Infrared input by secretary	0
ED MD Admitting MD talk	0
EKG for patient	0
Hook up to telemetry and blood pressure	0
Infrared input by secretary	5.5214
MD Exam on Side B	97.5058
MD to MD talk	9.6936
Medical Clearance	0
MRI	41.1841
Nurse Does Discharge	76.5000
Nurse fills out Mental Health papers	0
Nurse fills out MH papers	0
Nurse helps patient leave	28.8373
Nurse Nurse discussion	0
Patient put in room and changed into HA attire	0

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Unnamed Project

Replication 3

Start Time: 240.00   Stop Time: 720.00   Time Units: Hours

Process

Category by Replication

Accumulated Time

Accum VA Time	Value
Patient put in room and clothes changed	0
Physician Examination A	120.31
Pull IV	15.5539
Registration and Insurance	124.78
Remove Clothes and insert catheter	0
RN RN discussion	21.1437
RN tests and Labs A	130.52
RN tests and Labs Critical	0
Second MD Exam on B Side	7.5551
Second Physician Examination	36.6041
Sitter and Nurse review paperwork	0
Sitter and Nurse review paperwork during registration	0
Tests and Labs on Side B	104.97
Triage Area	207.41
Xrays	48.3890
Xrays Bedside	7.2817

179

Unnamed Project

Replication 3   Start Time: 240.00   Stop Time: 720.00   Time Units: Hours

Process

Category by Replication

Accumulated Time

Accum NVA Time	Value
Clean MH Room	0
Clean Side A Room	104.83
Clean Side B Room	84.1667
Clean Trauma Room	0
Clerk Call Admitting MD	0
Lipton Assessment	0
Strip MH Room	0
Strip Side A Room	20.9667
Strip Side B Room	16.8333
Strip Trauma Room	0
Trauma Patient gets bed	0

180

Unnamed Project

Replication 3   Start Time: 240.00   Stop Time: 720.00   Time Units: Hours

Process

Category by Replication

Accumulated Time

Accum Wait Time	Value
24 Hour Eval by MD Section 12	1.1289
Bedside registration MH	0
Bedside registration side A	0
Call Admitting MD	0
Clean MH Room	0
Clean Side A Room	22.7447
Clean Side B Room	16.1278
Clean Trauma Room	0
Clerk Call Admitting MD	0
Clerk calls for Lipton	0
ED Infrared input by secretary	0
ED MD Admitting MD talk	0
Infrared input by secretary	0
MD to MD talk	1.8351
Medical Clearance	0
Nurse fills out MH papers	0
Nurse helps patient leave	0
Nurse Nurse discussion	0
RN RN discussion	2.0845
RN tests and Labs A	0
Second MD Exam on B Side	3.8205
Second Physician Examination	9.7718
Strip MH Room	0
Strip Side A Room	0
Strip Side B Room	0

181

Unnamed Project   Replications: 3

Replication 3   Start Time: 240.00   Stop Time: 720.00   Time Units: Hours

Process

Category by Replication

Accumulated Time

Accum Wait Time	Value
Strip Trauma Room	0
Tests and Labs on Side B	0

Other

Unnamed Project

Replication 3

| Start Time: | 240.00 | Stop Time: | 720.00 | Time Units: | Hours |

Process

Other

Category by Replication

Number In	Value
24 Hour Eval by Lipton Section 12	97
24 Hour Eval by MD Section 12	97
Bedside registration MH	0
Bedside registration side A	164
Call Admitting MD	171
Clean MH Room	0
Clean Side A Room	629
Clean Side B Room	505
Clean Trauma Room	0
Clerk Call Admitting MD	0
Clerk calls for Lipton	0
CT Scan	163
Discharge Notes B side	459
ED Infrared input by secretary	0
ED MD Admitting MD talk	0
EKG for patient	0
Hook up to telemetry and blood pressure	0
Infrared input by secretary	170
Lipton Assessment	0
MD Exam on Side B	505
MD to MD talk	170
Medical Clearance	0
MRI	164
Nurse Does Discharge	459

183

Unnamed Project

Replication 3   Start Time: 240.00   Stop Time: 720.00   Time Units: Hours

Process

Category by Replication

Other

Number In	Value
Nurse fills out Mental Health papers	0
Nurse fills out MH papers	0
Nurse helps patient leave	505
Nurse Nurse discussion	0
Patient put in room and changed into HA attire	0
Patient put in room and clothes changed	0
Physician Examination A	629
Pull IV	459
Registration and Insurance	1,257
Remove Clothes and insert catheter	0
RN RN discussion	170
RN tests and Labs A	628
RN tests and Labs Critical	0
Second MD Exam on B Side	126
Second Physician Examination	630
Sitter and Nurse review paperwork	0
Sitter and Nurse review paperwork during registration	0
Strip MH Room	0
Strip Side A Room	629
Strip Side B Room	505
Strip Trauma Room	0
Tests and Labs on Side B	505

184

Unnamed Project

Replication 3

Start Time:	240.00	Stop Time:	720.00	Time Units:	Hours

Process

Category by Replication

Other

Number In	Value
Trauma Patient gets bed	0
Triage Area	1,666
Xrays	234
Xrays Bedside	34

185

Unnamed Project

Replication 3

Start Time: 240.00 Stop Time: 720.00 Time Units: Hours

Process

Category by Replication

Other

Number Out	Value
24 Hour Eval by Lipton Section 12	97
24 Hour Eval by MD Section 12	97
Bedside registration MH	0
Bedside registration side A	164
Call Admitting MD	170
Clean MH Room	0
Clean Side A Room	629
Clean Side B Room	505
Clean Trauma Room	0
Clerk Call Admitting MD	0
Clerk calls for Lipton	0
CT Scan	163
Discharge Notes B side	459
ED Infrared input by secretary	0
ED MD Admitting MD talk	0
EKG for patient	0
Hook up to telemetry and blood pressure	0
Infrared input by secretary	170
Lipton Assessment	0
MD Exam on Side B	505
MD to MD talk	170
Medical Clearance	0
MRI	164
Nurse Does Discharge	459

186

Unnamed Project

Replication 3

Start Time:	240.00	Stop Time:	720.00	Time Units:	Hours

Process

Other

Category by Replication

Number Out	Value
Nurse fills out Mental Health papers	0
Nurse fills out MH papers	0
Nurse helps patient leave	505
Nurse Nurse discussion	0
Patient put in room and changed into HA attire	0
Patient put in room and clothes changed	0
Physician Examination A	629
Pull IV	459
Registration and Insurance	1,257
Remove Clothes and insert catheter	0
RN RN discussion	170
RN tests and Labs A	629
RN tests and Labs Critical	0
Second MD Exam on B Side	126
Second Physician Examination	630
Sitter and Nurse review paperwork	0
Sitter and Nurse review paperwork during registration	0
Strip MH Room	0
Strip Side A Room	629
Strip Side B Room	505
Strip Trauma Room	0
Tests and Labs on Side B	505

187

Unnamed Project

Replication 3

Start Time: 240.00   Stop Time: 720.00   Time Units: Hours

Process

Category by Replication

Other

Number Out	Value
Trauma Patient gets bed	0
Triage Area	1,666
Xrays	234
Xrays Bedside	35

Queue

Time

188

Unnamed Project

Replication 3

Start Time:	240.00	Stop Time:	720.00	Time Units:	Hours

Queue

Category by Replication

Time

Waiting Time	Average	Half Width	Minimum	Maximum
24 Hour Eval by MD Section 12.Queue	0.01163849	(Insufficient)	0	0.1887
Batch 5.Queue	0.02087448	0.002135457	0	0.1057
Batch 6.Queue	0.0987	(Insufficient)	0	0.4806
Bedside registration side A.Queue	0	(Insufficient)	0	0
Call Admitting MD.Queue	0	(Insufficient)	0	0
Call for Transport.Queue	0	(Insufficient)	0	0
Call Radiology B side.Queue	0	(Insufficient)	0	0
Call Radiology.Queue	0	(Insufficient)	0	0
Clean Side A Room.Queue	0.03616012	0.005871489	0	0.4007
Clean Side B Room.Queue	0.03193618	0.008040035	0	0.3429
Get Nurse.Queue	0	0.000000000	0	0
Infrared input by secretary.Queue	0	(Insufficient)	0	0
MD to MD talk.Queue	0.01079497	(Insufficient)	0	0.1674
Nurse helps patient leave.Queue	0	0.000000000	0	0
Radiologist to come to ED.Queue	0	(Insufficient)	0	0
RN RN discussion.Queue	0.01226148	(Insufficient)	0	0.2625
RN tests and Labs A.Queue	0	0.000000000	0	0
Second MD Exam on B Side.Queue	0.03032173	(Insufficient)	0	0.7156
Second Physician Examination.Queue	0.01551085	0.005681969	0	0.8374
Seize CT Tech and Nurse.Queue	0	(Insufficient)	0	0
Seize MDfor Side B.Queue	0	0.000000000	0	0

189

Unnamed Project

Replication 3

Start Time:	240.00	Stop Time:	720.00	Time Units: Hours

Queue

Category by Replication

Time

Waiting Time	Average	Half Width	Minimum	Maximum
Seize MRI tech and Nurse.Queue	0	(Insufficient)	0	0
Seize Physician A.Queue	0	0.000000000	0	0
Seize Registration and Insurance.Queue	0	0.000000000	0	0
Seize Side A Room and Transport Nurse.Queue	0	0.000000000	0	0
Seize Side B Room and Transport Nurse.Queue	0	0.000000000	0	0
Seize Triage Nurse.Queue	0	0.000000000	0	0
Strip Side A Room.Queue	0	0.000000000	0	0
Strip Side B Room.Queue	0	0.000000000	0	0
Tests and Labs on Side B.Queue	0	0.000000000	0	0

Other

190

Unnamed Project

Replication 3

Start Time: 240.00   Stop Time: 720.00   Time Units: Hours

Queue

Other

Category by Replication

Number Waiting	Average	Half Width	Minimum	Maximum
24 Hour Eval by MD Section 12.Queue	0.00235194	(Insufficient)	0	1.0000
Arrange for Sitter.Queue	1.0000	(Insufficient)	1.0000	1.0000
Batch 11.Queue	0	(Insufficient)	0	0
Batch 4.Queue	0	(Insufficient)	0	0
Batch 5.Queue	0.01426423	0.002226516	0	2.0000
Batch 6.Queue	0.03990712	(Insufficient)	0	3.0000
Batch 7.Queue	5.0000	(Insufficient)	5.0000	5.0000
Bedside registration MH.Queue	0	(Insufficient)	0	0
Bedside registration side A.Queue	0	(Insufficient)	0	0
Call Admitting MD.Queue	0	(Insufficient)	0	0
Call for ED Transport.Queue	0	(Insufficient)	0	0
Call for Transport.Queue	0	(Insufficient)	0	0
Call Radiology B side.Queue	0	(Insufficient)	0	0
Call Radiology.Queue	0	(Insufficient)	0	0
Call transport for Trauma.Queue	0	(Insufficient)	0	0
Call transport to Helicopter.Queue	0	(Insufficient)	0	0
Clean MH Room.Queue	0	(Insufficient)	0	0
Clean Side A Room.Queue	0.04738482	0.007907548	0	2.0000
Clean Side B Room.Queue	0.03359952	(Insufficient)	0	2.0000
Clean Trauma Room.Queue	0	(Insufficient)	0	0
Clerk Call Admitting MD.Queue	0	(Insufficient)	0	0
Clerk calls for Lipton.Queue	0	(Insufficient)	0	0

191

Unnamed Project

Replication 3   Start Time: 240.00   Stop Time: 720.00   Time Units: Hours

Queue

Category by Replication

Other

Number Waiting	Average	Half Width	Minimum	Maximum
ED Infrared input by secretary.Queue	0	(Insufficient)	0	0
ED MD Admitting MD talk.Queue	0	(Insufficient)	0	0
Get Nurse.Queue	0	(Insufficient)	0	0
Infrared input by secretary.Queue	0	(Insufficient)	0	0
MD to MD talk.Queue	0.00382322	(Insufficient)	0	1.0000
Medical Clearance.Queue	0	(Insufficient)	0	0
Nurse fills out MH papers.Queue	0	(Insufficient)	0	0
Nurse helps patient leave.Queue	0	(Insufficient)	0	0
Nurse Nurse discussion.Queue	0	(Insufficient)	0	0
Radiologist to come to ED.Queue	0	(Insufficient)	0	0
RN RN discussion.Queue	0.00434261	(Insufficient)	0	1.0000
RN tests and Labs A.Queue	0	(Insufficient)	0	0
Second MD Exam on B Side.Queue	0.00795945	(Insufficient)	0	1.0000
Second Physician Examination.Queue	0.02035799	(Insufficient)	0	2.0000
Seize CT Tech and Nurse.Queue	0	(Insufficient)	0	0
Seize EKG and Tech.Queue	413.28	(Correlated)	215.00	624.00
Seize EKG.Queue	0	(Insufficient)	0	0
Seize MDfor Side B.Queue	0	(Insufficient)	0	0
Seize Mental Health nurse.Queue	0	(Insufficient)	0	0
Seize Mental Health Room and Nurse.Queue	111.40	(Insufficient)	48.0000	172.00

192

Unnamed Project

Replication 3

Start Time:	240.00	Stop Time:	720.00	Time Units: Hours

Queue

Category by Replication

Other

Number Waiting	Average	Half Width	Minimum	Maximum
Seize MRI tech and Nurse.Queue	0	(Insufficient)	0	0
Seize Physician A.Queue	0	(Insufficient)	0	0
Seize Registration and Insurance.Queue	0	(Insufficient)	0	0
Seize Room for Mental Health.Queue	44.2075	(Insufficient)	15.0000	64.0000
Seize Room.Queue	0	(Insufficient)	0	0
Seize Side A Room and Transport Nurse.Queue	0	(Insufficient)	0	0
Seize Side B Room and Transport Nurse.Queue	0	(Insufficient)	0	0
Seize Trauma Bed.Queue	193.95	(Insufficient)	96.0000	301.00
Seize Triage Nurse.Queue	0	(Insufficient)	0	0
Strip MH Room.Queue	0	(Insufficient)	0	0
Strip Side A Room.Queue	0	(Insufficient)	0	0
Strip Side B Room.Queue	0	(Insufficient)	0	0
Strip Trauma Room.Queue	0	(Insufficient)	0	0
Tests and Labs on Side B.Queue	0	(Insufficient)	0	0
Triage.Queue	0	(Insufficient)	0	0

Resource

Usage

193

Unnamed Project

Replication 3

Start Time: 240.00 Stop Time: 720.00 Time Units: Hours

Resource

Category by Replication

Usage

Instantaneous Utilization	Average	Half Width	Minimum	Maximum
Bed 1	0	(Insufficient)	0	0
Bed 10	0.1909	(Insufficient)	0	1.0000
Bed 11	0.1930	(Insufficient)	0	1.0000
Bed 12	0.1927	(Insufficient)	0	1.0000
Bed 13	0.1927	(Insufficient)	0	1.0000
Bed 14	1.0000	(Insufficient)	1.0000	1.0000
Bed 15	1.0000	(Insufficient)	1.0000	1.0000
Bed 16	1.0000	(Insufficient)	1.0000	1.0000
Bed 17	1.0000	(Insufficient)	1.0000	1.0000
Bed 18	1.0000	(Insufficient)	1.0000	1.0000
Bed 2	0	(Insufficient)	0	0
Bed 20	0.1521	(Insufficient)	0	1.0000
Bed 21	0.1506	(Insufficient)	0	1.0000
Bed 22	0.1461	(Insufficient)	0	1.0000
Bed 23	0.1480	(Insufficient)	0	1.0000
Bed 24	0.1498	(Insufficient)	0	1.0000
Bed 25	0.1444	(Insufficient)	0	1.0000
Bed 3	0	(Insufficient)	0	0
Bed 4	0.1910	(Insufficient)	0	1.0000
Bed 5	0.1886	(Insufficient)	0	1.0000
Bed 6	0.1917	(Insufficient)	0	1.0000
Bed 7	0.1876	(Insufficient)	0	1.0000
Bed 8	0.1906	(Insufficient)	0	1.0000
Bed 9	0.1953	(Insufficient)	0	1.0000
Charge Nurse	1.0000	(Insufficient)	1.0000	1.0000
Cleaning Staff	0.3937	0.012785933	0	1.0000
Clerk 1	0.01131884	0.002290405	0	1.0000

194

Unnamed Project

Replication 3	Start Time:	240.00	Stop Time:	720.00	Time Units:	Hours

Resource

Category by Replication

Usage

Instantaneous Utilization	Average	Half Width	Minimum	Maximum
Clerk 2	0.01221157	0.002367157	0	1.0000
CT Machine 1	0.04863264	(Insufficient)	0	1.0000
CT Machine 2	0.04766438	(Insufficient)	0	1.0000
CT Tech 1	0.04903538	(Insufficient)	0	1.0000
CT Tech 2	0.05858108	(Insufficient)	0	1.0000
ED Transport	0.00590278	0.000867864	0	0.4000
EKG Machine 1	0	(Insufficient)	0	0
EKG Machine 2	0	(Insufficient)	0	0
EKG Machine 3	0	(Insufficient)	0	0
Float Nurse	0.1703	0.014914561	0	1.0000
MD 1	0.1555	0.016282461	0	1.0000
MD 2	0.1395	0.011666432	0	1.0000
MD 3	0.1427	0.012788229	0	1.0000
MD 4	0.1465	0.016501856	0	1.0000
MD 5	0.1363	0.012939220	0	1.0000
Mental Health Group Room	1.0000	(Insufficient)	1.0000	1.0000
MRI Machine 1	0.04832006	(Insufficient)	0	1.0000
MRI Machine 2	0.04886903	(Insufficient)	0	1.0000
MRI Tech 1	0.05378168	(Insufficient)	0	1.0000
MRI Tech 2	0.05479629	(Insufficient)	0	1.0000
Nurse 1	0.1918	0.015147530	0	1.0000
Nurse 2	0.1647	0.015027221	0	1.0000
Nurse 3	0.1636	0.013721067	0	1.0000
Nurse 4	0.1577	0.012646518	0	1.0000
Nurse 5	0.1580	0.011161885	0	1.0000
Portable Xray 1	0.01792018	(Insufficient)	0	1.0000
Portable Xray 2	0.00890636	(Insufficient)	0	1.0000

195

Unnamed Project

Replication 3	Start Time:	240.00	Stop Time:	720.00	Time Units: Hours

Resource

Category by Replication

Usage

Instantaneous Utilization	Average	Half Width	Minimum	Maximum
Radiologist	0	(Insufficient)	0	0
Registration 1	0.1494	0.009937253	0	1.0000
Registration 2	0.1438	0.007435914	0	1.0000
Sitter 1	1.0000	(Insufficient)	1.0000	1.0000
Sitter 2	1.0000	(Insufficient)	1.0000	1.0000
Tech 1	1.0000	(Insufficient)	1.0000	1.0000
Tech 2	1.0000	(Insufficient)	1.0000	1.0000
Tech 3	1.0000	(Insufficient)	1.0000	1.0000
Triage Nurse	0.4466	0.007467467	0	1.0000
Xray Machine 1	0.02671366	(Insufficient)	0	1.0000
Xray Machine 2	0.03763439	(Insufficient)	0	1.0000
Xray Machine 3	0.01860536	(Insufficient)	0	1.0000
Xray Machine 4	0.03410698	(Insufficient)	0	1.0000
Xray Tech 1	0.03002225	(Insufficient)	0	1.0000
Xray Tech 2	0.02352442	(Insufficient)	0	1.0000
Xray Tech 3	0.02786468	(Insufficient)	0	1.0000
Xray Tech 4	0.02358798	(Insufficient)	0	1.0000
Xray Tech 5	0.02433333	(Insufficient)	0	1.0000
Xray Tech 6	0.03080427	(Insufficient)	0	1.0000

196

Unnamed Project

Replication 3

Start Time:	240.00	Stop Time:	720.00	Time Units: Hours

Resource

Category by Replication

Usage

Number Busy	Average	Half Width	Minimum	Maximum
Bed 1	0	(Insufficient)	0	0
Bed 10	0.1909	(Insufficient)	0	1.0000
Bed 11	0.1930	(Insufficient)	0	1.0000
Bed 12	0.1927	(Insufficient)	0	1.0000
Bed 13	0.1927	(Insufficient)	0	1.0000
Bed 14	1.0000	(Insufficient)	1.0000	1.0000
Bed 15	1.0000	(Insufficient)	1.0000	1.0000
Bed 16	1.0000	(Insufficient)	1.0000	1.0000
Bed 17	1.0000	(Insufficient)	1.0000	1.0000
Bed 18	1.0000	(Insufficient)	1.0000	1.0000
Bed 2	0	(Insufficient)	0	0
Bed 20	0.1521	(Insufficient)	0	1.0000
Bed 21	0.1506	(Insufficient)	0	1.0000
Bed 22	0.1461	(Insufficient)	0	1.0000
Bed 23	0.1480	(Insufficient)	0	1.0000
Bed 24	0.1498	(Insufficient)	0	1.0000
Bed 25	0.1444	(Insufficient)	0	1.0000
Bed 3	0	(Insufficient)	0	0
Bed 4	0.1910	(Insufficient)	0	1.0000
Bed 5	0.1886	(Insufficient)	0	1.0000
Bed 6	0.1917	(Insufficient)	0	1.0000
Bed 7	0.1876	(Insufficient)	0	1.0000
Bed 8	0.1906	(Insufficient)	0	1.0000
Bed 9	0.1953	(Insufficient)	0	1.0000
Charge Nurse	1.0000	(Insufficient)	1.0000	1.0000
Cleaning Staff	0.3937	0.012785933	0	1.0000
Clerk 1	0.01131884	0.002290405	0	1.0000

197

Unnamed Project

Replication 3

Start Time:	240.00	Stop Time:	720.00	Time Units: Hours

Resource

Category by Replication

Usage

Number Busy	Average	Half Width	Minimum	Maximum
Clerk 2	0.01221157	0.002367157	0	1.0000
CT Machine 1	0.04863264	(Insufficient)	0	1.0000
CT Machine 2	0.04766438	(Insufficient)	0	1.0000
CT Tech 1	0.04903538	(Insufficient)	0	1.0000
CT Tech 2	0.05858108	(Insufficient)	0	1.0000
ED Transport	0.02951389	0.004339318	0	2.0000
EKG Machine 1	0	(Insufficient)	0	0
EKG Machine 2	0	(Insufficient)	0	0
EKG Machine 3	0	(Insufficient)	0	0
Float Nurse	0.1703	0.014914561	0	1.0000
MD 1	0.1555	0.016282461	0	1.0000
MD 2	0.1395	0.011666432	0	1.0000
MD 3	0.1427	0.012788229	0	1.0000
MD 4	0.1465	0.016501856	0	1.0000
MD 5	0.1363	0.012939220	0	1.0000
Mental Health Group Room	1.0000	(Insufficient)	1.0000	1.0000
MRI Machine 1	0.04832006	(Insufficient)	0	1.0000
MRI Machine 2	0.04886903	(Insufficient)	0	1.0000
MRI Tech 1	0.05378168	(Insufficient)	0	1.0000
MRI Tech 2	0.05479629	(Insufficient)	0	1.0000
Nurse 1	0.1918	0.015147530	0	1.0000
Nurse 2	0.1647	0.015027221	0	1.0000
Nurse 3	0.1636	0.013721067	0	1.0000
Nurse 4	0.1577	0.012646518	0	1.0000
Nurse 5	0.1580	0.011161885	0	1.0000
Portable Xray 1	0.01792018	(Insufficient)	0	1.0000
Portable Xray 2	0.00890636	(Insufficient)	0	1.0000

198

Unnamed Project

Replication 3   Start Time: 240.00   Stop Time: 720.00   Time Units: Hours

Resource

<div align="center">

Category by Replication

</div>

Usage

Number Busy	Average	Half Width	Minimum	Maximum
Radiologist	0	(Insufficient)	0	0
Registration 1	0.1494	0.009937253	0	1.0000
Registration 2	0.1438	0.007435914	0	1.0000
Sitter 1	1.0000	(Insufficient)	1.0000	1.0000
Sitter 2	1.0000	(Insufficient)	1.0000	1.0000
Tech 1	1.0000	(Insufficient)	1.0000	1.0000
Tech 2	1.0000	(Insufficient)	1.0000	1.0000
Tech 3	1.0000	(Insufficient)	1.0000	1.0000
Triage Nurse	0.4466	0.007467467	0	1.0000
Xray Machine 1	0.02671366	(Insufficient)	0	1.0000
Xray Machine 2	0.03763439	(Insufficient)	0	1.0000
Xray Machine 3	0.01860536	(Insufficient)	0	1.0000
Xray Machine 4	0.03410698	(Insufficient)	0	1.0000
Xray Tech 1	0.03002225	(Insufficient)	0	1.0000
Xray Tech 2	0.02352442	(Insufficient)	0	1.0000
Xray Tech 3	0.02786468	(Insufficient)	0	1.0000
Xray Tech 4	0.02358798	(Insufficient)	0	1.0000
Xray Tech 5	0.02433333	(Insufficient)	0	1.0000
Xray Tech 6	0.03080427	(Insufficient)	0	1.0000

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Unnamed Project

Replication 3	Start Time:	240.00	Stop Time:	720.00	Time Units: Hours

Resource

Category by Replication

Usage

Number Scheduled	Average	Half Width	Minimum	Maximum
Bed 1	1.0000	(Insufficient)	1.0000	1.0000
Bed 10	1.0000	(Insufficient)	1.0000	1.0000
Bed 11	1.0000	(Insufficient)	1.0000	1.0000
Bed 12	1.0000	(Insufficient)	1.0000	1.0000
Bed 13	1.0000	(Insufficient)	1.0000	1.0000
Bed 14	1.0000	(Insufficient)	1.0000	1.0000
Bed 15	1.0000	(Insufficient)	1.0000	1.0000
Bed 16	1.0000	(Insufficient)	1.0000	1.0000
Bed 17	1.0000	(Insufficient)	1.0000	1.0000
Bed 18	1.0000	(Insufficient)	1.0000	1.0000
Bed 2	1.0000	(Insufficient)	1.0000	1.0000
Bed 20	1.0000	(Insufficient)	1.0000	1.0000
Bed 21	1.0000	(Insufficient)	1.0000	1.0000
Bed 22	1.0000	(Insufficient)	1.0000	1.0000
Bed 23	1.0000	(Insufficient)	1.0000	1.0000
Bed 24	1.0000	(Insufficient)	1.0000	1.0000
Bed 25	1.0000	(Insufficient)	1.0000	1.0000
Bed 3	1.0000	(Insufficient)	1.0000	1.0000
Bed 4	1.0000	(Insufficient)	1.0000	1.0000
Bed 5	1.0000	(Insufficient)	1.0000	1.0000
Bed 6	1.0000	(Insufficient)	1.0000	1.0000
Bed 7	1.0000	(Insufficient)	1.0000	1.0000
Bed 8	1.0000	(Insufficient)	1.0000	1.0000
Bed 9	1.0000	(Insufficient)	1.0000	1.0000
Charge Nurse	1.0000	(Insufficient)	1.0000	1.0000
Cleaning Staff	1.0000	(Insufficient)	1.0000	1.0000
Clerk 1	1.0000	(Insufficient)	1.0000	1.0000

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Unnamed Project

Replication 3

Start Time:	240.00	Stop Time:	720.00	Time Units: Hours

Resource

Category by Replication

Usage

Number Scheduled	Average	Half Width	Minimum	Maximum
Clerk 2	1.0000	(Insufficient)	1.0000	1.0000
CT Machine 1	1.0000	(Insufficient)	1.0000	1.0000
CT Machine 2	1.0000	(Insufficient)	1.0000	1.0000
CT Tech 1	1.0000	(Insufficient)	1.0000	1.0000
CT Tech 2	1.0000	(Insufficient)	1.0000	1.0000
ED Transport	5.0000	(Insufficient)	5.0000	5.0000
EKG Machine 1	1.0000	(Insufficient)	1.0000	1.0000
EKG Machine 2	1.0000	(Insufficient)	1.0000	1.0000
EKG Machine 3	1.0000	(Insufficient)	1.0000	1.0000
Float Nurse	1.0000	(Insufficient)	1.0000	1.0000
MD 1	1.0000	(Insufficient)	1.0000	1.0000
MD 2	1.0000	(Insufficient)	1.0000	1.0000
MD 3	1.0000	(Insufficient)	1.0000	1.0000
MD 4	1.0000	(Insufficient)	1.0000	1.0000
MD 5	1.0000	(Insufficient)	1.0000	1.0000
Mental Health Group Room	1.0000	(Insufficient)	1.0000	1.0000
MRI Machine 1	1.0000	(Insufficient)	1.0000	1.0000
MRI Machine 2	1.0000	(Insufficient)	1.0000	1.0000
MRI Tech 1	1.0000	(Insufficient)	1.0000	1.0000
MRI Tech 2	1.0000	(Insufficient)	1.0000	1.0000
Nurse 1	1.0000	(Insufficient)	1.0000	1.0000
Nurse 2	1.0000	(Insufficient)	1.0000	1.0000
Nurse 3	1.0000	(Insufficient)	1.0000	1.0000
Nurse 4	1.0000	(Insufficient)	1.0000	1.0000
Nurse 5	1.0000	(Insufficient)	1.0000	1.0000
Portable Xray 1	1.0000	(Insufficient)	1.0000	1.0000
Portable Xray 2	1.0000	(Insufficient)	1.0000	1.0000

201

Unnamed Project

Replication 3   Start Time: 240.00   Stop Time: 720.00   Time Units: Hours

Resource

Category by Replication

Usage

Number Scheduled	Average	Half Width	Minimum	Maximum
Radiologist	1.0000	(Insufficient)	1.0000	1.0000
Registration 1	1.0000	(Insufficient)	1.0000	1.0000
Registration 2	1.0000	(Insufficient)	1.0000	1.0000
Sitter 1	1.0000	(Insufficient)	1.0000	1.0000
Sitter 2	1.0000	(Insufficient)	1.0000	1.0000
Tech 1	1.0000	(Insufficient)	1.0000	1.0000
Tech 2	1.0000	(Insufficient)	1.0000	1.0000
Tech 3	1.0000	(Insufficient)	1.0000	1.0000
Triage Nurse	1.0000	(Insufficient)	1.0000	1.0000
Xray Machine 1	1.0000	(Insufficient)	1.0000	1.0000
Xray Machine 2	1.0000	(Insufficient)	1.0000	1.0000
Xray Machine 3	1.0000	(Insufficient)	1.0000	1.0000
Xray Machine 4	1.0000	(Insufficient)	1.0000	1.0000
Xray Tech 1	1.0000	(Insufficient)	1.0000	1.0000
Xray Tech 2	1.0000	(Insufficient)	1.0000	1.0000
Xray Tech 3	1.0000	(Insufficient)	1.0000	1.0000
Xray Tech 4	1.0000	(Insufficient)	1.0000	1.0000
Xray Tech 5	1.0000	(Insufficient)	1.0000	1.0000
Xray Tech 6	1.0000	(Insufficient)	1.0000	1.0000

202

Unnamed Project

Replication 3

Start Time:	240.00	Stop Time:	720.00	Time Units:	Hours

Resource

Category by Replication

Usage

Scheduled Utilization	Value
Bed 1	0
Bed 10	0.1909
Bed 11	0.1930
Bed 12	0.1927
Bed 13	0.1927
Bed 14	1.0000
Bed 15	1.0000
Bed 16	1.0000
Bed 17	1.0000
Bed 18	1.0000
Bed 2	0
Bed 20	0.1521
Bed 21	0.1506
Bed 22	0.1461
Bed 23	0.1480
Bed 24	0.1498
Bed 25	0.1444
Bed 3	0
Bed 4	0.1910
Bed 5	0.1886
Bed 6	0.1917
Bed 7	0.1876
Bed 8	0.1906
Bed 9	0.1953
Charge Nurse	1.0000
Cleaning Staff	0.3937
Clerk 1	0.01131884

203

Unnamed Project

Replication 3	Start Time:	240.00	Stop Time:	720.00	Time Units:	Hours

Resource

Category by Replication

Usage

Scheduled Utilization	Value
Clerk 2	0.01221157
CT Machine 1	0.04863264
CT Machine 2	0.04766438
CT Tech 1	0.04903538
CT Tech 2	0.05858108
ED Transport	0.00590278
EKG Machine 1	0
EKG Machine 2	0
EKG Machine 3	0
Float Nurse	0.1703
MD 1	0.1555
MD 2	0.1395
MD 3	0.1427
MD 4	0.1465
MD 5	0.1363
Mental Health Group Room	1.0000
MRI Machine 1	0.04832006
MRI Machine 2	0.04886903
MRI Tech 1	0.05378168
MRI Tech 2	0.05479629
Nurse 1	0.1918
Nurse 2	0.1647
Nurse 3	0.1636
Nurse 4	0.1577
Nurse 5	0.1580
Portable Xray 1	0.01792018
Portable Xray 2	0.00890636

204

Unnamed Project

Replication 3

Start Time: 240.00   Stop Time: 720.00   Time Units: Hours

Resource

Category by Replication

Usage

Scheduled Utilization	Value
Radiologist	0
Registration 1	0.1494
Registration 2	0.1438
Sitter 1	1.0000
Sitter 2	1.0000
Tech 1	1.0000
Tech 2	1.0000
Tech 3	1.0000
Triage Nurse	0.4466
Xray Machine 1	0.02671366
Xray Machine 2	0.03763439
Xray Machine 3	0.01860536
Xray Machine 4	0.03410698
Xray Tech 1	0.03002225
Xray Tech 2	0.02352442
Xray Tech 3	0.02786468
Xray Tech 4	0.02358798
Xray Tech 5	0.02433333
Xray Tech 6	0.03080427

205

Unnamed Project

Replication 3

Start Time: 240.00 Stop Time: 720.00 Time Units: Hours

Resource

Category by Replication

Usage

Total Number Seized	Value
Bed 1	0
Bed 10	63.0000
Bed 11	63.0000
Bed 12	63.0000
Bed 13	63.0000
Bed 14	0
Bed 15	0
Bed 16	0
Bed 17	0
Bed 18	0
Bed 2	0
Bed 20	84.0000
Bed 21	85.0000
Bed 22	84.0000
Bed 23	84.0000
Bed 24	84.0000
Bed 25	84.0000
Bed 3	0
Bed 4	63.0000
Bed 5	63.0000
Bed 6	62.0000
Bed 7	62.0000
Bed 8	63.0000
Bed 9	63.0000
Charge Nurse	0
Cleaning Staff	1,134.00
Clerk 1	165.00

206

Unnamed Project

Replication 3

Start Time:	240.00	Stop Time:	720.00	Time Units: Hours

Resource

Category by Replication

Usage

Total Number Seized	Value
Clerk 2	176.00
CT Machine 1	82.0000
CT Machine 2	81.0000
CT Tech 1	75.0000
CT Tech 2	88.0000
ED Transport	170.00
EKG Machine 1	0
EKG Machine 2	0
EKG Machine 3	0
Float Nurse	1,518.00
MD 1	468.00
MD 2	413.00
MD 3	429.00
MD 4	439.00
MD 5	408.00
Mental Health Group Room	0
MRI Machine 1	83.0000
MRI Machine 2	81.0000
MRI Tech 1	82.0000
MRI Tech 2	82.0000
Nurse 1	1,288.00
Nurse 2	698.00
Nurse 3	618.00
Nurse 4	586.00
Nurse 5	592.00
Portable Xray 1	23.0000
Portable Xray 2	11.0000

207

Unnamed Project

Replication 3

Start Time: 240.00   Stop Time: 720.00   Time Units: Hours

Resource

Category by Replication

Usage

Total Number Seized	Value
Radiologist	0
Registration 1	728.00
Registration 2	693.00
Sitter 1	0
Sitter 2	0
Tech 1	0
Tech 2	0
Tech 3	0
Triage Nurse	1,666.00
Xray Machine 1	53.0000
Xray Machine 2	75.0000
Xray Machine 3	37.0000
Xray Machine 4	69.0000
Xray Tech 1	50.0000
Xray Tech 2	38.0000
Xray Tech 3	47.0000
Xray Tech 4	40.0000
Xray Tech 5	41.0000
Xray Tech 6	52.0000

System

Other

Number Out	Value
System	6,108

User Specified

208

Unnamed Project

Replication 3

| | Start Time: | 240.00 | Stop Time: | 720.00 | Time Units: | Hours |

User Specified

<div align="center">

Category by Replication

</div>

Counter

Count	Value
Record 24	0
Record Errors	0
Record Errors6	0

209

Appendix H: Experimentation Plan

Experimentation Phase 1 (Original Model v. Plus One Nurse)

We began the first phase of experimentation by opening the simulation model given to us by the UMass Process Improvement Team. Before we actually ran the model we needed to establish how many times we would run the model and how long each run would last. To do this, we clicked Run > Setup located at the top of the Arena program. For "Number of Replications" we entered 25. This number was established so that we as users would get a feel for the variation of results. The next item in the Run > Setup dialog box we needed to determine was "Replication Length." We decided to use a length of seven days. This was determined to develop an understanding of patient flow for a one-week period. Following "Replication Length," we established a "Warm-up Period" of two days. This allowed for analysis to take place over a time period not affected by the initial-and-idle defaults of an Arena model. In other words, it allowed for the model to "warm up" until it appeared that the effects of the artificial initial conditions (e.g. zero patients within the emergency department) had worn off. Lastly, the final parameter we needed to establish in Run > Setup was the base time units. We chose "Minutes" as it appeared to be the most practical in viewing the results of different processes.

At this point we were able to move onto the comparison of the original simulation model and its patient throughput versus the patient throughput of the model that included an additional nurse. To begin we ran the simulation model and saved the results as a ".dat" file. This type of final is binary and can be read by the Output Analyzer. Next we added an additional nurse to the model by changing the "Resource" data module to include one more. We ran the model for this scenario and saved the results as a ".dat" file.

We then began work with the Output Analyzer to compare the effects the control change had on patient throughput. We started by clicking File > New to open a new data group. We selected the two saved "dat." files for the original model run and the additional nurse model run by clicking the "Add" button. By choosing Analyze > Compare Means we were able to view a comparison table of our user-specified response output – patient throughput.

Experimentation Phase 2 (Four Scenarios)

We began the second phase of experimentation opening the simulation model given to us by the UMass Process Improvement Team. At this point we checked to see if all of the run parameters (e.g. run length, number of replications, etc.) matched what we had used in the first phase of experimentation. Once we confirmed that they did we moved onto the next step in our four scenario experimentation.

At this point, we were able to begin work in the Process Analyzer. To open the program we went to Tools > Process Analyzer. Once it was running, we clicked File > New. A "Scenario Properties" Window opened and we double clicked within it to add new scenarios. A dialog box opened that required a "Program File." We browsed until we found the file we had been using for our simulation. By clicking on the "Scenario Properties" window three more times we had four base scenarios to use within the Process Analyzer.

After the four bases were established we could now define each scenario. We did so by going to Insert > Control and clicking on the "Resources" we would be adjusting for each scenario. For this project, we chose "Nurse 1", "Nurse 2", "Bed 1", "Bed 2", and "Triage Nurse." In order to see the effects of these scenarios on patient throughput we clicked on Insert > Response > User Specified > Patient Throughput. We actually defined this as an output before opening the Process Analyzer by clicking Advanced Process > Statistic. In this tab, an expression was needed. We right-clicked the expression tab to "Build an Expression." We chose Entity > Number Out in the new window. Then we added together the three entries within the model so that the expression looked like this:

EntitiesOut(Entity 1) + EntitiesOut(Patient Arrival) + EntitiesOut(Patient_Accuity_1)

After our "Controls" and "Responses" were established we entered the number of reps for each scenario. We chose to stay with "25" as that was what we used when testing the original simulation model. Our next step in this process was to run the simulation for each scenario. To do so we clicked the "Play Button" at the top of the Process Analyzer application.

Once the simulation was done we were left with a table featuring each scenario and their respective patient throughput (as an average of the 25 replications). From here we could view this information in different formats by clicking Insert > Chart.

Experimentation Phase 3 (combinations Based on Four Input Variables)

The third phase of our experimentation required the use of OptQuest, an application within Arena that seeks a combination of defined variables for maximizing or minimizing an objective. To begin we clicked, Tools > OptQuest for Arena within our simulation model. A window for OptQuest opened and we clicked "New Optimization" on the bottom right-hand corner. We were then prompted with a "Controls" list for which we chose every Bed, Lab Technician, Nurse, and Doctor within our simulation model. Because we wanted to see the effects of these control combinations on patient throughput, we clicked Response > User Specified > Output > Select All.

We also wanted to include some constraints on some of our controls so that the combinations would not become too realistic. We chose our limit for staffing at 26 and our limit for beds at 40. Also each one of our control variables had a limit of two – which meant there couldn't be a combination of more than 26 lab technicians, nurses, or doctors because there were only 13 of these staff members to begin with. The number of beds constrained to 40 because after talking with some nurses at Health Alliance, we were told the expected amount of beds a nurse could take care of at a given time was four. At most we would have 10 Nurses in these scenarios so a maximum of forty beds seemed reasonable.

After defining our controls, responses, and constraints we chose the number of replications to take place. Within the "Options" window, we set the "Replications for Simulation" to three to allow for some variation in results for each combination of controls. For "Number of Simulations" we chose a maximum 400 simulations. In addition, we accepted the "Automatic Stop" option, which meant that OptQuest would stop looking when it had not seen significant improvement for 100 different scenarios in a row.

We then defined our objective in the "Objectives" window to maximize the patient throughput equation for our model:

EntitiesOut(Entity 1) + EntitiesOut(Patient Arrival) + EntitiesOut(Patient_Accuity_1)

Once everything was defined we clicked the green "Optimize" button at the top of the application and watched the results. When the 400 simulations finished, we were able to view a graph of each simulation and its respective patient throughput response. In addition, the control combination of the best simulation in terms of maximum patient throughput was also visible in the form of a table. Lastly, we were able to see the best 25 control combinations for patient throughput.

Appendix I: Experimentation Results

Experimentation Phase 1 (Original Model v. Plus One Nurse)

This table compares the patient throughput of the original simulation model and the same model with one more nurse added to the ED staff.

Table 14: Two Scenario Comparison

Scenario Properties		Control	Response
Name	Reps	Nurse 1	Patient Throughput
Original Model	25	1	1256
One Additional Nurse	25	2	1280

Patient Throughput ComparisonFigure 6 shows the responses of the original model compared to the same model with an additional nurse. The patient throughput outputs represent the means of each scenario over the course of 25 runs.
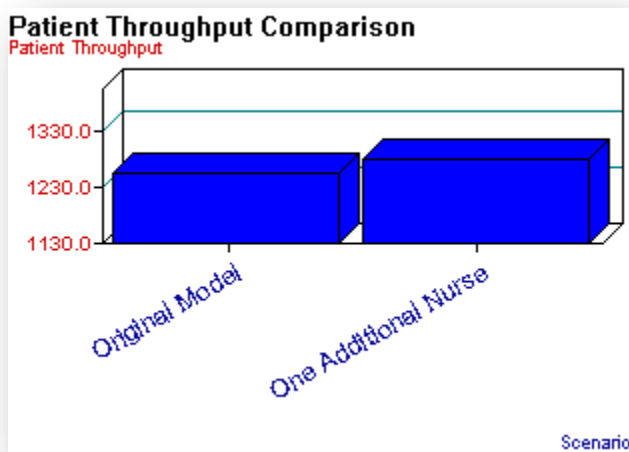
Figure 6: Patient Throughput Comparison

Experimentation Phase 2 (Four Scenarios)

Table 15 shows the results table from running the Process Analyzer for each designated scenario.

Table 15: Four Scenario Comparison

Scenario Properties		Controls					Response
Name	Reps	Nurse 1	Nurse 2	Bed 1	Bed 2	Triage Nurse	Patient Throughput
Original Model	25	1	1	1	1	1	1256
Two Additional Nurses	25	2	2	1	1	1	1265
Two Additional Beds	25	1	1	2	2	1	1258
One Add. Bed, One Add. Nurse	25	2	1	2	1	1	1291
Additional Triage Nurse	25	1	1	1	1	2	1256

Below is a bar graph giving a visual representation of patient throughput across each designated scenario.
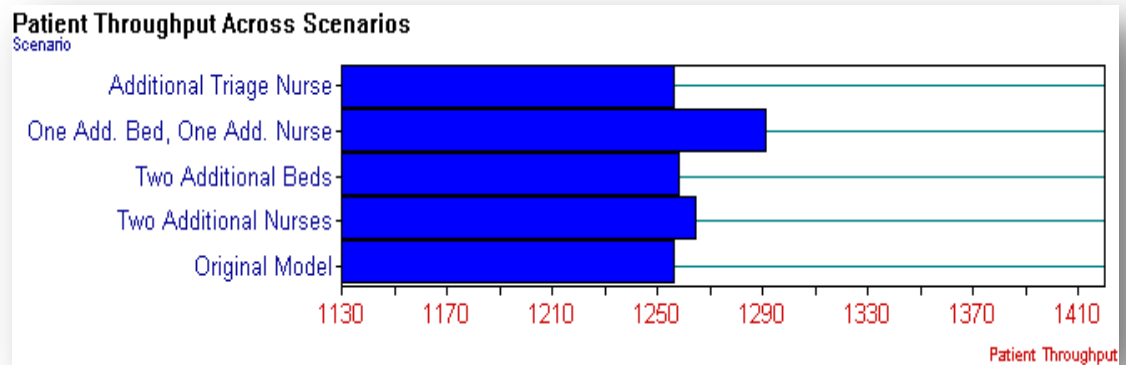
Figure 7: Patient Throughput Across Scenarios

Experimentation Phase 3 (Combinations Based on Four Input Variables)

After 400 different combinations of bed, nurse, physician, and lab technician inputs were produced by OptQuest, combination number 172 yielded the highest patient throughput. Below is the control list for run 172.

Table 16: Optimal Control Combinations

Controls			
Control Name	**Best Value**	**Control Name**	**Best Value**
Bed 1	1	Bed 5	2
Bed 10	1	Bed 6	1
Bed 11	2	Bed 7	2
Bed 12	1	Bed 8	2
Bed 13	1	Bed 9	1
Bed 14	1	MD 1	2
Bed 15	1	MD 2	1
Bed 16	2	MD 3	2
Bed 17	1	MD 4	1
Bed 18	1	MD 5	2
Bed 2	2	Nurse 1	2
Bed 20	1	Nurse 2	1
Bed 21	1	Nurse 3	1
Bed 22	1	Nurse 4	1
Bed 23	1	Nurse 5	2
Bed 24	2	Tech 1	2
Bed 25	2	Tech 2	1
Bed 3	2	Tech 3	2
Bed 4	2		

The patient throughput value yielded from run 172 was the highest among all of the 400 runs. The maximum patient throughput was 1475.667, as shown in Table 17. In addition, constraints were set to the maximum additional number of beds and the maximum amount of staffing at any given time. The values ranges are shown in Table 18.

Table 17: Maximum Throughput

Maximize		
	Objective Value	Status
Best Value	1475.667	Feasible

Table 18: OptQuest Constraints

Constraints	
Constraint Name	Limit
Bed Maximum	<=40
Staffing	<=26

Appendix J: Relationship Chart

Table 19: A Side Relationship Chart

	Ambulance Entrance	Trauma Room	Treatment Rooms 3-8	Treatment Rooms 9-12	Treatment Rooms 14-16	Psych Rooms 17-19	A Side Nurses Station	Family Waiting Room	Clean Supply	Soiled Workroom
Ambulance Entrance		A	I	U	U	X	O	U	U	U
Trauma Room			U	U	U	X	A	U	U	U
Treatment Rooms 3-8				U	U	X	A	O	U	U
Treatment Rooms 9-12					U	X	E	O	U	U
Treatment Rooms 14-16						X	I	O	U	U
Psych Rooms 17-19							O	X	U	U
A Side Nurses Station								U	I	I
Family Waiting Room									U	U
Clean Supply										O
Soiled Workroom										

Table 20: B Side Relationship Chart

	Treatment Rooms 20-25	Waiting Room	Triage	Registration	B Side Nurses Station	Housekeeping	Nurse Manager Office	Break Room	Clean Supply	Walk In Entrance
Treatment Rooms 20-25		U	U	U	A	O	U	I	U	U
Waiting Room			A	A	E	U	U	U	U	A
Triage				A	O	U	U	U	U	U
Registration					E	U	U	U	U	U
B Side Nurses Station						U	O	U	I	X
Housekeeping							U	U	I	U
Nurse Manager Office								U	U	X
Break Room									U	U
Clean Supply										U
Walk In Entrance										

Appendix K: Parsed Data

Patient Patterns Over Time

Figure 8: Monthly Patient Patterns
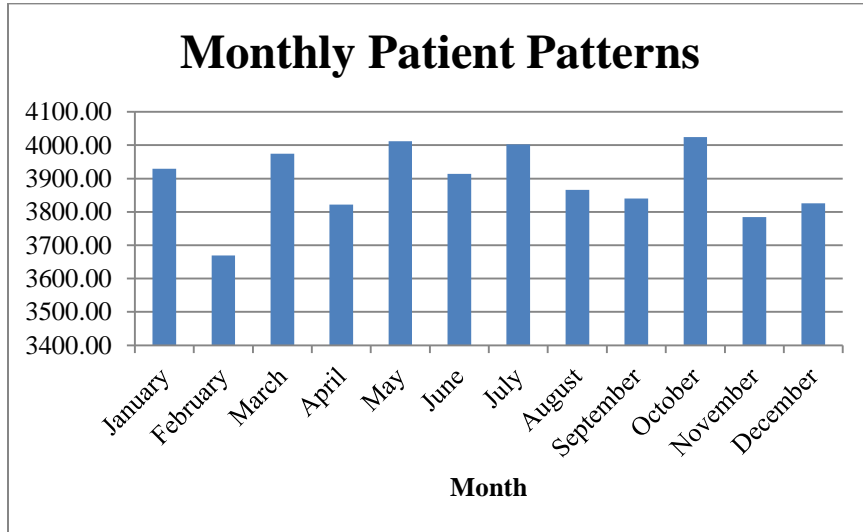
	Patients Per Month
January	3929.00
February	3669.00
March	3974.67
April	3821.67
May	4011.67
June	3914.33
July	4002.33
August	3865.67
September	3840.33
October	4024.33
November	3784.67
December	3825.67

Figure 9: Daily Patient Patterns
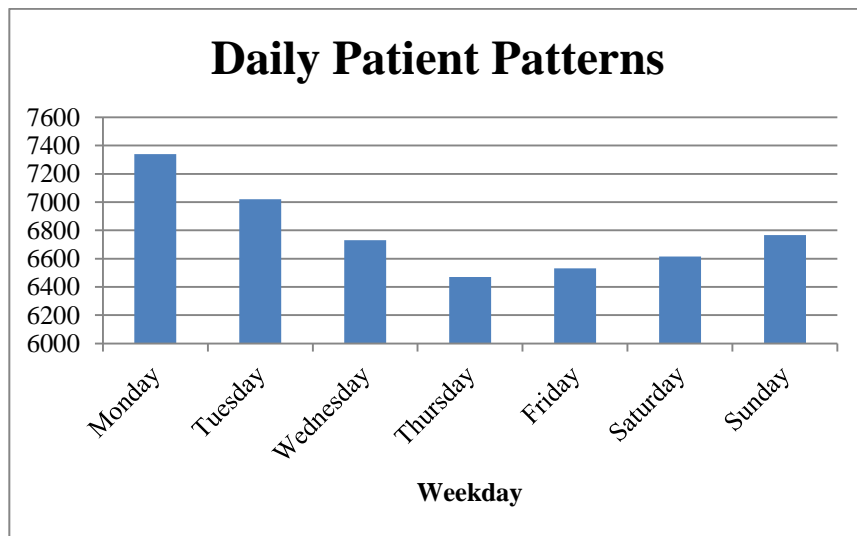
	Patients By Day
Monday	7341
Tuesday	7020.5
Wednesday	6731.5
Thursday	6471.5
Friday	6532
Saturday	6615
Sunday	6767

Monthly Mental Health Patient Patterns
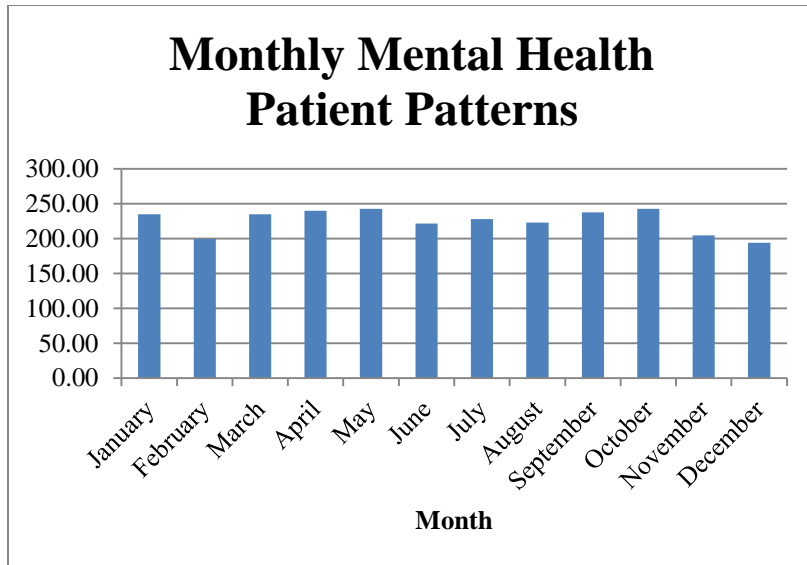
Figure 10: Monthly Mental Health Patient Patterns

	Mental Health Patients Per Month
January	234.67
February	199.33
March	234.67
April	240.00
May	242.67
June	221.67
July	227.67
August	223.00
September	237.67
October	242.67
November	204.67
December	194.00

Average Patient Distributions Over Time

Average Patients per Day

	Average Daily Patient Arrival
Monday	137.2
Tuesday	132.10
Wednesday	126.43
Thursday	123.25
Friday	123.17
Saturday	124.81
Sunday	129.39
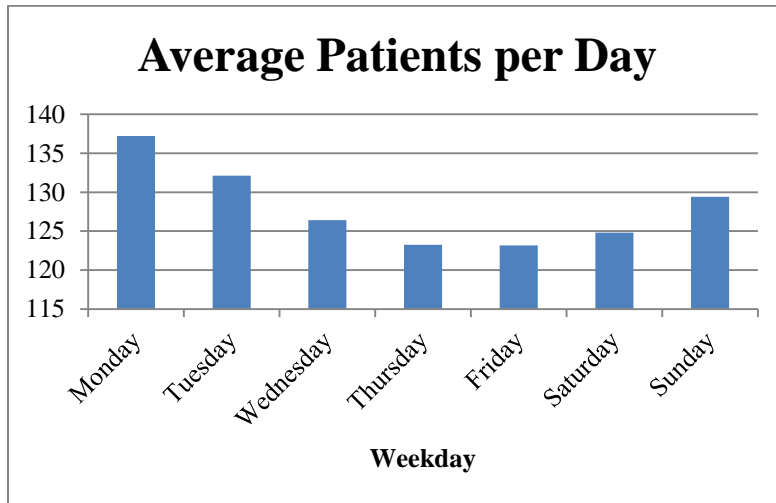
Figure 11: Average Daily Patient Arrival by Day

Average Patients Per Day

	Average Daily Patient Arrival
January	126.85
February	129.58
March	128.17
April	127.43
May	129.66
June	130.21
July	129.30
August	124.62
September	131.10
October	130.16
November	126.23
December	123.24
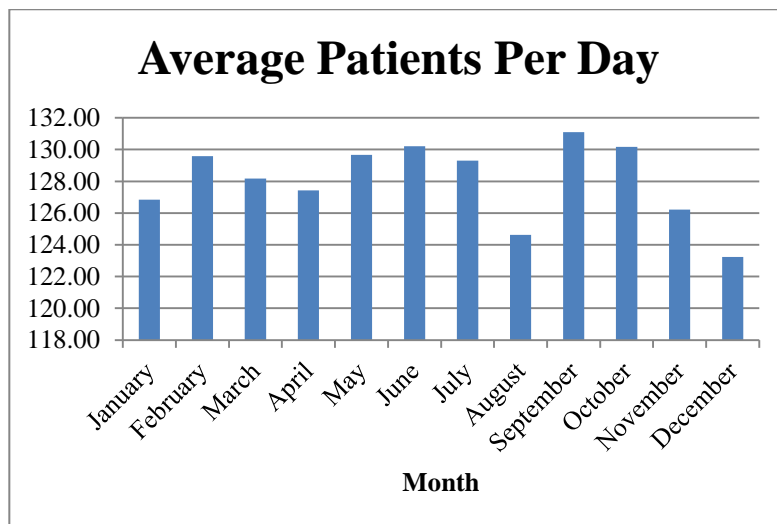
Figure 12: Average Daily Patient Arrival by Month

Length of Stay

Table 21: Weighted Length of Stay for Emergency Department Patients

	Non-Psych	Psych
Count	39735	2536
Percentage	94%	6%
Length of Stay	3:48	10:11
Weighted Length of Stay	4:10	

Arrival Method Acuity Distribution

Table 22: Acuity Distribution for Walk-In and Ambulance Patients

Walk-In Patients		Ambulance Patients	
Acuity	Count	Acuity	Count
1	15	1	172
2	4123	2	2779
3	13745	3	7198
4	12945	4	942
5	335	5	12
TOTAL	31163	TOTAL	11103

Admitted Patient Acuity Distribution

Table 23: Patient Admittance Distribution

	Count
Admitted	4856
Not Admitted	37415
Total	42271

Table 24: Acuity Distribution for Admitted Patients

Admitted Patients	
Acuity	Count
1	64
2	1876
3	2819
4	95
5	1

Treatment Distribution

Table 25: Acuity Distribution for Treatments

Acuity	CT Scan	Diagnostic Imaging	EKG	MRI
1	48	109	109	3
2	1872	3639	4153	197
3	4303	7387	7275	263
4	439	4995	255	13
5	3	6	1	0

Table 26: Total Treatments Performed

Count	
CT Scan	6665
Diagnostic Imaging	16138
EKG	11795
MRI	476
None	19883

Treatment Combinations

Table 27: Treatment Combinations

If CT		If Diagnostic Imaging		If EKG		If MRI	
Diagnostic Imaging	3292	CT	3292	CT	3516	CT	340
EKG	3516	EKG	7923	Diagnostic Imaging	7923	Diagnostic Imaging	333
MRI	340	MRI	333	MRI	401	EKG	401

Staffing Requirements and Emergency Department Patient Patterns

Sunday Staffing Model

Hourly Patterns of Emergency Department Patients on Sunday
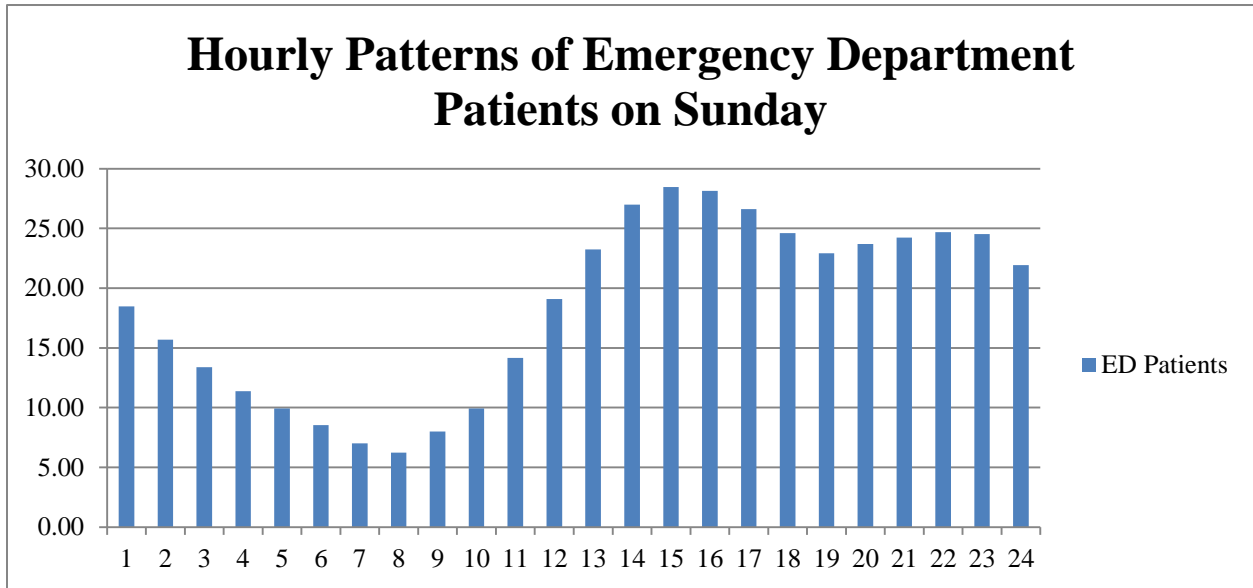
Figure 13: Hourly Patterns of Emergency Department Patients on Sunday

Nurse Staffing Model on Sunday
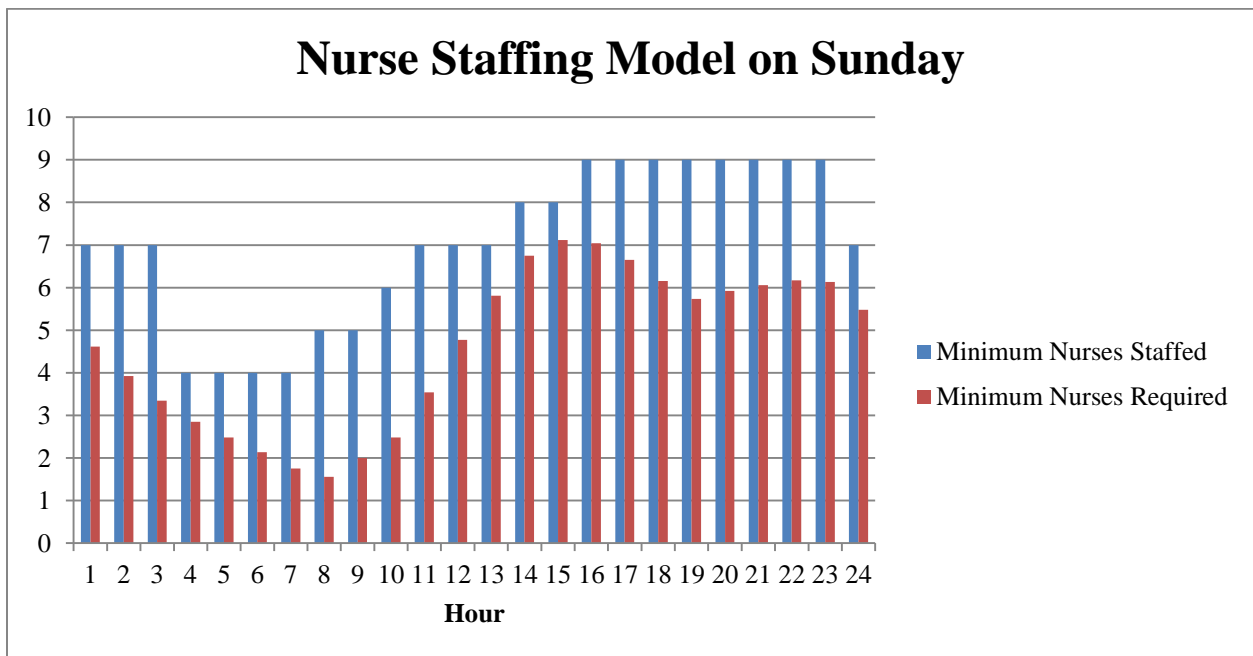
Figure 14: Nurse Staffing Comparison for Sunday
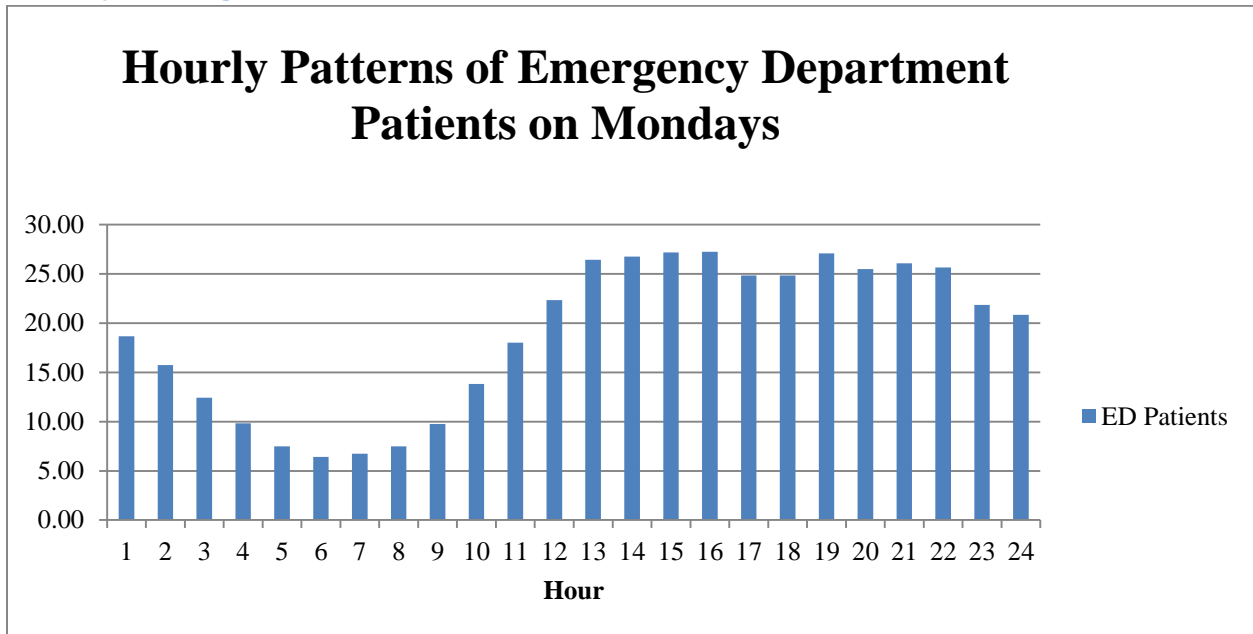
Figure 15: Hourly Patterns of Emergency Department Patients on Mondays
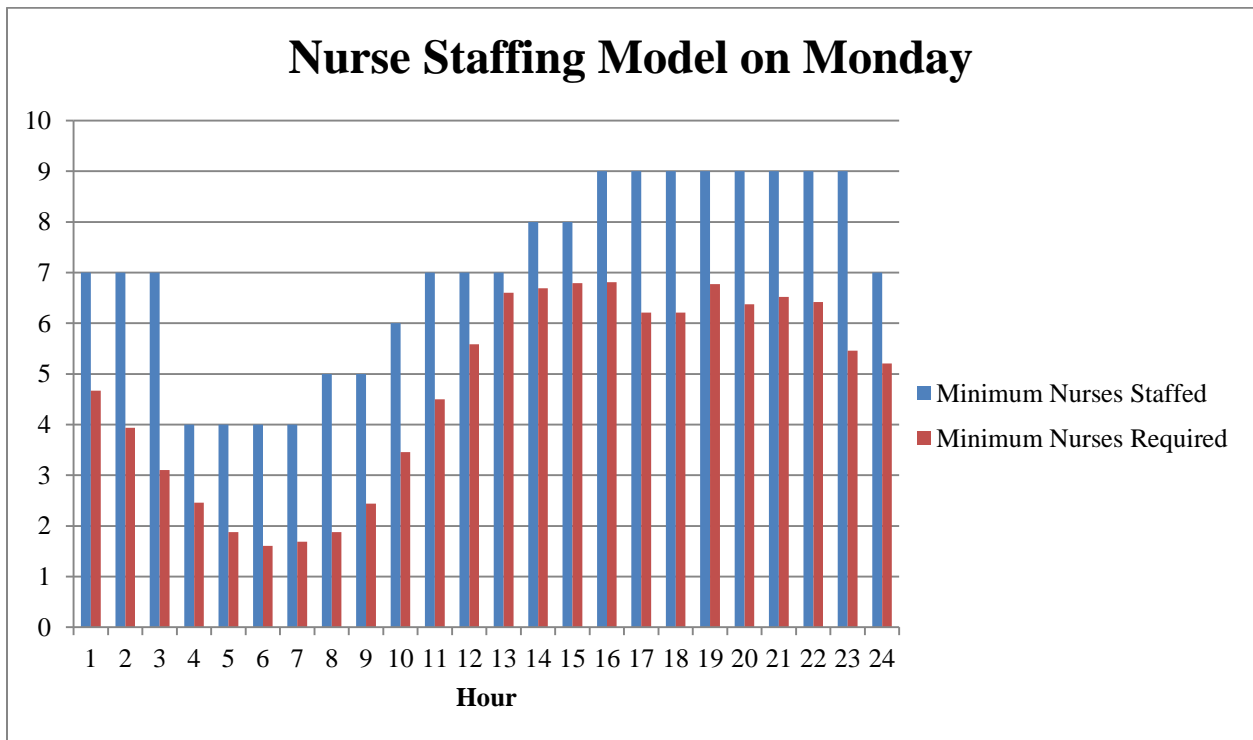
Figure 16: Nurse Staffing Comparison for Monday
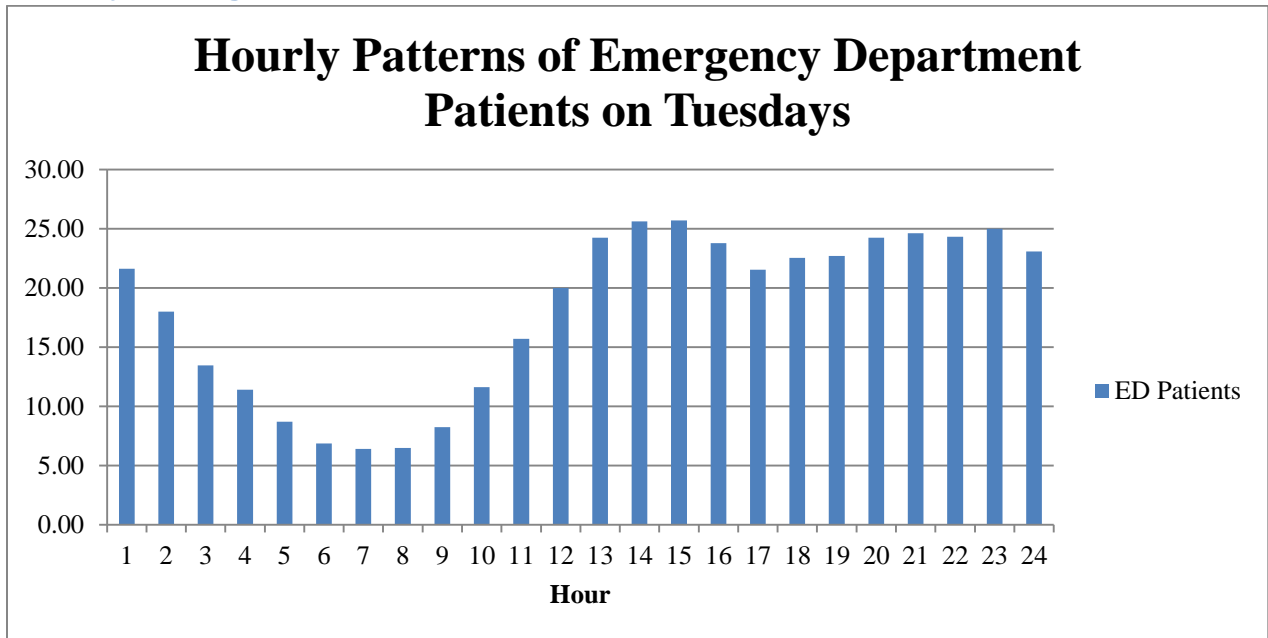
Figure 17: Hourly Patterns of Emergency Department Patients on Tuesdays
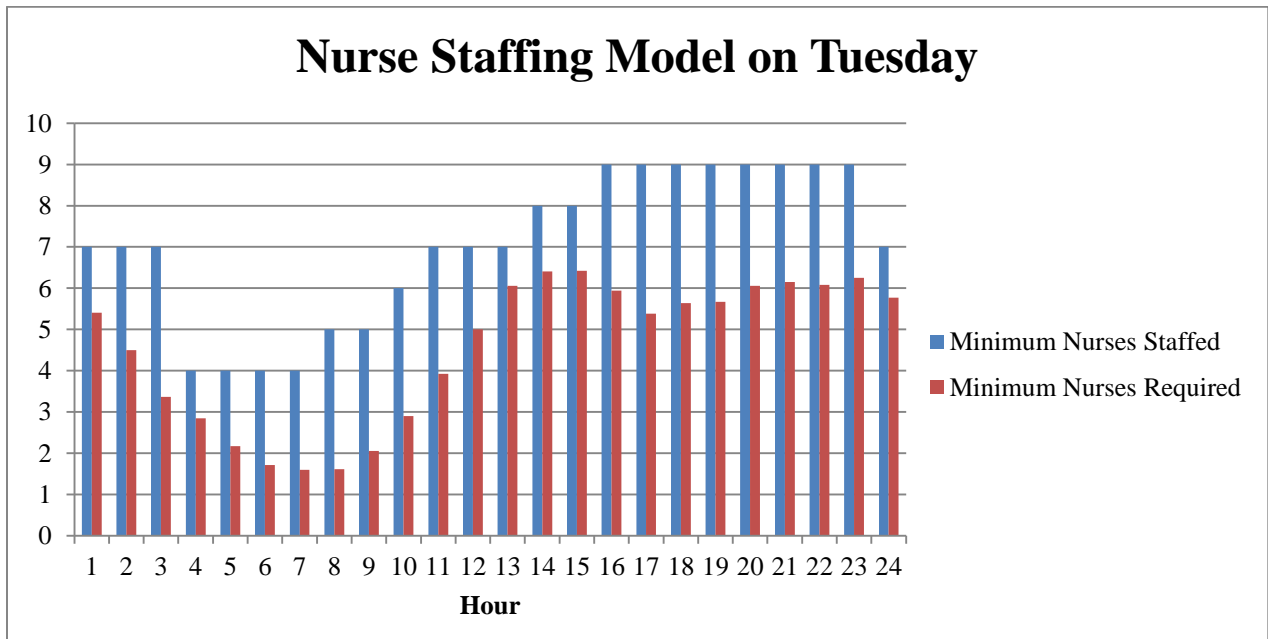
Figure 18: Nurse Staffing Comparison for Tuesday
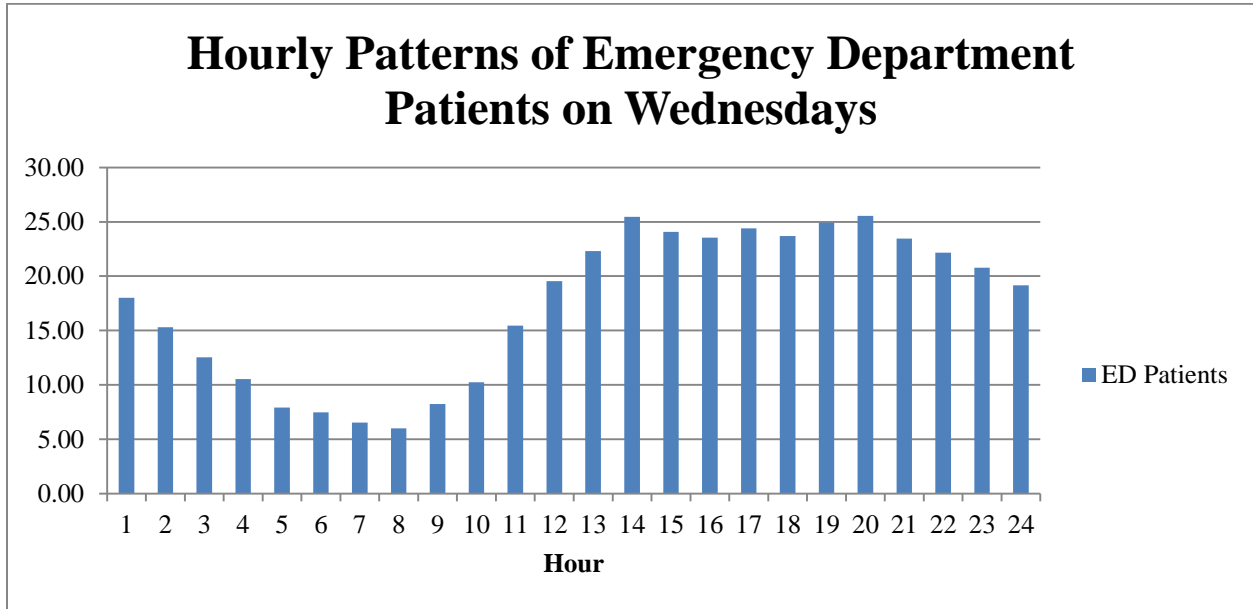
Figure 19: Hourly Patterns on Emergency Department Patients on Wednesdays
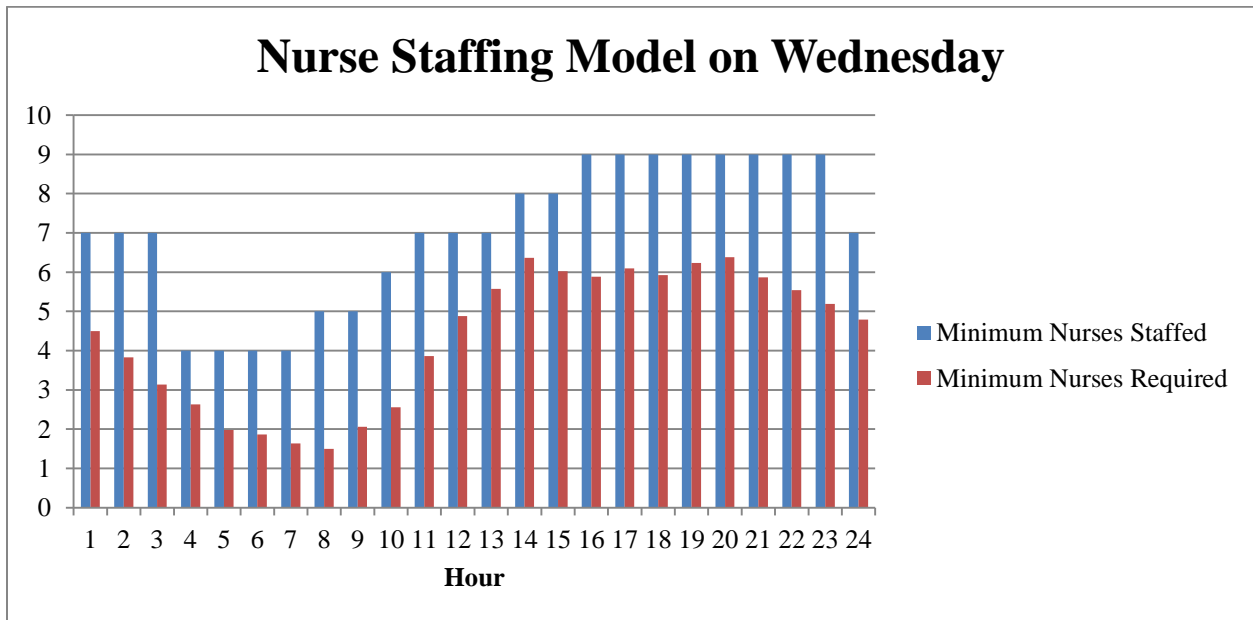
Figure 20: Nurse Staffing Comparison for Wednesday
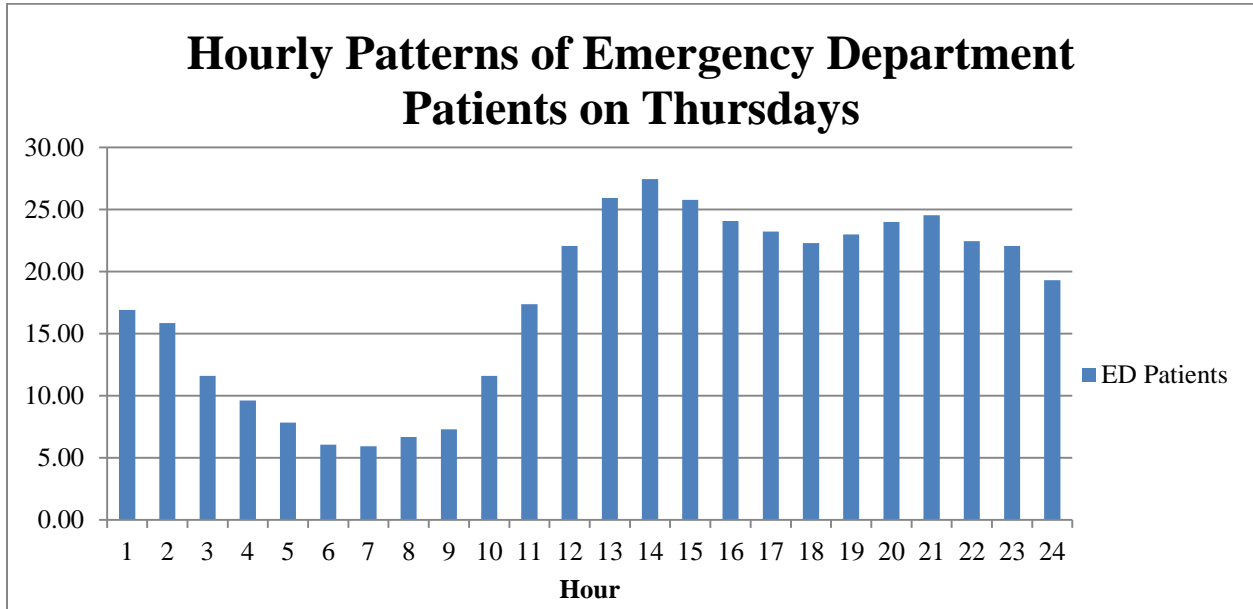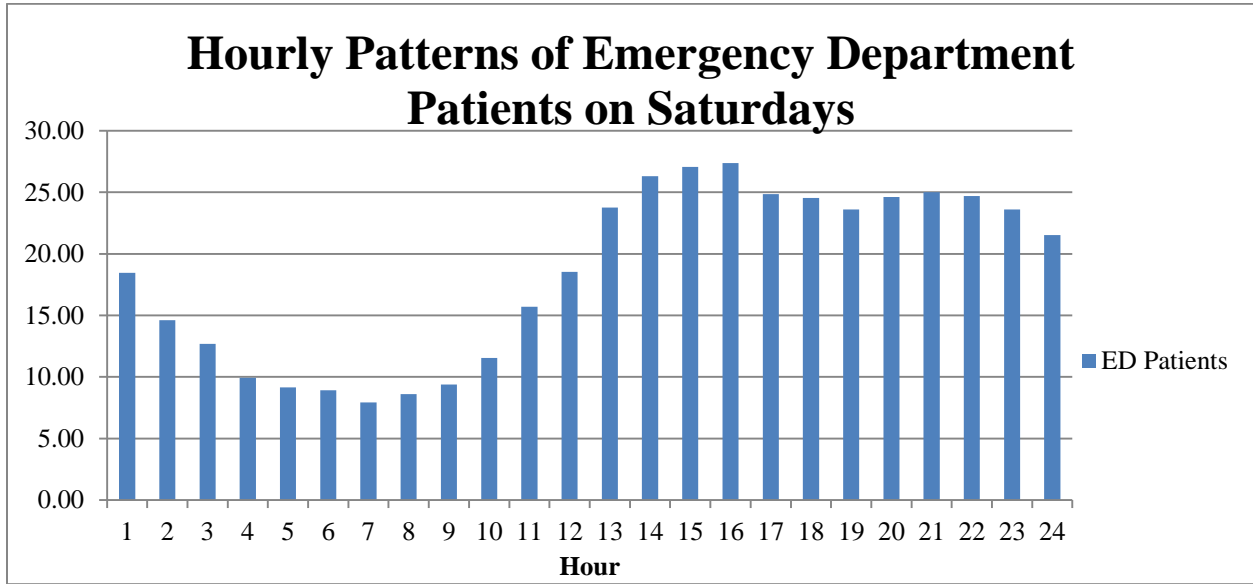
Figure 21: Hourly Patterns of Emergency Department Patients on Thursdays
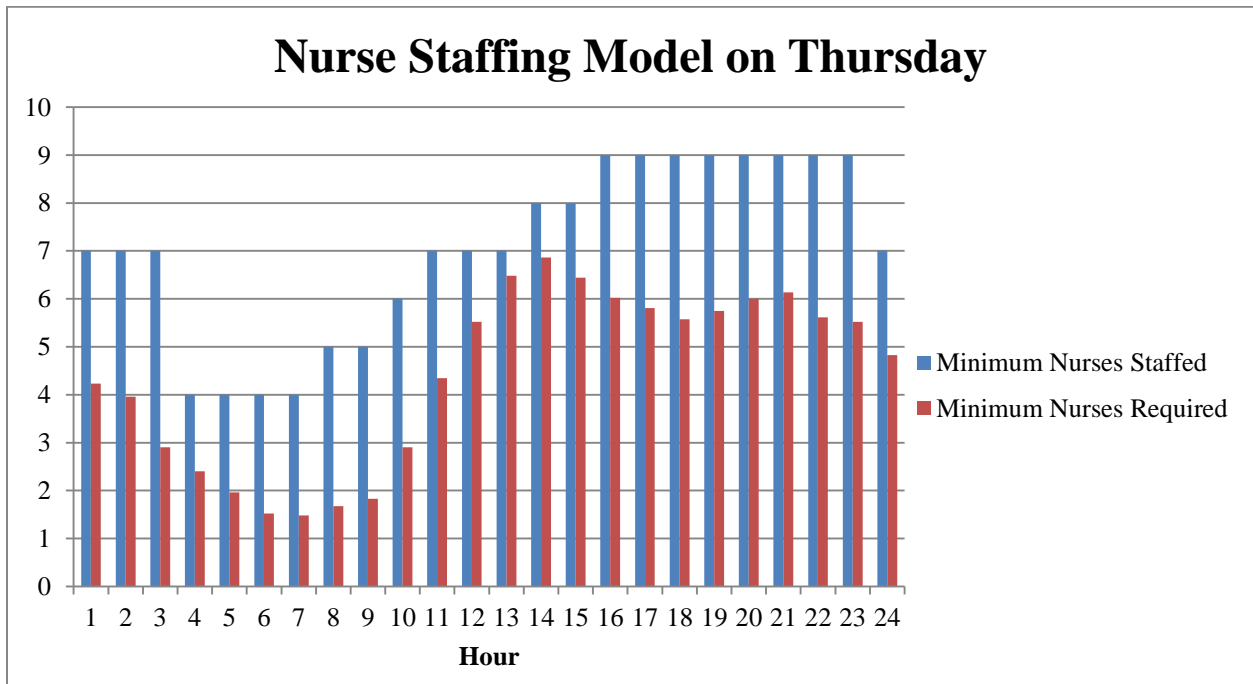
Figure 22: Nurse Staffing Comparison for Thursday

Hourly Patterns of Emergency Department Patients on Friday
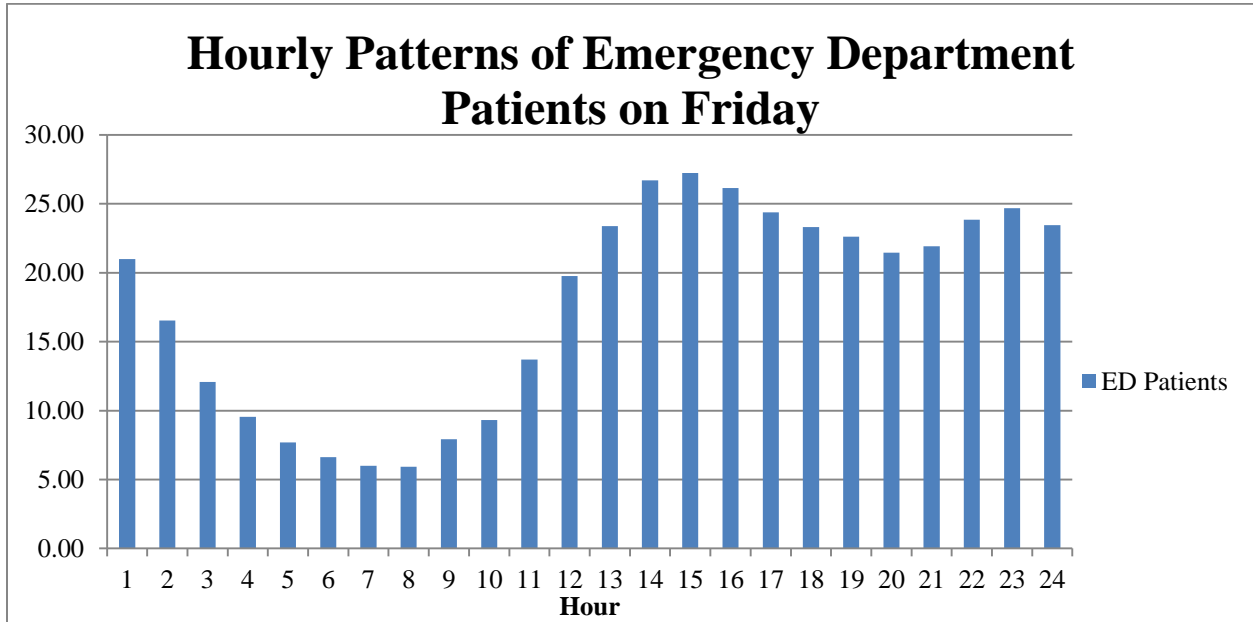
Figure 23: Hourly Patterns of Emergency Department Patients on Fridays

Nurse Staffing Model on Friday
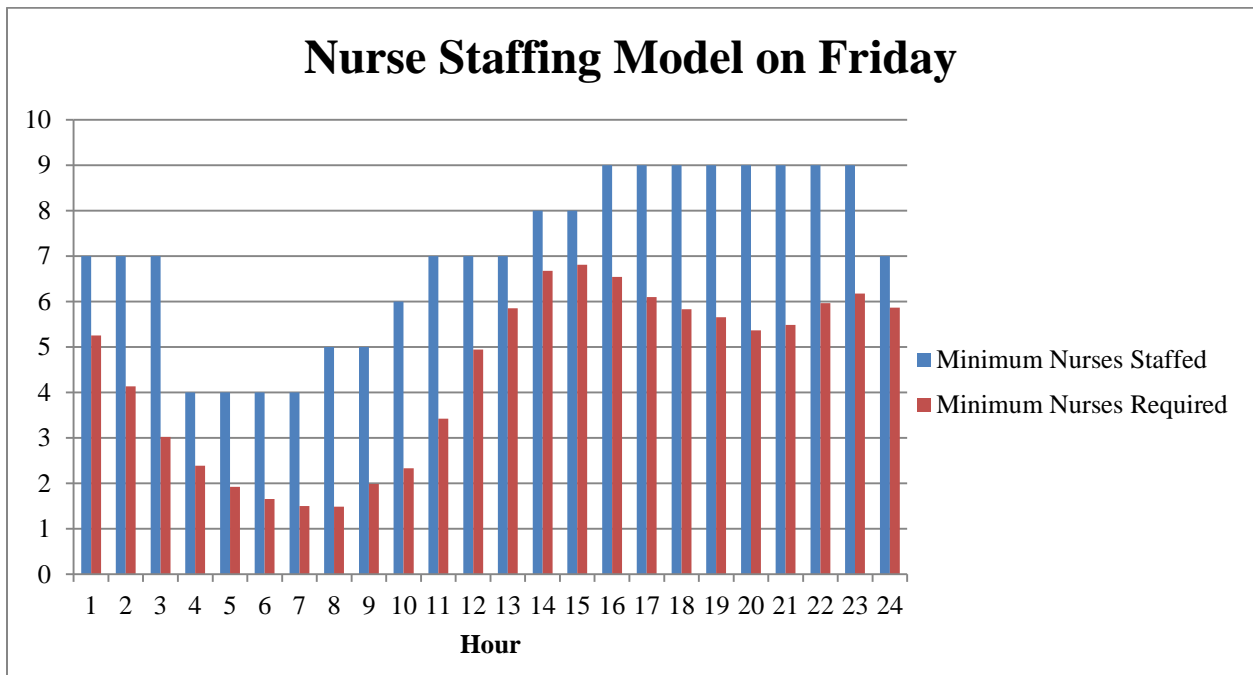
Figure 24: Nurse Staffing Comparison for Friday

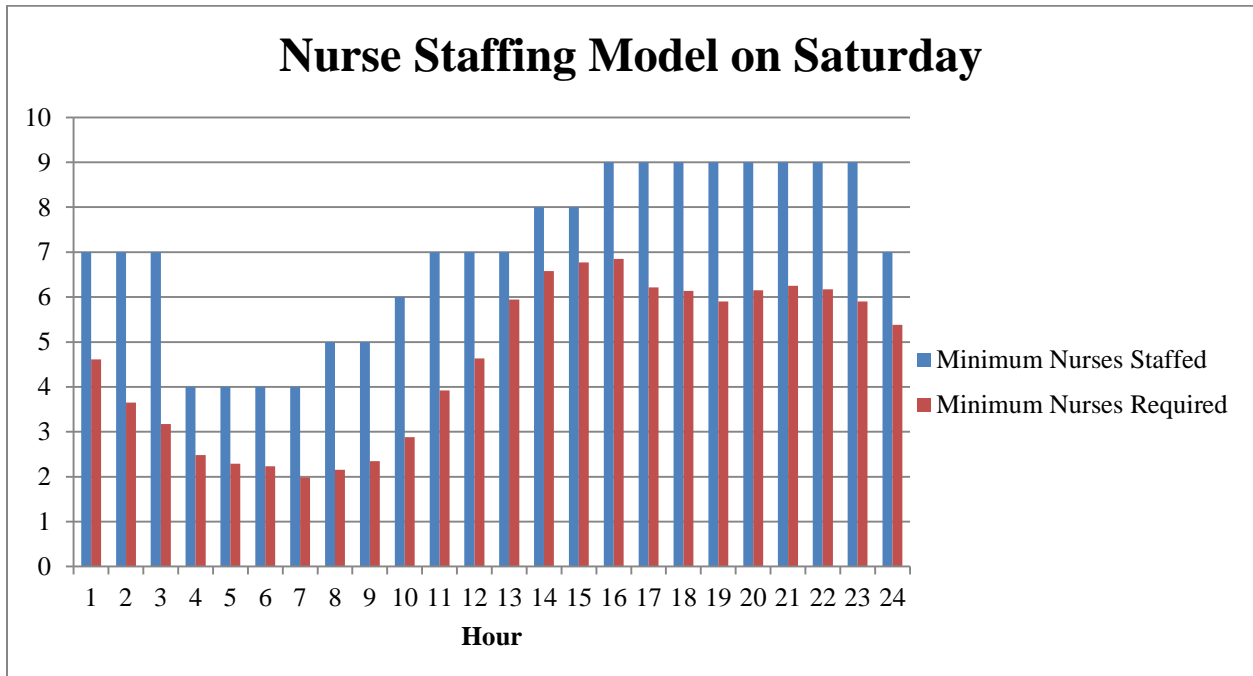**Figure 25: Hourly Patterns of Emergency Department Patients on Saturdays**

Figure 26: Nurse Staffing Comparison for Saturday