IN BY 9 OUT BY 6 - LEVEL LOADING

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Background

University of Michigan Health System is an award-winning health care system made up of Hospitals and Health Centers, including: University Hospital, C.S. Mott Children's Hospital , Women's Hospital and 30 health centers and 120 outpatient clinics. Excellence in patient care, medical education and research...that's what defines the University of Michigan Health System. University of Michigan Hospitals has 913 licensed beds and 44,194 Inpatient Discharges in FY 2006. The Department of Radiology, Computed Tomography (CT) consists of four CT Divisions - Neuro, Abdominal, Thoracic, and Musculoskeletal. There are 30 Clinical Faculty members. Approximately, 20,400 Inpatient CT exams are performed each year. We anticipate 10% growth per year.

Project Background

The scope of the project was to improve adult inpatient CT turn around time. The process starts when the attending physician orders a CT exam. The end of the process is the radiologist's final report in CareWeb, the electronic patient record system. It is often assumed that in the inpatient setting, nothing much can be done to affect the timing of the demand for diagnostic tests. In the case of CT, ordering physicians had no predictable way of knowing when they would receive results. In the current process, the average turnaround time for an inpatient CT was 20+ hours. The CT department had no way to predict necessary resources to devote to inpatients needing CT's. We will be presenting the approach that was used to level the demand for CT tests. In addition, we will demonstrate the daily visual management system to monitor and adjust for inpatient CT test demand.

A lean workshop brought together 25 individuals from all areas touching this flow. The team was comprised of physicians and staff inside and outside of radiology including IT. During the scoping of the project the team identified 7 problem areas: 1) Batching occurred inside and outside Radiology. 2) No dedicated scanner access for inpatients. 3) There are a large number of CT protocols. 4) University Hospital and radiology largely a paper based system. 5) The protocol / scheduling process involved many handoffs. 6) Communication breakdown occurred between inpatient staff and radiology. 7) No prioritization of inpatients. CT tests with the longest turn around time usually involve an overnight delay in reading. To avoid this overnight delay, we needed to reduce late afternoon scanning. Several things lead to late afternoon scanning times: delays in receiving orders from the inpatient units, the time of day orders were received, the patient prep required before scanning and scanner availability.

To solve the problem of uneven and unpredictable demand, a number of improvements had to be made. They included shifting demand to earlier in the day and changing the current processes to accommodate the earlier demand.

Implementation

Unit clerks were educated on the CT lean project, the negative impact of batching and the use of fax machines instead of the tube system to send orders to radiology CT department. We created a sweet reminder to residents and physicians to write orders early and not batch orders. Candy bars and posters were handed out at departmental staff meetings with a message on the wrapper encouraging early ordering.

To prevent patients from arriving in radiology unprepared for their scan, a CT Questionnaire was developed. It included reasons why patients could not be scanned i.e. contraindications to contrast and CT scanner restrictions due to height and weight. In addition, it includes specifications for proper IV access. Patients must have the proper size IV line and the line must be placed in the proper site on the arm.

Likewise, an oral prep sheet was developed to manage the patient prep process. The CT oral prep is a medication that requires a prescription. Previously, a nurse on the inpatient unit would have to search for a physician to write a prescription. This could take several hours. After the nurse obtained the sign prescription, the nurse would then get the prep from the pharmacy and administer the prep to the patient. This new oral prep sheet serves as a visual schedule for dosing and as the official prescription. In addition, this prep sheet meets the new Joint Commission standard requiring an official prescription for the oral prep.

To address scanner access, one CT scanner was dedicated to inpatients from 8am – 4 pm (16 slots, 30 minutes each) and a second CT scanner was dedicated

11am – 2 pm (6 slots, 30 minutes each). By dedicating the 18 slots before 2 PM, we anticipated being able to scan and have final results completed by 6 PM for most inpatients needing CT scans.

In addition, to addressing scanner access, a nurse practitioner (NP) was hired to expedite the protocoling process. The protocoling process is the identification of the most appropriate scan and oral preparation needed to assess the patient's diagnosis. The nurse practitioner is able to protocol 98% of all cases independent of radiologist review. This frees physicians from protocoling and gives them more time to focus on reading scans and reporting the results. Prior to hiring the NP, the clerk would have to walk the CT order to be protocoled by physicians located in 3 different reading rooms across the department traveling up to 1258 feet. This could take almost an hour considering the wait and travel time. Now, the NP protocolist is located in the CT core and the paperwork travels at most 72 feet. As a result, the nurse practitioner is able to complete the protocoling process in 16 minutes where the previous process took on average 54 minutes.

Once the protocol is completed and the patient is scanned, the next step in the process is for the images to be read or interpreted by the radiologist. Prior to this project, there was no consistent priority given to reading of inpatient exams. Now in the radiology information system, (RIS), inpatient exams are given the same priority as emergency department exams. Inpatient exams to be read are flagged in red and put at the top of the physicians work list. Likewise, the CT paperwork is electronically flagged STAT and hand stamped with a green "INPATIENT" stamp. This alerts the physicians in the reading room.

In order to help radiologists understand the negative impact of batching when reading exams, the director of radiology quality improvement, presented an educational session on lean. She demonstrated that with batching the first case read time could be as much as 6.33 hours versus 58 minutes without batching. At this time, radiologists were asked to remind their peers at conferences to get orders as early as possible to radiology in order to avoid overnight delay in reading.

In order to monitor radiologist reading, a monthly turn around time report with average reading times by division and by physician was created. Each division director was
asked to review the report with their staff and coach them as needed.

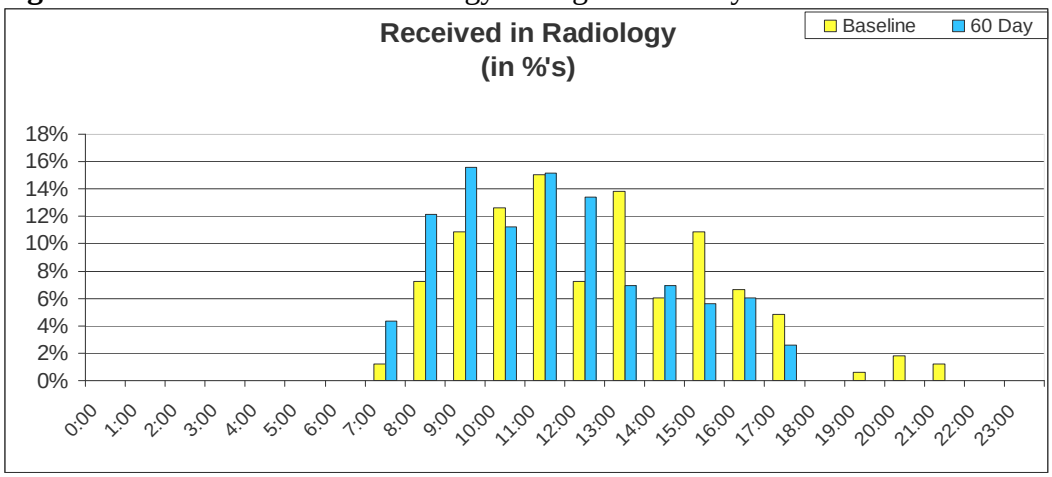
Data collection & Metrics

The data collected comes from two sources. One is a handwritten inpatient log book and the other is the electronic Radiology Information System, RIS. The inpatient log book included the times the orders are received in radiology, the time the protocol process began, and the time protocol process is completed. The RIS provided the scan start time, the scan end time and the time the radiology results were finalized in CareWeb, the electronic patient record system.

Sixty days post implementation, there were on average 1.1 orders per day before 9 AM. Now, there are on average 3.4 orders per day. Sixty-nine percent of the tests that are received by 9 am are scanned before 2 pm. Even with an increase in the volume of inpatient CT exams, the orders received by 9 went from 19% at baseline to 32% at 60 days (Figure 1). Additional work is needed to increase the number of orders received in radiology from 10 AM – 1 PM. Seventy nine percent of the exams that are received by 9 am are dictated before 6 pm.

There are a number of things that the team continues to work on. This includes creating a team to improve communication of the patient's NPO status (nothing by mouth). The team includes members of the hospital's Food Service Management & the staff of one of the general medicine units, Unit 5B. For many of the CT tests, the patient must refrain from eating or drinking before having the test. It's important to communicate the patient's NPO status to all staff working with the patient. This includes communicating with the food service staff so food is not delivered to the patient room. If a patient eats or drinks when they need to be NPO, the scan will be delayed. In by 9 out by 6 marketing continues to encourage culture change in ordering CT exams earlier in the day. Radiology residents will go to hospital inpatient units and to departmental division meetings to remind their peer to order CT exams early in the day. The University of Michigan Hospital will be implementing an electronic order entry process soon which will reduce the time it takes to get the orders to radiology. Radiology looks to further standardize the administration of oral preps. The department has proposed having a CT "On Deck Room" for inpatients. This on deck room will be a place to hold inpatients in the radiology department while they are receiving the oral prep. This will enable the CT technician to pull the patient as soon as a scanner slot is available. The radiology continues to implement lean throughout the department including an emergency department CT LEAN project. This project will further study prioritization of ED CT scans.

Figure 1. Orders received in radiology throughout the day.



Biography:

Kate Bombach is a Lean Coach at the University of Michigan Health System in Ann Arbor Michigan. She holds a bachelor and masters degree in Industrial and Operations Engineering from the University of Michigan. She has over 10 years experience as a performance improvement consultant in various industries: automotive, medical device, health insurance and hospital operations.

Susan Fisher is a Special Projects coordinator in the department of radiology at the University of Michigan Health System in Ann Arbor Michigan. She has over 20 years in lab administration experience. Currently, she serves as a Lean Coach for the Radiology department. She leads a variety of initiatives from clinical process flow to employee orientation. She holds a Bachelor of Arts from Albion College.