Implementation of Lean Methodology in a Free Clinic

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Abstract

Medical students have demonstrated difficulties performing their duties at the laboratory of a free clinic for the uninsured (SCU lab). This has a negative impact on patient care and patient safety as it results in longer clinic visit durations, as well as an increased number of laboratory-related errors. Our improvement project aims to use Lean principles derived from manufacturing industries in order to simplify and standardize the laboratory environment in an effort to increase performance of medical students and decrease wait times for patients in the laboratory setting.

Utilizing Lean methodology we can improve patient throughput. Our objective is to decrease the duration of time from patient entering the lab to leaving the lab by four minutes, decrease the number of patients needing more than two attempts to draw blood by 10%, and eliminate all laboratory-related errors.

We used process mapping, spaghetti diagrams, time studies and identification of waste opportunities to establish current-state conditions. Using root cause we implemented 5S organizational strategies in the work place to improve wastes identified. Students working in the lab were re-trained to the new process flow. The duration of patient encounters, the number of needle-sticks per patient, and laboratory-related errors were tracked through time studies.

In current-condition, a total of 39 patient encounters were tracked from May 10th – July 12th 2014. Average patient encounter duration was 15min 10sec, 21% of patients needed more than two attempts to obtain blood, and three laboratory-related errors occurred during this period. Seeking equipment and patient labels were largest opportunities for improvement. After implementing intervention, 29 patient encounters were tracked from July 19th – September 6th 2014. Average patient encounter duration was 10min 27sec, 10% of patients needed more than two attempts to obtain blood, and zero laboratory-related errors occurred during this period.

The implementation of 5S organizational strategies was shown to substantially decrease the duration of patient encounters and laboratory-related errors in the SCU lab. By implementing a simple and standardized process, medical students had greater success at performing their laboratory duties. This resulted in a positive impact on the patient experience at the SCU lab.

Introduction

The Saturday Free Clinic for the Uninsured (SCU) utilizes volunteer medical students to facilitate multiple aspects of patient care, such as obtaining specimens for diagnostic studies. Medical students that staff the SCU laboratory are tasked with completing the process of obtaining, labeling, and storing laboratory specimens used in routine diagnostic studies. Historically, students were placed into this role with minimal training, oversight, or preparation. This resulted in negative experiences for both students and patients, and additionally resulted in patient safety concerns. Students lacked

confidence and were unprepared for this role, while patients expressed frustrations with long wait times and multiple attempts to draw blood. Additionally, there were multiple instances of mislabeled samples which raised concerns for patient safety.

Prior to interventions, students working in the laboratory were trained in basic phlebotomy and protocols for specimen labeling and handling. This training occurred once a year for all students interested in working in SCU laboratory. Due to large student interest and low shift availability, periods of time from one to eight months would lapse between this training session and a student's laboratory shift. Students that arrived at the SCU laboratory for their shift would often report experiencing it poorly stocked, disorganized, and with protocols or instructions that were either out of date or missing completely. We believe that student difficulties at the SCU laboratory stems from a disorganized work environment and is compounded by frequent staff turnover in an unfamiliar role and environment. These difficulties carry onto the patient experience in a negative way, resulting in longer clinic visit durations, increased laboratory-related errors and increased patient dissatisfaction.

Our improvement project aims to use Lean principles derived from manufacturing industries in order to simplify and standardize the laboratory environment to increase the performance of medical students and improve patient care. Our objectives are to decrease the duration of visit from patient entering the lab to leaving the lab by four minutes, decrease the number of patients needing more than two attempts to draw blood by 10%, and eliminate all laboratory-related errors that result in an unusable specimen. These objectives were chosen as they are all objective measurements which each have an impact on patient satisfaction and patient safety, while being a reflection of how successful medical students are working in the laboratory environment.

Methods

In order to establish current-state conditions we utilized process mapping, spaghetti diagrams, time studies, identification of waste opportunities, and conducted informal interviews of both medical student phlebotomists and SCU patients. Using root cause analysis, we identified that processes involved in acquiring materials for phlebotomy draws resulted in wastes of motion, transportation, overproduction and inventory and additionally contributed a disproportionate amount time to the length of encounter. Additionally, it was identified that mislabeling of specimens was the leading cause of laboratory-related errors. We then organized a target state process map (Figure 1.1) with new protocols to guide workers towards this flow, implemented 5S organizational strategies in the laboratory space to improve identified wastes, and trained medical student phlebotomists in new process flow.

We specifically implemented 5S organizational strategies targeting the supply cabinet where laboratory supplies were stocked and stored as well as the phlebotomy caddy used to hold supplies for a blood

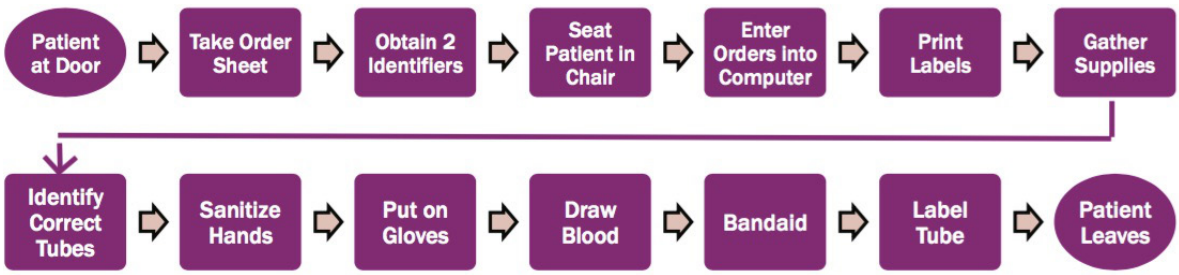


Figure 1.1: Target state process map, created to identify our ideal state condition. All interventions were geared towards guiding worker flow to this process.

draw (Image 1.1, 1.2). First we removed all unnecessary items from both spaces in order to reduce confusion and clutter, and obtained a new phlebotomy caddy with discrete modular sections to store each item needed for a blood draw. We then utilized colored tape to allow for a visually intuitive workspace. Colored tape was labeled and applied to the supply cabinet shelving to provide a unique color and outline for each stored item. We then labeled each discrete section of the phlebotomy caddy with colored tape that corresponds to an item in the supply closet, for example blue tape was used to indicate alcohol prep pads in both the supply closet and phlebotomy caddy. We then organized each modular section in the phlebotomy caddy in the particular order that items will be needed for a complete blood draw, clockwise from left to right.

Interventions were assessed through time studies that measured the duration of patient encounters, number of needle-sticks per patient, and number of laboratory-related errors. These measurements were chosen as they are objective, easy to obtain, and align with our stated objectives. The duration of patient encounters was defined as the period of time from patient arrival to the laboratory to their departure from the laboratory. The number of needle-sticks per patient is defined as the total number times that a needle is inserted into skin to obtain a blood specimen. Laboratory-related errors are defined as any instance when a sent specimen could not be analyzed due to an error by SCU student workers. Measurements were recorded by either a silent observer in the laboratory, or through logs completed by student workers. When an observer was not present to perform time trials, logs were filled out by workers for each patient. These logs tracked the time of patient arrival, time of patient departure, and number of needle-sticks needed to draw blood.

Results

Prior to interventions, a total of 39 patient encounters were tracked from May 10th – July 12th 2014. The average patient encounter was 15 minutes and 10 seconds, 21% of patients needed more than two attempts to obtain blood, and three laboratory-related errors occurred during this time period. It was determined that processes involved in seeking equipment and obtaining labels for specimens were the largest opportunities for improvement. After implementing interventions, a total of 29 patient encounters were tracked from July 19th – September 6th 2014. The average patient encounter duration was

Image 1.1: Phlebotomy caddy used for blood draws at the SCU laboratory, prior to 5S organizational strategies.

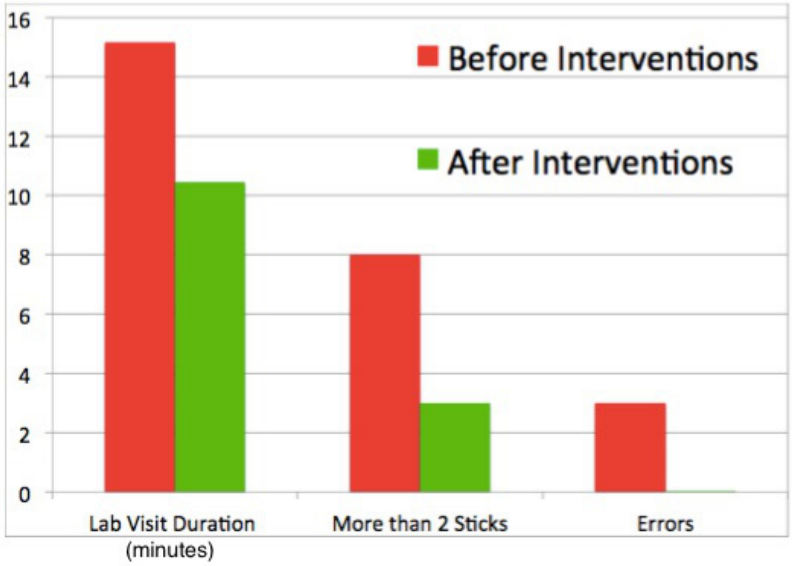
Image 1.: Phlebotomy caddy used during blood draw at the SCU laboratory, after 5S organizational strategies.

10 minutes and 27 seconds, 10% of patients needed more than two attempts to obtain blood, and zero laboratory-related errors occurred during this time period. (Figure 1.2).

Discussion

In summary, after implementation of 5S organizational strategies the average patient encounter decreased by 4 minutes and 43 seconds, the number of patients needing more than two attempts to obtain blood decreased by 11%, and no laboratory errors occurred. Our interventions were effective at accomplishing all specific aims set forth by this project. By establishing a standardized process and simplifying the work space, medical students had greater success at performing their laboratory duties which in turn and a positive impact on the patient experience.

The reduction in encounter time occurred as a direct result of 5S organizational strategies applied to the supply cabinet and phlebotomy caddy. Observations prior to intervention indicated that students spent a disproportionate amount of time locating equipment for the blood draw. Spaghetti diagrams recorded prior to intervention (Figure 1.3) showed this as well, as there was a large amount of motion waste to gather supplies. Spaghetti diagrams recorded after interventions (Figure 1.4) revealed a significant decrease in motion with less time spent gathering supplies. As very few medical students had any experience performing phlebotomy prior to medical school, most had very limited knowledge on what supplies they would need for a standard blood



	Before Interventions	After Interventions
Lab Visit Duration (min)	15.1578	10.448
> 2 Sticks	8	3
Errors	3	0

Figure 1.2: Graphical summary and table of lab visit duration (min), number of patients needing more than 2 sticks to draw blood, and number of laboratory-related errors prior to and after interventions.

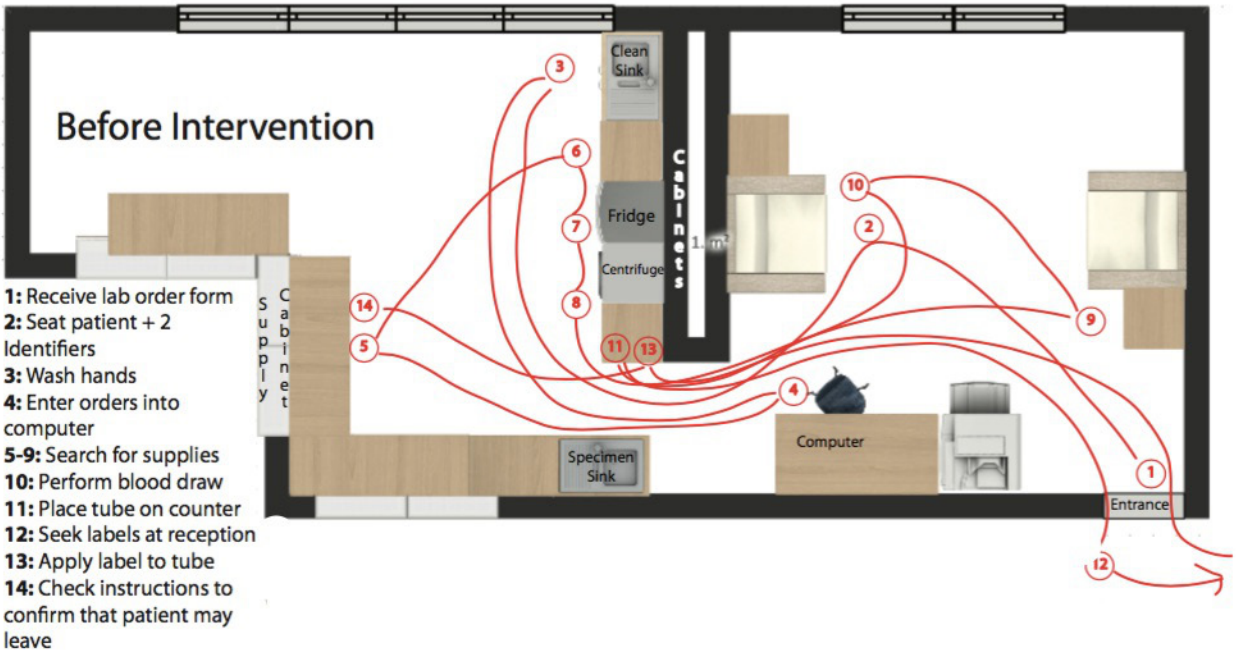


Figure 1.3: Representative spaghetti diagram of a single blood draw taken on June 14th 2014, before interventions. Movement of lab worker was traced on map and all stops were identified. Total duration of visit was 15 minutes.

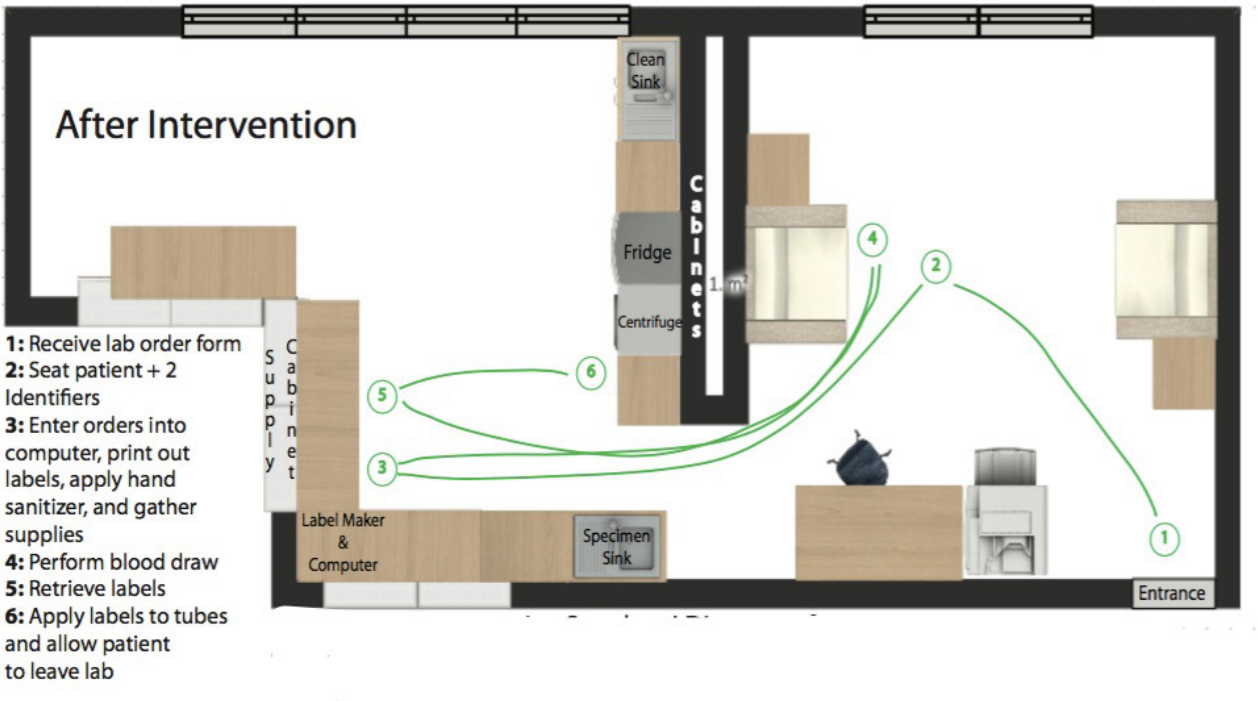


Figure 1.4: Representative spaghetti diagram of a single blood draw, taken on September 6, 2014, after interventions. Movement of lab worker was traced on map, and all stops were identified. Total duration of this visit was 7 min.

draw. This fact, in conjunction with working in a disorganized environment, were the main contributors to why students spent so much time and motion obtaining supplies for a blood draw. Standardization of the workspace and implementation of many visual cues helped improve student performance in this unfamiliar environment.

The reduction in needle sticks needed to acquire blood that occurred after interventions is likely due to improved confidence of medical students after interventions were in place. After the workspace was simplified and visualized, students informally reported feeling less anxiety about the physical act of drawing a patient's blood.

The reduction in laboratory-related errors occurred as a result of designing a new processes flow aimed towards our target state process map (Figure 1.1) and training students to these new processes. Mislabeling of specimens was the leading cause of laboratory specimens being rejected, therefore a focus was made to better integrate labeling of specimens into the target state process map as well as worker training. By integrating the printing of labels with entering orders and teaching workers to apply labels to specimens at the patient's side, there was now greater structure to standardize the specimen labeling process. This improved structure, which was previously absent, allowed for an improvement in specimen labeling and a reduction in laboratory related errors.

A key limitation of this project's results is the fact that students working after implementation of interventions had received training more recently than those working prior to interventions. This played a role in the increased success of students observed after interventions, however as our interventions changed both the training students received as well as the environment they were introduced to this is difficult to directly compare. It is likely that a combination of increased training and the 5S tactics contributed to the improvement seen in students after intervention. Data would need to be gathered on the performance of students further removed from this training to better assess the impact this decreased training lag time has on student performance.

By implementing a simple and standardized process and creating a visually intuitive workspace, medical students working in the SCU laboratory had greater success at accomplishing their roles which translated to an improved patient experience. This work can be translated into any environment that expects workers to succeed at a complex task despite having significant worker turnover, little oversight, and little training. It would be especially beneficial in a free-clinic setting that uses volunteer staff, similar to SCU. Further steps of this study would focus on sustainability and ensuring that the interventions continue to be in place. Additionally, formal surveys administered to both workers and patients prior to and after interventions could help gather objective information on the impact of these interventions.