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USING A LEAN PERSPECTIVE TO EXPLORE THE IMPACT OF THE BUILT ENVIRONMENT AND OPERATIONS ON THE RETENTION OF PATIENTS IN AN OUTPATIENT CARE DELIVERY SETTING: *Improving Efficiency as a Strategy to Increase Capacity*

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ABSTRACT
The Grady Health System Ponce de Leon Center is a comprehensive outpatient clinic for treatment of HIV and AIDS. The Center sought to improve operations and the built environment to retain and attract more patients in ongoing care at the Center. The project employed a Lean perspective to identify opportunities and improve efficiency within the clinic. Lean tools such as observational studies, spaghetti diagrams, value stream maps, and utilization analyses were used to assess the current patient flow and service within the clinic. Findings were utilized to develop conceptual diagrams reflecting a modified built environment to facilitate greater efficiency in providing care.

KEYWORDS: patient-centered medical home, clinic redesign, efficiency, primary care, HIV/AIDS

1.0 INTRODUCTION

1.1 Client Background

The Ponce de Leon Center is one of the largest, most comprehensive facilities dedicated to the treatment of advanced Human Immunodeficiency Virus (HIV) and Acquired Immunodeficiency Syndrome (AIDS) in the United States. Founded in 1986, the Ponce de Leon Center provides health care and support services to approximately 5,000 eligible men, women, adolescents/young adults, and children living with HIV/AIDS.

The Ponce de Leon Center integrates primary internal medicine and infectious disease subspecialty care in three clinics. Staffed by doctors, nurse practitioners, physician assistants, nurses, and more than 100 staff, the care teams seamlessly provide medical, support, and community services.

To qualify for care in the Ponce de Leon Center, adult referrals must have a previous AIDS diagnosis or a Nadir CD4 count below 200 (a clinical indicator of the severity of the disease). Pediatric and adolescent patients have no referral restrictions.

Services Offered at the Ponce de Leon Center include:

- Laboratory
- Pharmacy
- X-Ray
- Translation services
- Social services
- Financial counseling
- Behavioral health
- Non-Emergency clinic
- Specialty clinics
- Oral health

The Ponce de Leon Center operates from the former Presbyterian Headquarters in Atlanta, Georgia. Atlanta is considered to be one of the epicenters of the HIV/AIDS epidemic in the United States. The biggest problem associated with care of these patients is getting them into the care system and retaining them. Only approximately 66 percent of the people living with HIV or AIDS are linked to care and only 37 percent are retained in care and treatment. Many do not seek treatment or drop out of treatment due to challenges such as homelessness, mental illness, substance abuse, and/or stigma associated with the disease. Because of the stigma, many patients fear other people seeing them while they

receive care, as that would reveal their diagnosis. Large waiting areas that lack privacy, coupled with long waits, increase the chances of patients being seen while at the Center.

1.2 Research Interest

The primary research interest was to explore the impact of the physical environment on care process efficiency and patient satisfaction. Specifically, current operations were analyzed, including identification of opportunities to gain efficiencies in providing care to patients. Then, a few redesign options were considered for enhancing the patient flow and experience. Overall, the purpose was to enhance the care process to retain patients in the care delivery system.

2.0 PROJECT DETAILS

2.1 Project Goals

The project had three main goals:
Goal 1: Increase the percentage of people with HIV/AIDS who receive care at the clinic. The two main barriers to people with these diagnoses receiving care are stigma and the possibility of seeing people they know while receiving care. The project goal was to provide-patient privacy and efficiency in receiving care at the Center.

Goal 2: Improve patient flow to ensure patients do not feel herded or confined in the building.

Goal 3: Maximize the use of the existing space in the building, and explore the potential to use the existing shell space on the fifth and sixth floors.

While not a stated goal, the cost of the project needed to be kept to a minimum. Being a subsidiary of a large public, academic hospital, there is limited funding for improvements or changes to the building. Therefore, when identifying potential changes, high priority was given to solutions with minimal cost.

2.2 Project Objectives

Based on the three goals, the project team identified four objectives to drive the work in alignment with the stated goals:

1. Increase privacy to reduce the likelihood of patients seeing other patients.
2. Improve flow to reduce the feeling of being confined or herded through the care process.
3. Improve efficiency to decrease the total time a patient spends in clinic (throughput time).
4. Increase capacity to optimize the use of resources (space and people) to achieve maximum results.

All solutions were also checked against an organizational strategy to become a patient-centered medical home.

2.3 Project Approach

The project approach could be summarized in three steps:

1. Understand the current flow of patients and staff.
2. Identify opportunities to enhance efficiency and efficacy of clinic operations.
3. Define potential changes to improve flow and reduce turnaround (throughput) times.

These three steps were completed using Lean approach and tools. Lean is a method that is based on continuous improvement, and focuses on increasing value delivered to the customer while minimizing waste. In this project, the customer was defined as the patient. Value to the patient includes tasks that the patient would be willing to pay for and tasks that advance the care process. Waste includes tasks that the patient would not be willing to pay for, tasks that are not done correctly the first time, or tasks that do not advance the patient's care process.

In Lean, there are eight types of waste that can be found in processes[1]. The eight wastes include defects, overproduction, waiting, non-utilized talent, transportation, inventory, motion, and excess processing[2]:

- Defects include errors, and examples in healthcare include medication errors and surgical errors[3].
- Redundant work is covered by the waste of overproduction. In healthcare, an example of overproduction is completion of many forms with the same information[3].
- Waiting is a waste that is difficult to be avoided in healthcare. After all, in healthcare, rooms are designated for the function of waiting.
- Non-utilized talent includes lack of engagement of employees[1]. Examples of non-utilized talent in healthcare include unmonitored suggestion boxes and assigning tasks that do not require licensure to licensed employees.
- The waste of transportation includes movement of the patient or supplies to complete a task[3]. An example of transportation in healthcare is staff leaving their assigned work area to go to central supply to pick up supplies[3].
- Inventory includes any materials that are available, yet not needed to do the work at hand[3]. Examples of inventory include overstocked medications and supplies at the point of use[3].

- The waste of motion is movement or double-handling that is not necessary. The waste of motion is often described as "hunting and gathering." An example is a nurse looking for supplies needed to do a task[3].
- The eighth waste of excess processing, includes activities that do not align with the patient's needs[1]. An example of excess processing in healthcare is the collection of data that is never used[1].

In this project, the team analyzed processes, identifying the eight wastes, and considering processes to eliminate the wastes.

2.4 Project Deliverables

The project entailed conducting several observational studies. An observational study, in Lean speak, refers to "going to the gemba." Gemba is a Japanese word meaning "the real place."[4] Going to the gemba means going to the location where the work is done. In this project, the team toured the existing environment, spoke with employees and patients, and gathered their feedback and ideas for improvement. During an observational study, current workflow and processes were observed. Further, the observational study allowed the team to understand the myriad of roles of workers in the environment, what the scope of each role was, and how the various roles interacted. From a built environment perspective, the workspace was visualized, and issues identified.

After the observational study, floor plans were updated to reflect the current use of each space on five floors of the building (patio level through fourth floor level). This exercise was imperative to understand the space allocation of each function, as well as the relationship between each function. Figure 1 displays the updated floor plan for the patio level. Many areas were being utilized for purposes different than what was labeled on the floor plan drawings. For example, the area labeled as "break room" was actually being used as office space. Another example was the room labeled "trash/soiled linen," which was being used as a maintenance shop.

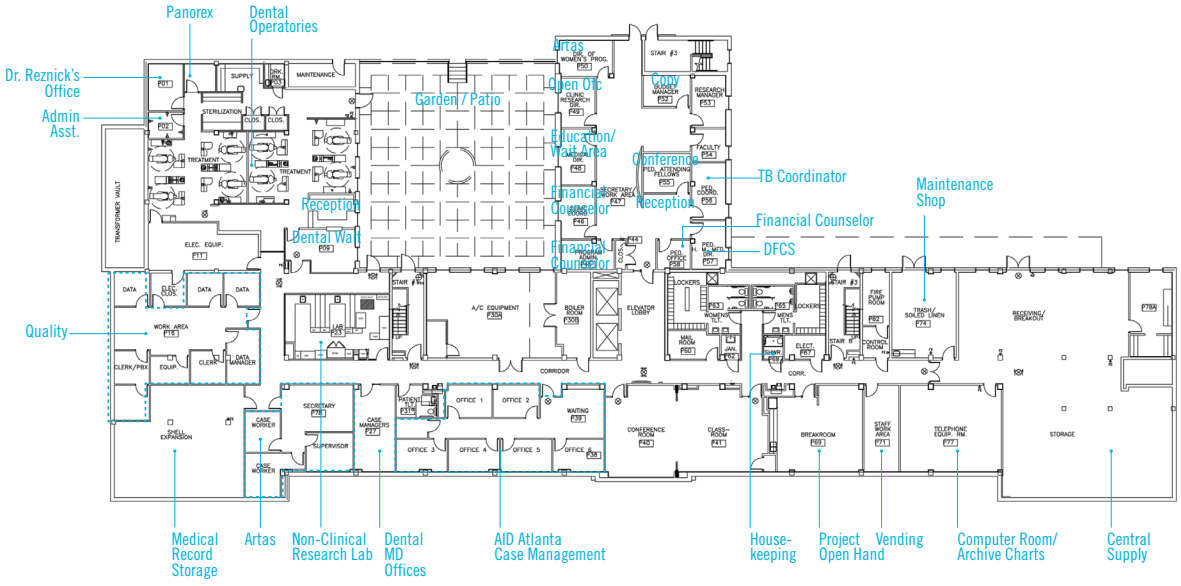

Figure 1: Updated floor plan for the patio level of the Ponce de Leon Center.

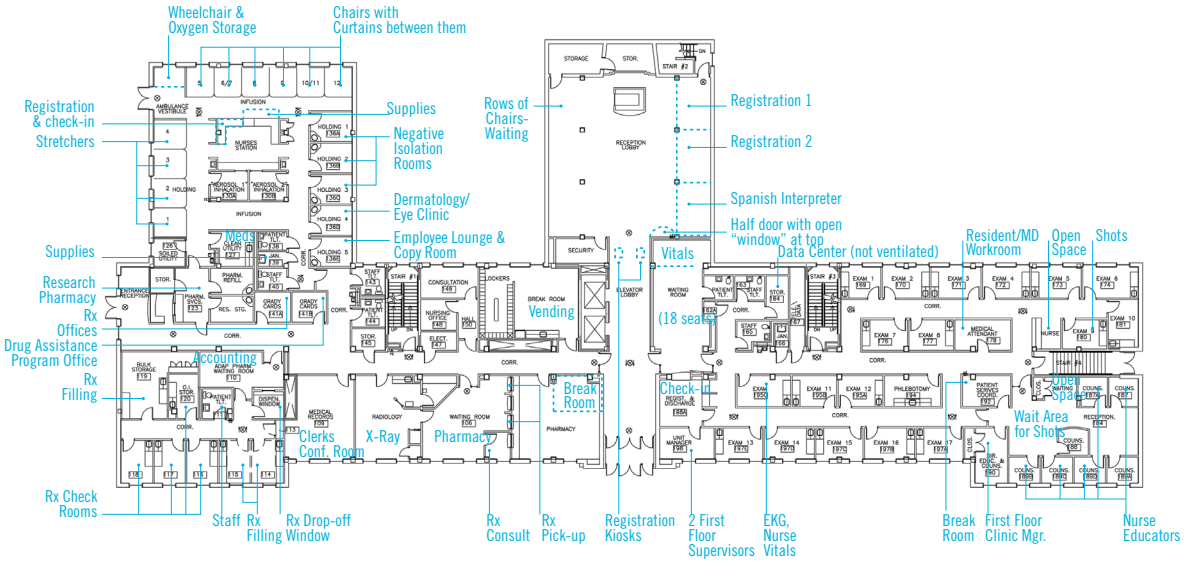

Figure 2: Updated floor plan for the first level of the Ponce de Leon Center.

Figure 2 displays the first level floor plan with updated room labels. Some of the discrepancies on this floor included the omission of the registration and interpreter cubicles located in the reception/lobby area. This area was previously used as a chapel, and it has high ceilings and acoustics to facilitate sound travel. This acoustical property is undesirable for functions requiring privacy, such as registration.

The next step was to develop spaghetti diagrams to outline the flow of patients in each clinical service area. According to the American Society for Quality, "A spaghetti diagram is a visual representation using a continuous flow line tracing the path of an an item or activity through a process. The continuous flow line enables process teams to identify redudancies in the work flow and opportunities to expedite process flow."[5] In the example of the Ponce de Leon Center, spaghetti diagrams were utilized to identify opportunities to streamline patient flow through each clinical area. Figure 3 and Figure 4 demonstrate examples of spaghetti diagrams of patient flow in two of the clinics at the Ponce de Leon Center.

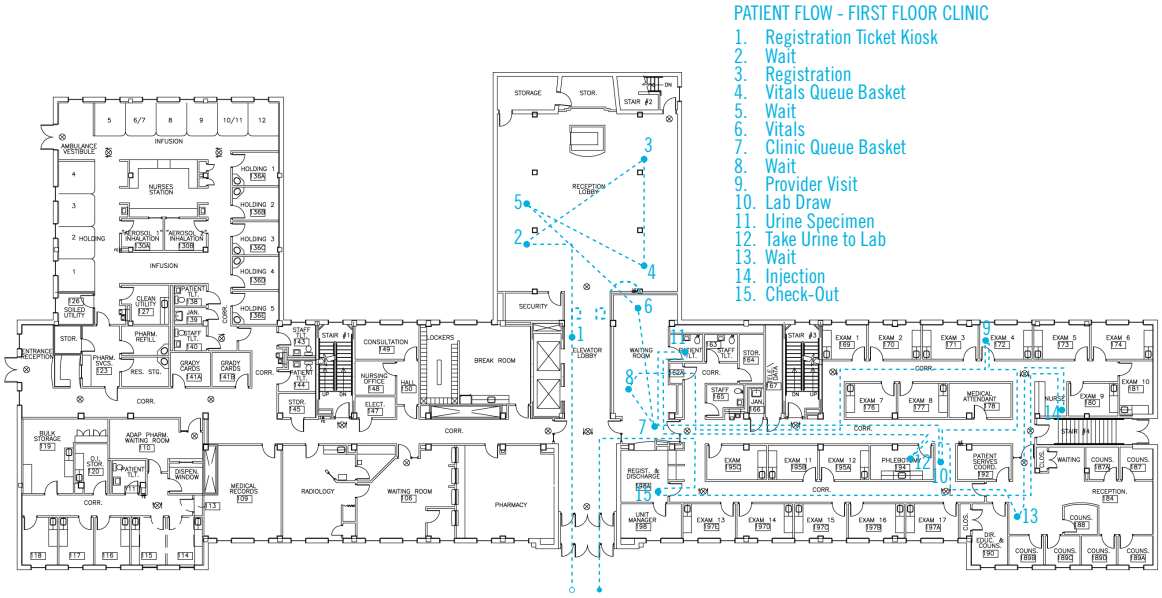

Figure 3: Spaghetti diagram of patient flow in the First Floor Clinic.

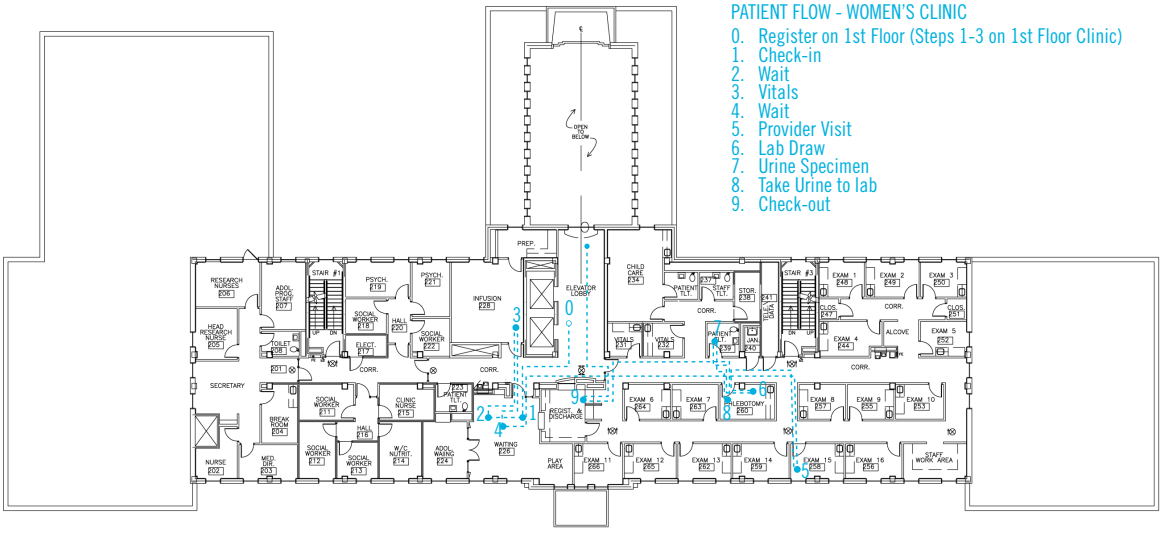

Figure 4: Spaghetti diagram of patient flow in the Women's Clinic.

After conducting the observational study, updating the floor plans based on current utilization, and development of spaghetti diagrams, a report of opportunities with potential actions was developed. The report focused on opportunities to achieve greater efficiency with patient flow and throughput. The report identified dozens of opportunities, of assorted varieties. For example, some of the opportunities included redundant pharmacies, lack of access to food for staff, inability for wheelchairs and walkers to navigate through waiting area, and exam rooms being used for multiple functions such as offices and patient exam space.

The project chose to focus on two main opportunities that would drive the most improvement in value to the patient.

One opportunity was the way that the exam rooms were utilized. Exam rooms served as a place for patient consultation, patient exam, and as clinical provider offices. This varied utilization of the rooms resulted in an area of focus for several reasons:

- Exam rooms were not utilized fully. Many exam rooms were idle while the waiting area was full. Patients in exam rooms have more privacy than in large waiting spaces where they can be seen by other patients. This visibility between patients was a main objective to be addressed by the project.
- All clinical providers are not working simultaneously. Therefore, the exam rooms that are used as provider offices could not be used when the provider was not present. This resulted in idle rooms.
- Flow of patients was hindered due to the artificial lack of exam rooms caused by the first two points.
- Further, provider's belongings could not be secured in the exam rooms. If the provider must leave a patient in the exam room alone, the provider's belongings are at risk.
- With no central work area for collaboration between providers, many providers felt isolated and lacked opportunities to collaborate.

To address the utilization of exam rooms, the team proposed utilization of exam rooms exclusively for patient consultation and exam. Additionally, a centralized staff work area would be provided for providers to complete documentation and store valuables.

The second opportunity of focus was the patient experience. Patient satisfaction surveys revealed a desire for patients to spend less time in the clinic, receive more communication throughout their clinic visit, and provide access to providers via telephone. In analyzing the process, it was found that the current average patient throughput time was 185 minutes, or just over three hours.

To address this opportunity, the team created a hybrid value stream map/swim lane diagram of the clinic visit. Value steam mapping is a tool to visualize information and material flow through processes[6]. The value stream map provides a way to identify value-added steps in processes, from the customer's perspective[6]. Aligning all stakeholders in an understanding of the current process and the vision for the future process is another benefit of the value stream map[6]. Swim lane diagrams provide a visual way to identify the responsible party for each process step. The hybrid of value stream mapping and swim lane diagramming was used to reap the benefits of both types of flow charting.

The current state value stream map/swim lane diagram created for the first floor clinic is illustrated in Figure 5. The map was created in a swim-lane format, with each lane indicating a role or responsible party for the step. Each step of the process is indicated by a shape, with the task, time, and location indicated in the shape. The various shapes represented the areas within the clinic, such as the lobby, phlebotomy, and injection. Each shape or task was then color-coded. Red shapes indicated tasks or steps that were non-value-added, meaning that the step did not add value to the process. Yellow shapes indicated tasks or steps that were non-value-added but necessary. These tasks do not add value to the process, but are required, for regulatory purposes, as an example. Green shapes indicated value-added tasks or steps. These shapes illustrate the core of the process.

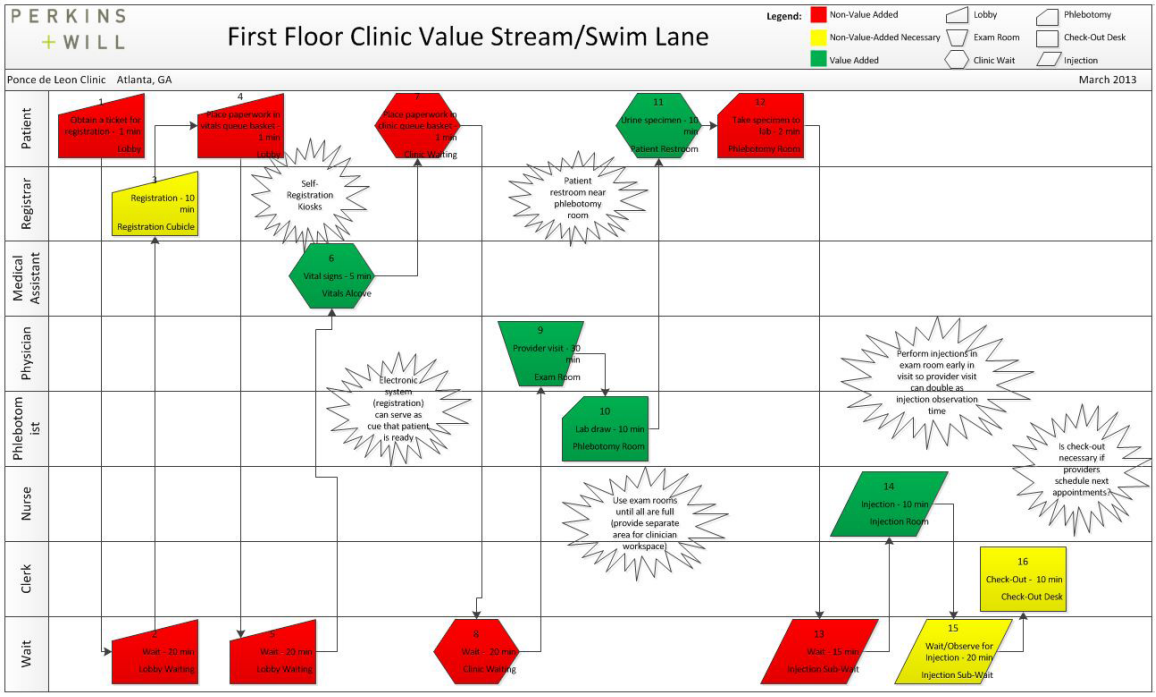

Figure 5: Current state hybrid value stream map/swim lane diagram for the Ponce de Leon Center's First Floor Clinic.

By analyzing the red and yellow shapes, waste in the process can be eliminated. As waste is eliminated, the total throughput time for patients in the clinic is reduced. One of the wastes identified on the value stream map and in the spaghetti diagram was the travel distance for patients. Patients repeatedly travel throughout the clinic and back again.

The team then analyzed the design of the built environment, to identify opportunities to modify the environment and operations to provide smoother flow. Conceptual diagrams were created to illustrate the future clinic structure.

Figure 6 illustrates the conceptual diagram of the patio level of the Ponce de Leon Center. Modified areas are highlighted in blue. The changes in this floor plan include the addition of a cafeteria, as well as four dental operatories, and the expansion of several support spaces.

In Figure 7, modifications to the first floor of the Ponce de Leon Center are outlined. The modifications on this floor are expected to have the biggest impact on the patient experience. Two pharmacies are reduced to one pharmacy, with a U-shaped flow (another lean principle). An odd entry to the infusion center is corrected with a clean, obvious entry. The waiting area for the first floor clinic is moved from the old Presbyterian chapel, with high ceilings that echo and conflict with patient privacy goals. Instead, this area is moved to an area just inside the front entry, with dividers, low ceilings, and furnishings to promote patient privacy. Registration, also formerly located in the chapel, is also moved and placed just inside the front door. This helps with privacy as well as serves the function of greeting the patient. The issues of idle exam rooms and lack of opportunities to collaborate are addressed by moving provider work areas out of exam rooms and into the center of the clinic.

In Figure 8, the fifth floor conceptual diagram displays an option for finishing this currently shelled floor. The building boasts beautiful views of the city of Atlanta from the fifth and sixth floors, which are currently used for storage. Finishing the fifth floor as an area for patient and staff education makes great use of this area. The large classroom provides a space for staff meetings, an area that is currently not available to the employees of the clinic. Further, the education area and offices could be more accessible to patients. Additional space is also needed to support the significant research projects that take place at the facility by Emory University researchers.

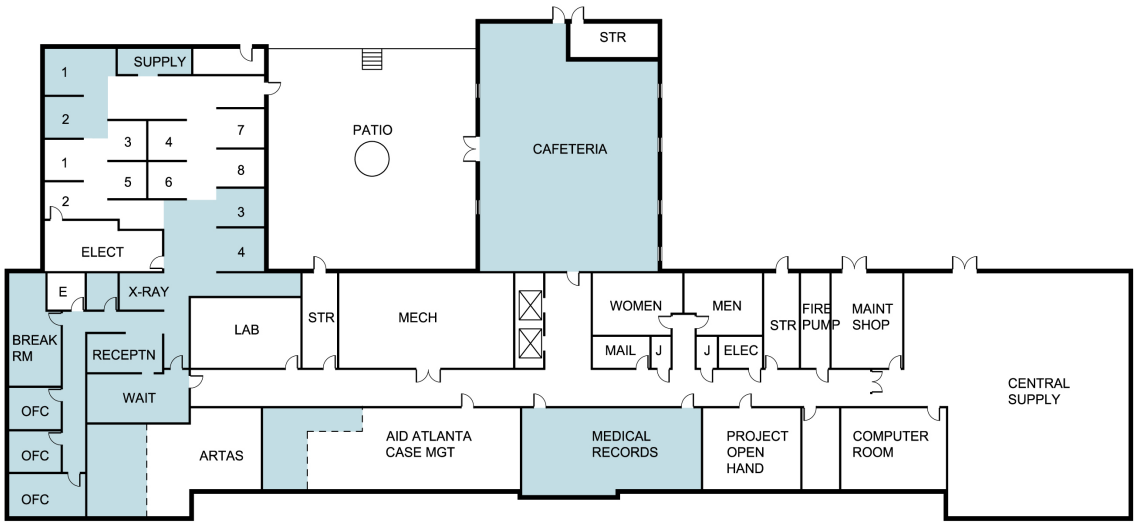

Figure 6: Conceptual diagram of the patio level of the Ponce de Leon Center.

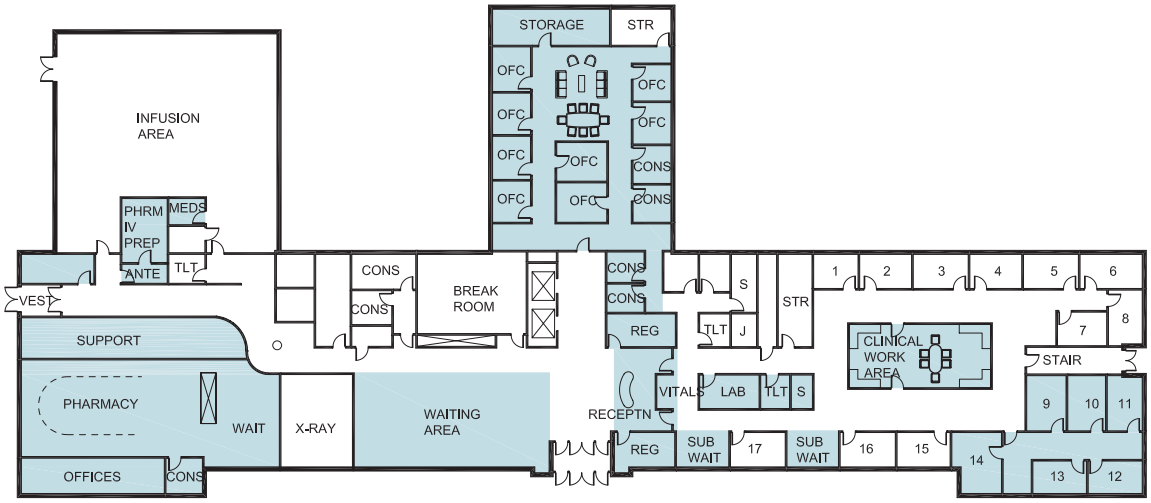

Figure 7: Conceptual diagram of the first floor of the Ponce de Leon Center.

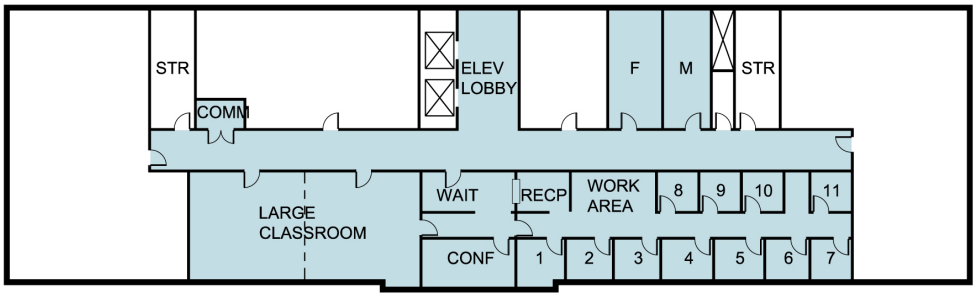

Figure 8: Conceptual diagram of the fifth floor of the Ponce de Leon Center.

The final aspect of the project was to ensure that the conceptual diagrams outline enough exam rooms and provider work areas to support the patient load and clinicians working simultaneously. First, provider schedules were analyzed to assess workload. Room utilization rates were reviewed based on the assumption that providers are fully booked. Room utilization was calculated as the number of rooms with a provider scheduled plus one room for the doctor-of-the-day and walk-in patients. Then, a review of the number of providers present at any given time was completed, to ensure the conceptual diagrams had enough workstations to accommodate all providers. Providers present was calculated as the number of providers scheduled plus one team nurse plus one registered nurse plus one medical assistant. Table 1 shows a snapshot of the analysis for the first floor clinic.

The analysis demonstrated that there are enough workstations and exam rooms in the conceptual diagrams to support clinic operations.

Table 1: Room utilization and provider workstation analysis for first floor clinic.

Shift	Rooms Utilized	Rooms Available	Room Utilization Rate	Providers Present (not including residents)	Rooms in Conceptual Drawing	Workstations in Conceptual Drawing
Monday am	14	16	88%	17	16	19
Monday pm	12	16	75%	15	16	19
Tuesday am	13	16	81%	16	16	19
Tuesday pm	11	16	69%	14	16	19
Wednesday am	15	16	94%	18	16	19
Wednesday pm	11	16	69%	14	16	19
Thursday am	15	16	94%	18	16	19
Thursday pm	12	16	75%	15	16	19
Friday am	11	16	69%	14	16	19
Friday pm	11	16	69%	14	16	19

3.0 CONCLUSION

The team learned the value of Lean tools in the assessment of healthcare operations and the built environment. Specifically, use of gemba, or visiting the place where work happens, assisted with understanding the use of the space, as well as current operations. Spaghetti diagrams were utilized as a visual way to understand the flow of patients through the clinical environment. Both gemba and spaghetti diagrams facilitated the identification of opportunities that would help the Ponce de Leon Center in achieving its goals. Digging into the details further with value stream maps helped to understand the value delivered to the patient, from the patient's perspective. This refined the team's focus further, exploring turn-around-times and privacy issues in more detail. Finally, conceptual diagrams were created to resolve many of the issues that resulted from the current built environment. Using Lean principles in analyzing the operations and built environment proved to be an intuitive way to approach design. Lean tools provided a common language for communicating between planners, designers, and client representatives. Further, Lean tools helped to ensure that the most important stake-holder in healthcare, the patient, remained as the focal point of all improvement efforts. Next steps in the project include prioritization of the solutions, identification of funding for implementation, and then implementation of the solutions. Several of the proposed changes have already been implemented, resulting in a reduction in the total turn-around-time of patients in the clinics.

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