The Journey Toward a Lean ED

Jody Crane, MD, MBA

**Description:** This session will outline advances made in a busy, 100,000 visit Emergency Department at Mary Washington Hospital on a journey toward a complete lean transformation. Original applications of Lean will be presented including Super Track and Rapid Assessment, Triage, and Efficient Disposition in the Emergency Department (R.A.T.E.D. ER). Future directions toward completing the lean journey will be discussed.

**Abstract:** To date there have been limited applications of Lean within healthcare. There have been an equally limited number of applications in Emergency Department settings with no complete ED lean transformations. This presentation will focus on the transformation of a busy, 100,000-visit Emergency Department into a Lean ED. Two specific projects will be outlined from a process improvement perspective, detailing change management methods, lean tools implemented, and outcomes related to flow and throughput. Where applicable, pitfalls and cultural issues will be detailed.

The first project called, “Super Track,” will focus on lean tools applied in a fast track setting located in triage. Lean Tools such as value stream mapping (current and future state), concurrency, rapid change over, load leveling, standard work, and elimination of waste will be highlighted. This project highlights the benefits of applying lean concepts to low acuity patients resulting in a decrease in length of stay (LOS) from 2.5 hour to less than 1 hour. The project demonstrates a consistent LOS of 35 minutes for ESI triage level 5 patients. Other examples of similar implementations in conjunction with work at the Institute for Healthcare Improvement will be referenced.

The second project called, “Rapid Assessment, Triage, and Efficient Disposition in the Emergency Department (R.A.T.E.D. ER),” will focus on lean tools applied to a value stream of ESI level 3 patients. Lean tools such as rapid improvement teams, takt times, visual signals, load leveling, standard work, and elimination of waste will be demonstrated to markedly improve efficiency. Project highlights a 14% decrease in overall ED LOS, 66% reduction of triage time, 45% reduction in “door to doc” time, and 24% reduction in “In-ED evaluation.”

Future directions towards a complete lean transformation will be discussed highlighting the impact of variation, and the value of patient value streams, patient segmentation, and application of lean tools.

The Journey Toward a Lean ED
Lean Applications in a 100,000-visit Emergency Department

**Background**

Mary Washington Hospital is located in Fredericksburg, Virginia, about 40 miles due South of Washington DC. The hospital has served the local population for over 100 years in 3 different locations. The current facility was built in 1993, originally having 300 private inpatient rooms and 25 ED beds.
In 2001, the ED reached its limits in the space that was available at the time. That year, 75,000 patients were seen with a 6% walkout rate. The ED was seeing 3,000 patients annually per ED bed at that time with the average length of stay (LOS) approaching 5 hours. Hallway beds were frequently utilized and there were frequent reports of patient dissatisfaction.

In the summer of 2002, Mary Washington Hospital opened a 50-bed, 26,000 square foot, state-of-the-art Emergency Department. The move to the new ED was problematic in many respects. The staffing budget, like most hospitals, was based on projected volume and there was no increased staffing allocation based on the false presumption that, “It will never fill up.” As is usually the case with similar expansions in similar situations, the ED filled up on the first day.

There were numerous problems with the transition. Not only did the demand of patients outstrip the ability of the human resources to treat them, but there was no discrete plan or organization to the operations of the new department. The thought was, “Why change what we are currently doing when it will undoubtedly change once we move in to the new ED.” There were no discrete nursing or physician room assignments and no team-based care.

In 2002, the ED had implemented an EDIS which had a proficient tracking grid, however the site was a beta-test facility and the computer system was riddled with problems including slow-downs and system crashes. Nursing staff was quickly frustrated and overwhelmed with nurse-to-bed ratios which were increased and a mass exodus ensued. Over the first 6 months of the move, approximately 1/3 of the nursing workforce resigned due to a combination of work and leadership-related issues. With the transition to the new ED, the volume dropped slightly as is usually the case in such transitions. The annual volume of patients served in 2002 was 73,819.

Shortly after the initial move, it became clear that process improvements were necessary. Basic steps were taken which facilitated patient care and communication. Treatment teams were created with discrete locations and bed assignments for nurses, physicians, techs, and unit secretaries. A separate lower acuity area was formed to facilitate throughput of ESI level 4 and 5 patients. This area was staffed by Physician Assistants, Registered Nurses and Licensed Practical Nurses in an area consisting of 16 total beds.

In 2003, the volume rebounded to 83,000 visits. This was due to a combination of process improvement, human resource expansion, and one of the worst influenza seasons in recent history. While expansion of the main hospital by 100-beds began in early 2003, this would prove to be too late to handle the volume of admissions generated by the increased capacity of the new ED. By the summer of 2003, the increased volume coupled with increased bed capacity and insufficient human resource capacity brought long waits. The inevitable hospital overcrowding ensued due to lack of inpatient capacity resulting in ED holds. While there were plenty of ED beds, the admission holds further taxed the already oversaturated ED nursing staff. Walkouts and patient dissatisfaction became major issues resulting in a community-wide outrage about the quality of their ED. During the summer of 2003, there were 13 negatively-biased letters-to-the-editor regarding the ED.

Winter came and brought with it a terrible season of influenza which was early, starting in November, and particularly severe, resulting in a massive increase in demand of patients seeking care in the emergency department. The inpatient side was full, resulting in a gridlocked ED. The rise in admission holds paralyzed the ED. Starting in November of 2003, holds began to rise, averaging over 20 patients at all times through the end of January 2004.

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Ironically, yet predictably, the 25 additional beds were completely consumed with holds resulting in a net increase of zero beds. Unfortunately, because the nursing staff had not increased proportionally to the number of beds, 50% of the nursing resources were then consumed with treating inpatients. Subsequently, the walkout rate climbed to 10-12% from November to January resulting in over 3,000 walkouts over a 4-month period. As a result, the volume in 2003, after a rapid increase, actually ended 5,000 patients lower than the previous year. In addition to the immediate impact, the lasting impact due to a damaged reputation resulted in a stunted volume growth for the next 12 month period.

The most serious impact of the overcrowding situation was felt on 3 separate occasions when the ED admission holds exceeded 40. The peak number of holds at one time was 44 on December 2, 2003. On that day, at noon, there were 6 beds available to see patients and 75 patients in the waiting room. There were 6 providers working in the ED for a bed-to-provider ratio of 1:1. Yet patients still complained, “You need more doctors!” Because Mary Washington Hospital has no diversion protocol, patients languished in the waiting room. Due to EMTALA prohibiting announcing waiting times, patients sat without any clue as to what was happening and how long they could potentially wait.

The Lean Vision

The vision to become a Lean ED was straightforward. Focus on patient value streams, processes, and creating patient value. The goal was to reduce the amount of non-value-added patient processing, waiting, and other forms of waste in the ED. Focusing on patient service families was the obvious key to developing unique value streams and maximizing the value for each, while minimizing the non-value-added steps involved with those patients falling outside of each particular value stream. The next step would be to value stream map the individual processes, identify waste, and employ the lean tools necessary to improve the processes. Finally, to redesign the processes based on the desired future states which would maximize value from the patients’ perspective.

Through this process, 3 distinct patient service families for ED patients were identified. This was accomplished based on a retrospective utilization review of over 9,000 patients relative to chief complaint. Patients were delineated based on likelihood of ancillary testing based on chief complaint. The 3 patients service families identified were Super Track, Mega-workups, and Tweeners. These correspond roughly to ESI levels 4,5 for Super Track, 1,2,3 for Mega-workups, and 3 for Tweeners.

Patients in the Super Track patient family were, in general, unlikely to require ancillary testing, but if necessary, usually required one x-ray or one brief lab test, namely a complete blood count or urinalysis. Another important feature of this patient family is the fact that they are almost never admitted.

Patients in the Tweeners group had less likelihood of “no orders”. They usually require more radiology testing including CT scanning and multiple imaging tests. The Tweener family had increased lab utilization as well, but mainly required a complete blood count, comprehensive metabolic profile, and urinalysis. This family also had a higher, but not high likelihood of needing admission.

The Mega-workups group, as the name would suggest, required a significant amount of complex testing, including CT scanning. They also required a comprehensive array of laboratory testing and were likely to require admission about 50% of the time.
After establishing the patient families, the vision was then to start with those patient value streams most under control of the emergency department. We began with the Super Track group in 2005 and 2006. This group was chosen because it only deals with limited diagnostic and ancillary testing. Initially, it was felt that when beginning to implement this vision that it was important to limit the exposure other stakeholders and their existing cultures as much as possible. The focus could then fall solely on the ED culture. The Tweener group followed in the beginning of 2007, capitalizing on the wins established with the Super Track family allowing the culture change to spread as well. Finally, in the fall of 2007, the Mega-workups team was established. This is the most challenging patient family as many of these patients are admitted. This requires extensive interactions between the Ed and the wards, each of which has its own identity and culture, which, most of the time, is different to that of the ED.

Super Track

The concept of a Super Track was derived as an evolution of the traditional Fast Track after value stream mapping identified a significant amount of waste in the traditional system. Super Track is thus a Fast Track that is located in or near triage for the purpose of promptly treating patients who require very low resource utilization. The team consists of a physician or midlevel provider, a nurse, and a medical assistant utilizing 3 treatment areas, usually 2 beds and a treatment/discharge chair, and incorporates a results waiting area where patients wait for the results of their ancillary testing without tying up a treatment bed.

The goals of the Super Track Rapid Improvement Team were to apply lean concepts and tools to eliminate waste, reduce work in process, namely patients in the ED, reduce lead times and ED waiting, reduce balk rates or left without being seen (LWOBS) rates, and to improve revenue through enhanced throughput. Decreasing length of stay for patients who needed little or no testing was considered paramount as these patients tie up treatment areas needed to see sicker patients and can go elsewhere for care. Maximizing the value for patients who could otherwise be seen in a primary care office or urgent care center was considered important with the introduction of “Minute Clinics,” and the increasing prevalence of urgent care centers in the area. Finally, by focusing on throughput, revenue could be enhanced by enhanced productivity from human and physical plant resources by leveraging our fixed costs to drive down the average cost per patient and thus increase the net revenue per patient. All of this while focusing on enhancing value from the patient’s perspective.

Before any process improvement was implemented, low acuity patients were being seen in the “Low Acuity Area,” of our emergency department. This area was composed of 16 beds staffed by 3 Physician Assistants, 3 nurses, and 2 medical assistants. This area saw primarily ESI level 4 and 5 patients, or patients with lower acuity complaints. During times when the higher acuity side was overwhelmed, the higher acuity patients would spill over into this area, creating flow problems as well as patient care issues. When the low acuity beds filled with high acuity patients, the low acuity patients would back up into the waiting room and wait hours to be seen. Also, the physician assistants were forced to see patients that they were not qualified to see, or a physician was pulled from the main ED to see these patients, further exacerbating the inefficiencies in the Main ED. In this low acuity area, under this staffing scenario, the physician assistants were able to see, on average, 2.1 patients per hour, and consequently, since the nurses were staffed in a one to one ratio with the physician
assistants, they were also caring for, on average, 2.1 patients per hour. Due to the inefficiency in the system, the length of stay for these patients was averaging 2.5 hours. Ironically, patients who needed no more than an evaluation and a prescription were languishing in the waiting room waiting to be seen for hours when they only needed minutes with a provider.

We began assessing the current state by running reports on length of stay (LOS) by chief complaint. We isolated the patients that could go through a Super Track type setting and determined that about 17% of our patients needed no testing whatsoever. However, when we looked at the LOS for these patients, we found that it was 2.5 hours. We determined that by targeting the benchmark LOS for “Fast Track” patients of 60 minutes overall LOS, we could save over 26,500 hours of ED treatment time. Averaging this time over the overall LOS would reduce the average LOS of all patients by 16 minutes. This time could be used to see an additional 24 patients per day or 8,856 patients annually.

We then took this same patient population and looked at arrivals per hour over the course of 1 week. We found that, on average, 2-3 patients per hour were presenting during peak times, with the stated chief complaints, at the 75th percentile, 3-4 patients per hour, and at the 95th percentile, 5-6 patients per hour.

After determining this potential, we began to map the current state. We found that much of the time spent caring for these patients, was tied up getting them into a bed and out of a bed. It was estimated that 39 minutes were spent processing the patient before they ever reached a position where they could be evaluated by a provider, 5 minutes signing in, 16 minutes waiting for or being triaged, and 18 minutes waiting for or getting to a room. The evaluation stage took, on average 79 minutes. The time from provider disposition to discharge was taking 26 minutes, 10 waiting to be discharged and 16 for the actual discharge process.

After looking at the process from a patient’s perspective, obvious non-value added steps were apparent as were areas to implement lean tools to refine processes and remove waste. Indeed, there was over an hour of waste just getting patients into and out of treatment beds. To remove this waste, the concept of moving providers to the point of first contact came to light. By placing a provider in triage and implementing lean tools and focusing on queuing, the process could be greatly improved. In fact, the future state map was reduced to 3 major steps involving a 5 minute sign-in process, 20 minute evaluation and treatment subprocess, and 5 minute discharge. Including queuing, the entire LOS of a patient with no testing could be reduced to 35 minutes.

Once the future state had been designed, the team set out to implement the new process using rapid cycle testing. The new design incorporated key lean concepts such as waste reduction, rapid changeover, point of use supplies and materials, one piece flow, load leveling, and a concept called, “Virtual Beds,” developed at our facility. The team utilized 2 treatment beds in triage and one chair for tech procedures and discharge. These beds were previously used as actual triage beds. All of the supplies needed for the patients included in the treatment population were placed in a cart and a charge sheet was developed. When used, the techs would place a patient sticker and then charge the supplies outside of the patient care process, thereby eliminating critical time spent going back and forth to various Pyxis machines to gather supplies while the patient is waiting.

Likewise, rapid changeover was implemented. Commonly used supplies such as suture trays were setup while the room was idle in preparation for the next patient requiring suturing. After the patient had been treated and discharged, the supplies would be charged

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from the Pyxis and the next suture tray would be set up in anticipation of the next laceration case.

One piece flow was implemented. As initially designed, the nurse and PA would interview the patient together, sharing the information gathering process, thereby eliminating redundant information gathering and rework. As time evolved, this proved challenging for providers, so the process evolved to “flip-flopping” where the nurse and PA would alternate rooms, maintaining one-piece flow as there was no WIP between the 2 steps. A pull process was also implemented in which the team would pull the next patient to be seen from the triage line. If there were patients waiting to be seen for Super Track, patients would go through the normal triage process and go to the main ED if Super Track was still unavailable.

Load leveling was implemented as much as possible. Job duties were distributed among operators (nurses and midlevels) whenever possible. Every attempt was made to match the cycle times between providers so that continuous flow could be maintained, thereby reducing waiting as much as possible. This also ensured that resource utilization was balanced to the extent that this was controllable.

Finally, “Virtual Beds,” were utilized. “Virtual Beds,” are established results waiting areas for patients that do not need to occupy a bed while awaiting results of ancillary testing. This frees critical bed resources to see other patients while patients in process await testing results. This ensures that patients that need nothing will have ready access to a treatment bed so that they can be seen and discharged in a prompt manner. This concept compensates for large imbalances between ancillary and provider cycle times. For instance, if the evaluation process takes 10 minutes, but it takes 60 minutes to get radiology results back, if the patient remains in the treatment bed, this effectively prevents the provider from potentially seeing 5 more patients in that hour. Alternatively, if ancillary cycle times are very short (immediate such as I-stat labs which take 2 minutes), “Virtual Beds,” have no role as the patient can remain in the bed for the short duration of the ancillary testing. “Virtual Beds,” greatly enhance capacity in direct proportion to the turn around time for ancillary testing and allow human resources to function unfettered by lack of physical bed space.

Rapid cycle testing was utilized to test the future state design. Cycle one was run as is typical in our institution on a low volume day for a 4 hour time period in order to allow the staff to become familiar with the new system without the added stress of patient volume. During this trial, 16 patients were seen by a single Physician Assistant and nurse. The average length of stay was 51 minutes for all patients. Of the patients that needed nothing (12/16), but did have procedures such as suturing, the average LOS was 42 minutes. This was a decrease of almost 2 hours over baseline. The next rapid cycle tests occurred with 2 simultaneous Super Track teams again on slow days. The teams saw 38 patients during 7 hours on Wednesday and 44 patients in 8 hours on Thursday. This is an average of 5 to 6 patients per hour. The volume on those days was 258 and 265 patients with 3 and 4 walkouts respectively. The next rapid cycle test occurred on Monday, the busiest day of the week, again with 2 PA teams running simultaneously. Together, the PAs saw 65 patients in 9 hours, averaging 7.2 patients per hour. The volume was heavy at 288 patients with 5 walkouts.

After several rounds of rapid cycle testing, a 6-day pilot was undertaken on 3 consecutive Mondays and Tuesdays for shift lengths varying from 4 hours to 8 hours with 2 PAs. The results were quite impressive. For patients with no testing, the average LOS ranged from 26 minutes to 45 minutes representing a decrease of about 2 hours from baseline. The LOS of patients who received radiology testing had more variable length of stays depending

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on the numbers of patients. The LOS ranged from 1 hour and 26 minutes on 7 studies to 2 hours and 20 minutes on 23 studies. This was felt to be related to queuing effects in radiology. The patients with procedures only had LOS ranging from 36 minutes to 1 hour and 36 minutes. Overall the average length of stay of all patients ranged from 50 minutes to 1 hour and 45 minutes. Again, the high end of LOS was most affected by radiology performance.

In summary, the number of beds decreased 74% from 16 to 4 beds. The number of PAs and nurses required decreased 33 percent due to the increased productivity of the improved system which increased anywhere from 75-100%. The length of stay for all patients decreased, on average 60-66%. Patient satisfaction surveys collected at the time of service as well as impromptu comments from patients indicated a greatly improved level of patient satisfaction. This project highlights the value of applying lean concepts and tools to patients that have been defined by their value streams. It also highlights the value of rapid cycle testing and the use of data to drive process improvement efforts.

**R.A.T.E.D. E.R.**

Rapid Assessment, Triage, and Efficient Disposition of patients in the Emergency Room (RATED ER) is a concept derived as an evolution of a rudimentary physician-in-triage model. Our ED experimented with various physician in triage models from 2002 through 2006, each had its own problems. After applying lean concepts and tools to the problem of ED overcrowding, the resulting design was created. The design consists of a “quick look” nursing assessment, an abbreviated triage assessment and immediate evaluation by a team of providers consisting of a physician, midlevel, 2 RNs, 1 paramedic, and a unit secretary staffing 5 beds behind triage.

The goal of this team is to provide a comprehensive physician or midlevel evaluation, start treatment if possible, and determine the bed needs of all ESI level 3 patients. After this assessment, the patients who don’t need beds are sent to radiology, lab and then a results waiting area, again utilizing the “Virtual Bed,” concept. Patients who need beds are placed in beds and treated in a traditional manner by nurses in conjunction with the providers staffing the intake team. The concept of patient segmentation is used to direct patients to the location where they may be treated by the process that best suits their needs (Super Track, RATED ER, or the traditional Main ED).

RATED ER actually developed as a result of continuous improvement efforts in response to the implementation of Super Track, which immediately decreased the backlog of ESI level 4 and 5 patients. The result was a more obvious backlog of ESI level 3 patients and a dysfunctional triage system which was never appropriately staffed and as such created long waits to be triaged. The RATED ER team was assembled to solve these two problems as well as to effectively identify and sort ESI level 1,2 and 4,5 patients so that they could be seen in their respective areas immediately.

In the RATED ER system, patients present to reception where they are greeted by an ED medical technician (tech), registration clerk, and an experienced ED nurse (Pivot RN). They initially complete a brief sign-in sheet and hand this to the tech. Based on the chief complaint presented and the patient’s general appearance, the Pivot nurse quickly assigns the patient to the Main ED, Super Track, or Mini Triage. The Pivot RN also is in charge of the placement of patients in the waiting and results waiting areas. The registration clerk performs a quick registration which consists of searching the database for previous visits and creating a
new account number under the patient’s medical record number. If the patient has never visited the ED, the patient is given a new medical record number and account number.

Those patients that are not pre-selected to go to Super Track or the Main ED advance to the Mini-Triage area. In order to correctly capacitate the system, takt times were calculated based on average patient demand by hour of day. During peak times, our patients arrive at a rate close to 20 arrivals per hour. Takt time calculations would indicate that a patient must be processed every 3 minutes based on this arrival rate. Based on baseline measurements, our existing triage cycle times averaged over nine minutes, indicating a significant need for reduction of the amount of work performed at this step in the process. Looking at the process suggested that this work reduction would involve reducing non-value added as well as temporarily delaying some value added steps until later in the process. Based on our takt time calculations, it was determined that only critical information could be obtained at triage, namely:

1. Single phrase Chief Complaint
2. Allergies
3. Pain scale
4. Vital signs
5. Assign an ESI level

Limiting the initial triage assessment to these 5 criteria satisfy the need to assign an ESI triage level as well as to not delay further progress of the patient through the system. It was estimated that the triage process would take, on average 3 minutes and that the nurse would need 2-3 minutes to get the patient in and out of the room. This being the case, the system would be appropriately capacitated with 2 servers each able to process one patient every 6 minutes, thus meeting the takt time of 3 minutes. After the 5-component triage, this nurse is also responsible for identifying ESI level 1,2 and 4,5 patients who have made it past the initial screening process, some of which can only be identified by a brief consultation or after measuring the vital signs. A Patient Service Representative maintains flow of patients between the various steps during this part of the process. From the Mini Triage step, the patients can either be sent to the Main ED (ESI levels 1,2), Super Track (ESI levels 4,5), or the Intake Team (ESI level 3 and some 4).

The Intake Team is the backbone of the RATED ER process. It is where all of the assessment, initial testing and treatment, and disposition takes place. Again, takrt time was used to appropriately capacitate this step in the process. It was considered that in the worst case scenario, all 20 patients per hour would progress to the Intake Team. If this was the case, again, the system must process 1 patient every 3 minutes. The team estimated that each patient would require 30 minutes in the intake bed in order to complete the triage, initial nursing assessment, physician assessment, complete ancillary testing, and initiate therapy. Based on this assumption, in order to meet takt time, 10 beds would be necessary for the system to process 1 patient every 3 minutes.

The Intake Team consists of a physician, a physician assistant, 2 nurses, 2 scribes, and a health unit coordinator (HUC). The scribes are pre-med students from the local University. They are responsible for documenting patient information in conjunction with nursing and physician assessments. They document the primary physician, expanded chief complaint, past medical history, medications, social history, review of systems, tetanus and immunization status, and any other information solicited during the assessment. The MD performs a complete history and physical exam, orders the necessary diagnostic testing,
orders medications and other initial therapies and determines the bed needs of the patient. The nurse completes the triage assessment, the initial nursing assessment, performs initial nursing procedures such as urine catheterization and IV placement, and administers the initial medications ordered by the physician or midlevel. Paramedics perform traditional tech duties such as EKG, phlebotomy, help with IV starts and other tasks. They also help coordinate patient movement and assist with room changeover for the next patient.

From the Intake Team, the patients have several destinations. After the physician assessment, the patient can be determined to need no further care and can be discharged home. Patients can be sent to phlebotomy and/or radiology and then to the results waiting area if they are determined to not need bed resources. Patients can be determined to require a higher level of care, in which case they will be transferred to the Main ED and signed out to the MD staffing that area. Finally, after the assessment in the Intake Team, the physician can determine that the patient needs ongoing management usually for IV fluids or medications. In this case, the patient is moved to the treatment area associated with their respective intake team.

The treatment area associated with each team consists of 8-10 treatment beds, 2-3 nurses, and 1 tech. This team is responsible for executing the orders initiated by the intake physician. Staff members periodically update the physician as to the patient’s status, and the status of ancillary testing results. Once the patient is ready for a disposition, the physician comes to the treatment area to discharge or admit the patient.

In addition to the takt-time based design, other lean concepts and tools were implemented in this project based on viewing the process from the patient’s perspective. Waste is greatly eliminated by design. There is a significant reduction in the amount of over-processing. Patients are rarely asked repetitive questions and there is rarely rework or clarification of testing and or treatment status due to the implementation of standard work. Due to the size of the intake teams and the implementation of point of use materials such as pelvic exam kits, EKG machines, and medications, staff movement is greatly reduced. Point of use supplies also contribute to reduced setup times for commonly performed procedures. The small team size also contributes to better communication and visual cues outside of the patients’ rooms can be readily identified to signal that a task needs to be or has been completed. Patient waiting is significantly reduced due to the focus on getting the patient seen by a provider as quickly as possible. Because of this focus, the time traditionally wasted waiting on a provider is now spent waiting on test results to return or waiting on response to initial therapy; arguably more valuable to the patient than waiting for nothing. Due to the location of the team near triage, patient movement is greatly reduced, especially for patients who may be immediately discharged.

Initial rapid cycle testing and implementation of this process brought astounding improvements in all measures of ED efficiency, most notably length of stay, walkouts, and door to doc time, even when including all trial dates, even those not performing optimally. Also of note is the fact that this system has been implemented on only the busiest, usually poorest-performing days (Monday and Tuesday). When compared to pre-improvement measures, treat and release length of stay decreased 24 minutes from a 2007 Q-1 average of 188 minutes to 164 minutes, treat and admit LOS decreased 40 minutes from 2007 Q-1 average of 308 minutes to 268 minutes. Overall LOS of all patients decreased by 30 minutes from a 2007 Q-1 average of 211 minutes to 181 minutes. The result is a 14% reduction in overall LOS without additional staffing or resources. Walkouts on RATED ER days
dramatically improved over baseline. Based on an average daily volume of 298 patients, there were, on average, 1 AMA and 5 patients who left without being seen. This equates to a 1.6% walkout rate on 108,000 annualized visits.

Our current IT system does not allow us to run reports on intervals on non-contiguous days, therefore interval comparisons were made using like days with exactly the same volume employing traditional ED process vs. RATED ER. When looking at the interval analysis, there are remarkable improvements in every interval. The “arrival to triage,” interval decreased by 10% from 12 to 10 minutes. The “triage start to triage end” interval decreased 66% from 9 to 3 minutes. The “triage end,” to “bed assignment” interval decreased 88%. This results in a 60% reduction in door to bed time of 38 minutes down to 15 minutes. The “bed placement to MD seen” interval decreased 12% from 17 to 15 minutes. This results in a total “door to doc” time of 30 minutes, down from 55 minutes, for a 45% improvement. The “MD seen to MD discharge” time interval decreased 24% from 121 minutes to 92 minutes. Finally, the “MD discharge to patient departure” interval decreased by 18% from 38 minutes to 31 minutes.

In summary, redesigning the front end processes in the ED employing takt time and other lean concepts and tools can result in remarkable improvement in traditional measures of ED performance. Redesigning the process with lean methodology increases the value that patients receive when presenting for care in the emergency department primarily by reducing waste and bringing the patient and physician together very early in the course of the patient’s value stream.

Future Directions

Mary Washington Hospital is continuing its continuous improvement efforts in the current projects creating value from the patient’s perspective. We have also now begun our efforts on the “Mega-workups,” value stream which not only involves care of complicated patients in the ED, but also spans multiple departments. We are starting by using productivity measures to right-size teams in the ED, load leveling by dividing duties between team members to balance flow, and developing protocol-based care in order to standardize care and reduce variation. In addition to improving patient care, these efforts should also serve to expand the scope and practice of lean throughout other areas of the hospital, allowing the lean transformation to progress.

Summary

In the first half of the decade, Mary Washington Hospital was facing enormous pressure from expanding volumes, and worsening performance metrics. By employing lean concepts and tools, the ED has reduced its length of stay of treat and release patients from almost 4 hours to below 3 hours for a reduction of over 25 percent from 2003 to 2007. The walkout rate has also been reduced from an average of 6% and a high of 12% to below 2% over the same time period. All of this has been accomplished with an increase in volume of over 25% from 78,606 to a projected 100,000 visits from 2004 to the present. All of this has been accomplished without additional bed resources, physicians, or midlevels.