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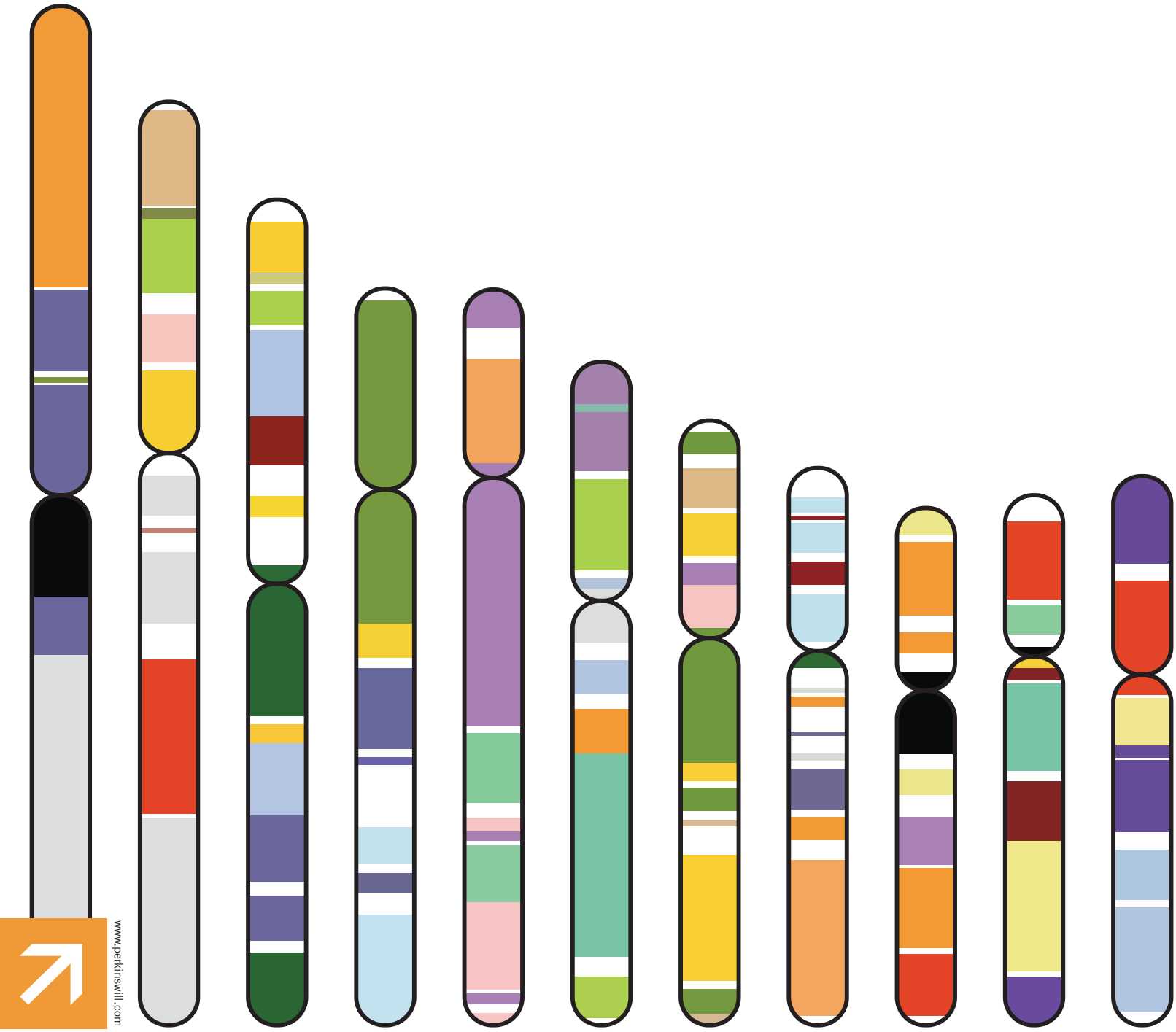

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05.
THE IMPACT OF AN OPERATIONAL PROCESS ON SPACE:
Improving the Efficiency of Patient Wait Times

Amanda Mewborn, RN, IE, MSHS, Lean Black Belt, *amanda.mewborn@perkinswill.com*
Marvina Williams, RN, Lean Black Belt, *marvina.williams@perkinswill.com*
Jeff Tyner, AIA, LEED BD+C, Lean Black Belt, *jeff.tyner@perkinswill.com*

ABSTRACT
A large community hospital with over 100,000 emergency visits annually was challenged with reducing their patient waiting times, and decided to make some critical changes to their process in order to care for their patients. The hospital was certain that the lack of space was the primary cause of the problem, as all exam rooms and the waiting areas were occupied during peak times. This study was conducted to understand the relationships between current operational practices, patient volumes and flow of patients through the different areas of the emergency department. The team first approached the study by understanding the operational processes in the emergency department. Through the use of Lean design principles, observational study, and other methods such as data analysis and operational modeling, the research team identified opportunities that would improve operations and flow with minimal construction costs.

KEYWORDS: emergency department, process improvement, fast track, operations modeling, Lean

1.0 INTRODUCTION

This study focused on an emergency department (ED) of a large community hospital. The emergency department operates as four entities: Children's Emergency Center (CEC), Fast Track (FT), Main, and Observation. The CEC cares for all pediatric patients, while the other three areas care for adults. FT is dedicated to simple medical issues, Main is for complex medical issues, and Observation is for patients who need to be observed further, but do not need to be admitted to the hospital.

FT, with the shortest turn-around-time for patients, at less than two hours, was targeted for improvement. The hypothesis was that if more patients could be seen in the FT area, additional space would be available in the other areas, patient turn-around-times would decrease, and patient and staff satisfaction would improve.

The researchers utilized different methods to understand the operations of the emergency department, assess the primary causes of these challenges, analyze several options, and then recommend potential solutions. Many of these methods have their origins in Lean design principles. While Lean processes are not new (it started with Henry Ford in 1913), it has only recently taken hold in healthcare and service industries[1]. The utilized research methods included:

- *Observational Study* – Observational studies allow the researchers to see the workplace in action, at the front-line. For this study, observational study focused on identifying wastes in the current operation of the emergency department, as well as understanding the culture of the existing work environment.
- *Process Mapping* – Hospital staff collaborated with the facilitators to map out the current workflow for processing patients in the emergency department. Each step was mapped, and opportunities for improvement were placed on a map as yellow starbursts. Then, a future state process map was developed to depict the desired method for operating in the FT area.

- *Data Analysis* – Operational data, such as turn-around-times, number of visits by service area, and number of visits by intensity of services rendered, were analyzed. The analysis revealed potential opportunities for improvement.
- *Operational Modeling* – After potential changes were identified through data analysis, a simple operational model was completed to estimate the impact of the changes on the workflow that would improve their original concern of patient flow.

2.0 METHODOLOGY

2.1 Observational Study

The research team toured the existing workspace, learning about the current work processes and patient flow processes. The team was able to visualize the space and how it was utilized by its occupants. As "outsiders", the team quickly identified opportunities to improve the use of the existing space. For example, FT was operating out of a small, short hallway with only five small rooms (that were each unique) and three recliners. This small space facilitated collegiality amongst the staff as well as close communication. Cultural aspects were identified as important considerations for process mapping, as well as understating how this space functions.

Furthermore, the team identified the eight wastes outlined by Lean principles, which include: overproduction, defects, inventory, over-processing, transportation, waiting, motion, and unutilized people[2]. Table 1 shows the examples that were recorded during the observational study.

Table 1: The eight wastes.

Waste	Description	Example from Observational Study
Overproduction	Processing too soon or too much	Greeters prepared multiple clipboards with forms in advance of a patient's arrival
Defects	Errors, mistakes, rework	Mis-keyed information in the registration system, medication errors
Inventory	Holding more inventory than required	Stock-piles of supplies and equipment in some areas while others were short of the same supplies and equipment (for example, wheelchairs)
Over-processing	Processing more than required (overly-complex process)	Patients repeat the same information multiple times to various workers
Transportation	Moving items more than required (wasting energy)	Many hand-offs of the patient and his/her information amongst various workers
Waiting	Employees or customers waiting	Employees at the Triage area waiting to see a patient while Registration registered the patient; patients waiting in the waiting area and in exam rooms
Motion	Moving people more than required	Workers moving from exam rooms to the waiting area, back to exam rooms; workers hunting for supplies and equipment
Unutilized People	Not leveraging workers to their fullest potential	Having nurses clean exam rooms between patients

The team utilized a floor plan of the existing space to outline how all areas are currently being used, and to note any barriers created by the existing space. For example, the FT area lacked visibility to the waiting area, causing disconnect from lack of information about the number of patients waiting, and the condition of those patients.

2.2 Process Mapping

Next, the research team met with several members of the department to understand and map the current workflow. A technique known as "swim lane format" was utilized to map the flow of patients[3]. In this format, roles or locations are represented graphically in lanes across the page, with steps completed by that role or in that location displayed in that row. Swim lanes are a way to visualize how much activity is completed by each role or in each location. Additionally, challenges currently encountered in the process were highlighted with yellow bursts. A sample of the process maps developed is shown in Figure 1.

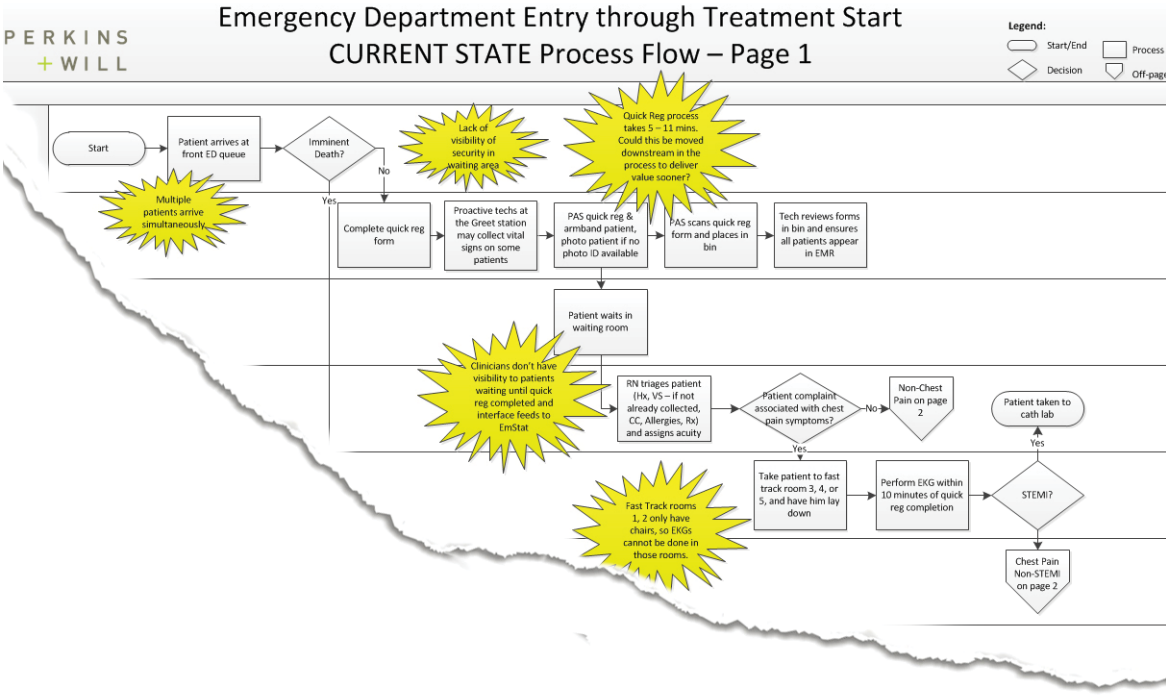

Figure 1: Process flow map of the current state in emergency department.

Next, the team evaluated a process where many more patients could be cared for in FT. This process was outlined as the "future state" and represented how the department wanted to operate. When envisioning the future state, the team utilized some of the earlier referenced Lean principles, such as the elimination of waste, delivering more value to the customer in less time, and 5S for organization of spaces. The Lean tool, 5S, is about organizing spaces, and includes five steps: sort, set in order, shine, standardize, and sustain. The future state was meant to reflect an ideal situation, and it was documented as process maps, assuming space and staffing would not be an issue. Here again, swim lane maps were utilized. The yellow bursts in the future state map represented opportunities for further improvement. For example, one burst highlighted the opportunity to standardize processes for making clinical decisions. A sample of the future state process is shown in Figure 2.

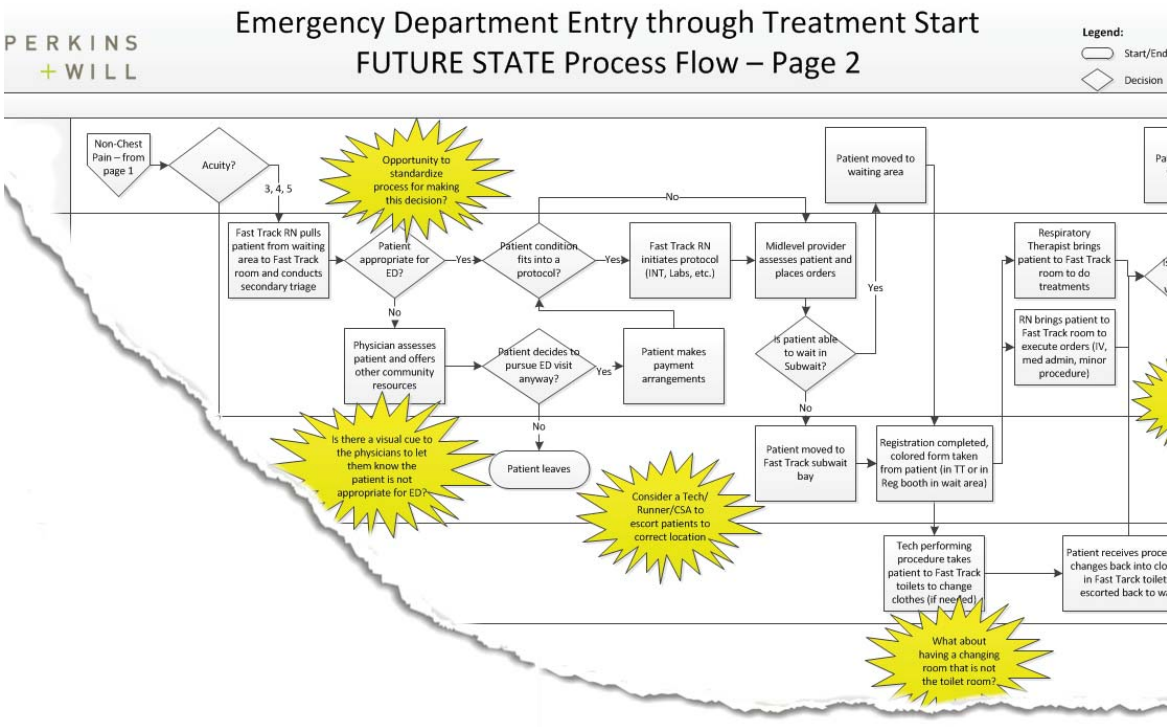

Figure 2: Process flow map of the future state.

2.3 Data Analysis

Next, the research team analyzed patient volumes and the impact of shifting care of patients to other areas within the department. The first step in the analysis identified how many patients were in the ED at any given time of day. This analysis demonstrated that the facility may need 71 spaces (including Waiting Areas) to care for Adults and 16 spaces (including Waiting Areas) to care for Children with current patient volumes. Next, the same analysis was completed for FT patients. This analysis suggested that 7 spaces were needed to care for current FT patients, and that the existing FT space (5 rooms + 3 recliners) was unable to accommodate any additional patient visits, as shown in Figure 3.

Data provided on patient visits that could qualify to be seen in FT (if there was capacity) was reviewed. The daily FT volume in current state was 52 visits, with the most patients at any given hour being less than seven, as shown in Figure 3. There were 122 additional visits per day identified that would qualify for FT, if there was space capacity. This represented a 235 percent increase in daily patient visits to FT, to 174 visits per day, with the most patients in any given hour being about 22, as shown in Figure 4. The analysis suggested that 24 spaces would be needed to care for the proposed FT patient visits.

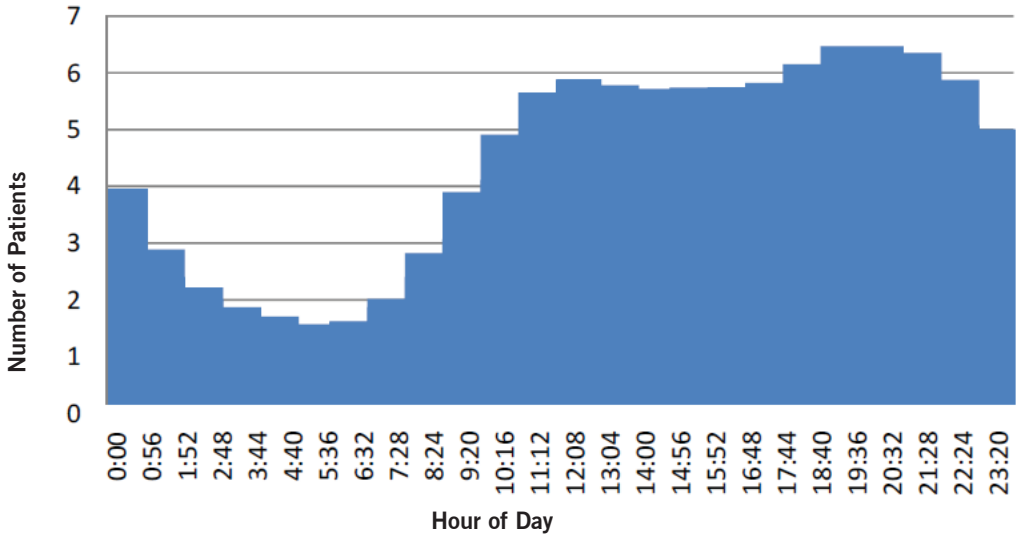

Figure 3: Current daily volume of patients in FT.

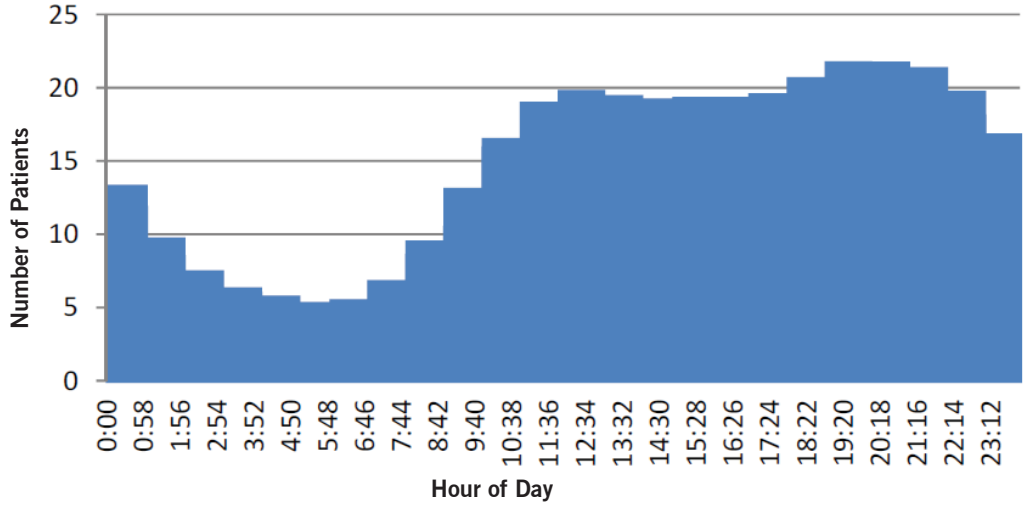

Figure 4: Proposed daily volume of patients in FT.

With only eight existing care spaces, and the analysis suggesting the need for 24 care spaces to accommodate a shift of patients from Main and CEC to FT, operational modeling was necessary to identify the impact to the Main and CEC spaces if these patients were shifted to FT.

2.4 Operational Modeling

Shifting 122 visits per day from care in Main and CEC to FT would certainly have an impact on the space needed by CEC and Main. Creating additional care spaces for FT would result in reduction in existing rooms in Main and CEC. Assuming the same average visit time for these additional 122 visits, the analysis demonstrated 241 hours of additional patient care per day that would take place in FT. This resulted in 10 additional FT spaces needed to accommodate the additional patient visits.

The team went on to identify the reduction in spaces needed in Main and CEC for patients that would now be cared for in FT. Assuming the same average visit time for the 122 visits that were shifted from Main and CEC to FT, the analysis showed that 527 hours of patient care each day would no longer take place in Main and CEC. This resulted in up to 22 Main and CEC spaces that would no longer be needed.

Based on this analysis, it was suggested that if the ED would like to shift patient visits from care in the Main and CEC to FT, the ED will need to add 16 more patient care spaces in FT to provide an additional 241 hours of care each day. Further, it was estimated that the ED may need 22 fewer patient care spaces in Main and CEC to provide 527 fewer hours of care each day. Results are shown in Table 2.

2.4 Potential Architectural Design

While the current state process map, future state process map, data analysis, and operational modeling were taking place, the research team designed a new Fast Track that alleviated the pressure on the waiting area and addressed many of the challenges identified in the current state process map. An initial design that was considered would be impacted by these analyses and simulation; but, the analysis informed the process in time to make some valuable changes before any construction. One of the possible floor plan solutions was reviewed with emergency department staff, and it was determined that the layout would not facilitate the privacy needed to pre-register and triage patients. The team is modifying the architectural design to allow for floating booths or tables that would facilitate privacy as well as flow of patients. The greeter desks were shifted to the shape of a triangle instead of a square. The triangle would facilitate more privacy for patients during quick registration and triage, increase communication between registration and clinical staff, and would allow better flow of patients upon entry.

Table 2: Comparison of the space requirements and patient volumes for FT, Main and CEC areas.

Fast Track Impact		Main/ Children's Impact	
Additional FT patients/day	122	Fewer Main/Children's patients/day	122
Increase in FT patient care hours/day	241	Decrease in Main/Children's patient care hours/day	527
Additional FT care spaces needed	16	Fewer Main/Children's care spaces needed	22

3.0 CONCLUSION

Based on this study, it was suggested that if the ED would like to shift patient visits from care in the Main and CEC to FT, the ED will need to add 16 more patient care spaces in FT to provide an additional 241 hours of care each day. Further, it is estimated that the ED may need 22 fewer patient care spaces in Main and CEC to provide 527 fewer hours of care each day.

The methods that were utilized to determine the requirements included observational study, process mapping, data analysis, and operational modeling. Additionally, Lean principles and concepts were utilized in designing the future state process map as well as the floor plan. Lean principles generally focus on the reduction of waste in a process. Lean design is the application of Lean principles to the design or architectural process. Lean methods applied to the design process result in designs that are developed faster, more operationally efficient, and with the elimination of waste.

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