White Memorial Medical Center

Diagnostic Imaging Department

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I. Summary

About the Hospital

White Memorial Medical Center is an urban, not-for-profit, faith-based, teaching hospital in Los Angeles with 354 beds, and 110,000 outpatient visits (excluding emergency department) in 2005. White Memorial provides a full range of inpatient, outpatient, emergency, and diagnostic services to communities in and near downtown Los Angeles. The hospital's diagnostic imaging department has a full range of modalities. Imaging is digitized and includes a separate registration and check-in.

Problems

A high rate of no shows, underutilized equipment and staff, and unnecessarily long waiting times for patients after check-in persisted in the department. As a result, White Memorial suffered from low patient satisfaction, low productivity, and a shortage of operational data. The diagnostic imaging department, an important revenue source for the center, is in a new building with relatively new equipment. The expectation had been that these would automatically yield high patient satisfaction, but patient and physician satisfaction surveys told a different story. The case was excessive wait times for the patients and difficulty in getting desired appointments by the doctors for their patients.

The physical layout of the new building was a problem, as it was difficult to locate patients and staff in the convoluted set of corridors and rooms. There was no visibility between check-in, registration, dressing rooms, exam rooms, and waiting rooms. The department's patient tracking information system was no help, as it was difficult to use.

Intervention

Based on flowcharting and productivity measurement, it became apparent that changes to certain workflow, particularly administrative tasks in check in, registration, and patient escorting, would improve productivity. A team of management engineers from the University of Southern California recommended changes in workflow based on observation and analysis of jobs in the department and patient flow. These included simplifying patient tracking, earlier availability of appointment data, earlier phoning of patients to remind them of appointments, development of a dashboard report, comparison to industry benchmarks, preparation of inpatients at units, research into no-show causes, reporting of exam start and end times by technicians, incorporating actual procedure time averages for patient scheduling, and a new patient tracking system. Processes improvements eliminated registration tasks, such as data entry. The management engineers also developed benchmarks for a departmental dashboard – a report that includes key indicators for the department -- that highlighted productivity targets for supervision. In addition, a specific patient tracking system was identified.

Impact

As a result of the intervention, no-show rates, patient tracking, productivity, utilization, and scheduling improved. Patient satisfaction lagged, but began to trend up as additional changes were implemented.

No-show rate: During the project, the no-show rate declined from 45 percent to 40 percent. This was accomplished by phoning patients more in advance than had previously been the practice. By changing the paper flow, the department is now able to call four days prior to appointment and are also able to reach more patients, nearly 100 percent. The department is also tracking a "registration complete" percentage that records the percent of appointments that are ready in time for phoning. This has improved from about 20 percent to more than 90 percent.

Patient tracking: Tracking patients had been a problem in the radiology area due to a physical layout that made it difficult to observe patient flow, and because a patient tracking information system was extremely difficult for staff to use. At the USC engineers' suggestion, the system's corporate office canceled the contract for its tracking system, which freed staff for other duties. This past July, the hospital decided to deploy digital technology, which automatically reports on the patient's location, much like a global location tracking device. The system was planned to be installed later in the year.

Patient satisfaction: This figure started out very low, but is climbing steadily. In early 2007 the percent rating the department as "excellent" was 5 to 15 percent. By May it was 19 percent. Patient satisfaction, rated as "excellent" on independently done surveys, in November averaged about 45 percent.

Room utilization: With high utilization being a primary objective, all agreed the lack of utilization measures was hurting the hospital. The department took the difficult step of putting a measurement process in place. Room utilization rates were discovered to be 60 percent in computerized tomography and 70 percent in magnetic resonance. The department's implementation committee has set a target of 80 percent.

Productivity: Time per patient declined from 1.8 hours before the project to 1.5 hours.

Ongoing changes: The implementation committee has designed a dashboard, which it now produces regularly. Specific functional staff areas are responsible to enter their own data and a summary report is produced. The department is implementing additional changes, with a task force of managers and technicians meeting regularly to review their progress.

Record actual exam times for use in patient scheduling: The staff had recorded exam times previously, but not accurately. The supervisors and technicians have now made accuracy a priority, and are working to use the information for tracking and better scheduling based on accurate cycle times.

Track room utilization as a measure of scheduling effectiveness: Department management lacked information on utilization. The management engineers worked with staff and the hospital's information technology department to create useful measures. They then set goals to improve the utilization of these expensive resources. This has become part of the dashboard used to manage the department. The department continued to meet to implement recommended changes and monitor results.

II. Background

A.   About the Hospital

White Memorial Medical Center is an urban, not-for-profit, faith-based, teaching hospital in Los Angeles with 354 beds, and 110,000 outpatient visits (excluding emergency department) in 2005. White Memorial provides a full range of inpatient, outpatient, emergency, and diagnostic services to communities in and near downtown Los Angeles. It is part of Adventist Health, headquartered in Roseville, California, which operates health care facilities throughout California, Hawaii, Oregon, and Washington, and includes 19 hospitals with more than 2,800 beds, 18,000 employees, numerous clinics and outpatient facilities, 16 home care agencies, and three joint-venture retirement centers.

WMMC New Building

The hospital's diagnostic imaging department has a full range of modalities. Imaging is digitized and the department includes a separate registration and check-in staff.

B.   Proposal and Project Start

The California HealthCare Foundation provided funding for management engineering studies. An RFP was issued to California safety net hospitals. WMMC proposed a project that addressed patient throughput in their radiology services (Diagnostic Imaging). They sent in a written proposal explaining what they wished to do. They had a concern with patient satisfaction, backlog and productivity within their diagnostic imaging (DI) department.

The WMMC proposal was accepted in December 2006 and the project begun soon after. Contacts within the hospital were with several individuals including Steve ___, Associate Vice President responsible for several clinical and ancillary areas, including Diagnostic Imaging.

WMMC requested a project regarding its diagnostic imaging (radiology) department. The proposal was from Steve ___, Associate Vice President, Outpatient Services and ___, President and CEO of the hospital. They described their problem as follows:

"White Memorial Medical Center has completed construction on a new patient care tower that includes Diagnostic imaging, Surgery, Vascular, and Cardiac Services on the same floor. Patients arriving for any of the services are process through our one stop admitting process that includes registration, insurance verification, and hospital computer order entry. With tight time constraints any delay in patient intake, pre-procedural patient processing or performing the actual service can cause a ripple effect that impacts inpatient and outpatient care for the entire day. When this occurs patients may leave and never return, thus compromising their care or diagnostic workup.

The Patient Intake area of the hospital has become a critical access point for patient services at the hospital. Volumes vary greatly during the day and day of the week with volumes of sometimes 100 patients being processed in a day. With the variability of the volume and the patient lack of transportation to their appointments, keeping a steady workflow becomes very difficult. This disruption can ripple throughout the institution causing delays in surgery, radiology, cardiology, and vascular services.

The cumulative effect of a patient delay in registration can result in the patient receiving their care or procedure up to three hours behind their expected time. The White Memorial Medical Center opened the new patient care tower in April of 2006. The Patient Intake area was opened at the same time with a workflow process that had been developed in advance. With a few months of workflow occurring in the existing space reengineering of the workflow needs to be accomplished. Since the space is new, new construction costs would be prohibited."

Proposals were received from a variety of California hospitals and the proposal from WMMC was accepted. The project began in late January 2007. At the initial meeting and most subsequent meetings were chaired by Steve ____, a VP responsible for the area. He remained as the primary contact at the hospital throughout the project. All the members of the department were interviewed initially, their comments solicited and observation of operations begun.

The hospital's diagnostic imaging department has a full range of radiology modalities; MRI, CT, Mammography and other radiology services. The department is located on the first floor in a newly constructed wing of the hospital.

The initial proposal was quite clear, if broad. The staff expressed enthusiastic interest in the project. All the DI supervisors attended an initial kick-off meeting as well as the supervisors from registration, check in and scheduling. All participants expressed enthusiastic support. During the project, IT staff also became actively involved in the project.

C. Departmental Processes

Outpatients

Outpatients are scheduled throughout the day from 7:30 am to 3:30 pm at the latest. Sometimes the schedule ends even earlier than this, which leaves the exam rooms idle at the end of the day unless there are a great number of inpatient orders, because the technicians' normal shifts do not end until 5pm.

The outpatients are told to arrive 30 minutes prior to their appointment time in order to complete the needed paperwork. Once an outpatient arrives, they check-in with the clerk at the Check-In window. A registration person then meets with the outpatient and completes their registration. Once the registration is complete, the patient is given a beeper. The beeper is actuated when the technician is ready to do their exam; the patient goes to the dressing room where they are met with an escort. The patient then changes if necessary and is brought to the exam room.

If the outpatient is having an exam, which requires some preparation such as drinking an oral contrast liquid, they are called into a preparation room before they are paged to change, in order to answer the required questionnaires with the technician and consume the materials.

Inpatients
Most patients served by DI are outpatients but some are inpatients. Patients in inpatient beds are called down to the exam area by the technicians whenever there is available time in the schedule or a scheduled outpatient does not show up. The technician receives the order from the doctor via the hospital's information system (PAC) who calls the nurse when he/she feels there is time for the exam. The nurse must then prepare the patient and wait for the patient transport system to come pick the patient up and deliver him/her to radiology.

The patient transport system has an impact on the productivity of the MRI and CT examinations. Often inpatient exams are unscheduled and used to fill in for no-show outpatients. It typically takes over an hour for them to bring the patient down to DI from an inpatient bed. By this time, the open time slot has passed and an outpatient is now waiting for the exam. Either the outpatient must wait longer or the inpatient must wait in the hallway.
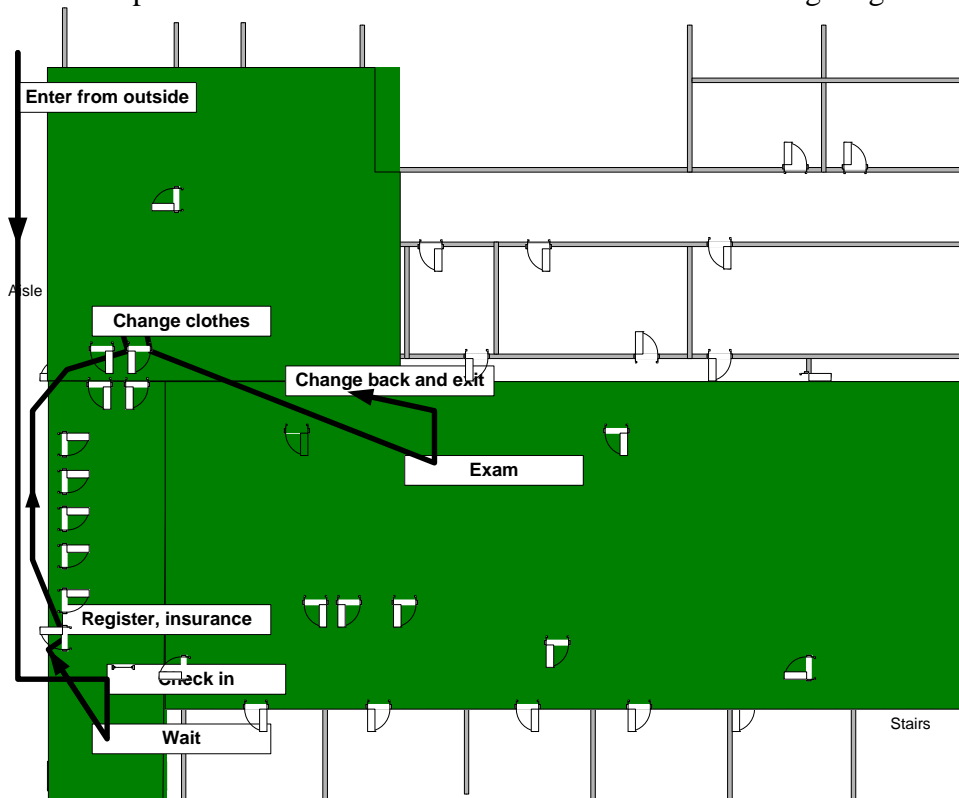
D.   Facility
DI occupied a new building on the ground floor. They shared a registration and check-in as well as a waiting area with the day surgery department.
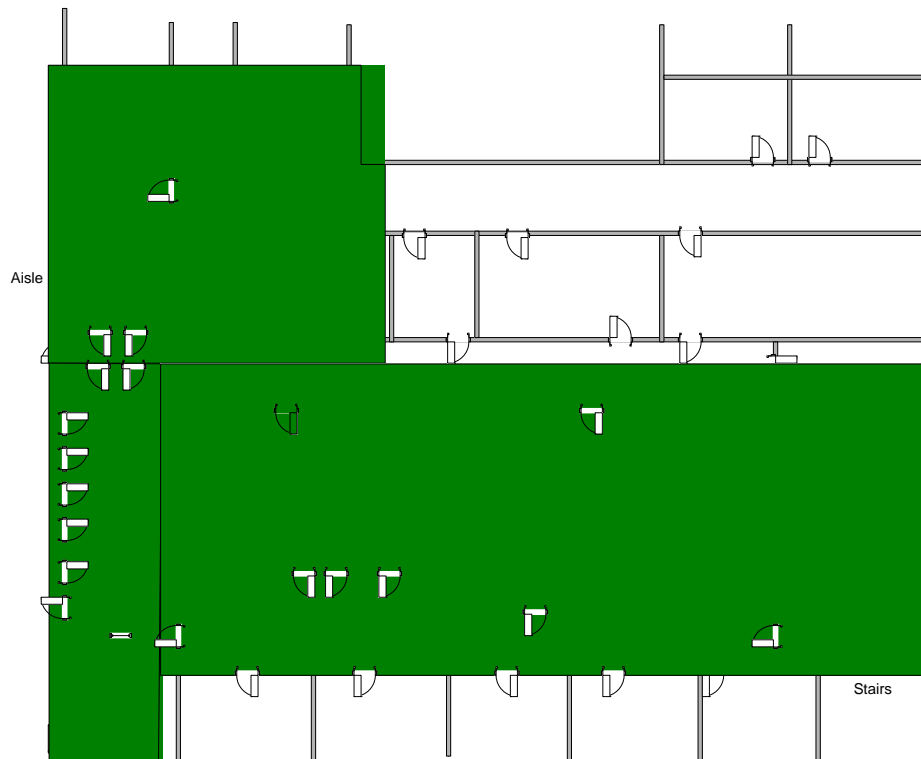
Diagnostic Imaging Department

A typical flow for a patient visit within this area is shown in the following diagram.

Path for a patient visit

E.   Modalities and Services

Diagnostic imaging included a full range of radiology and administrative related services. Groups included Patient Scheduling, Patient Registration, CT, MRI, Mammography, Ultrasound and Nuclear Medicine.

Computerized Tomography (CT) represents one of the important diagnostic imaging modalities provided. In CT there are an average of 8.83 outpatients per day and 9.08 inpatients per day, giving an average of 17.92 total patients examined each day. Exam times range from two minutes (head without contrast) to twenty minutes (stomach and pelvis with and without contrast). The longest exams can last up to forty minutes. Notes from observing these areas include:

Certain CT exams require contrast. This can be administered orally, rectally, or through an IV. The most common by far is a combination of oral and IV contrast. All patients who need contrast must fill out a detailed form of their medications that is faxed to the hospital's pharmacy. The technician must then call the pharmacist to get the OK to proceed with administering the contrast. This was recently implemented due to a suggestion from the Joint Commission on Accreditation of Healthcare Organization (JCAHO).
Oral contrast must be given an hour before and then again a half our before the exam; therefore even if a patient comes in on time, they cannot possibly have their exam until an hour after their appointment. Also, if an IV is required, a nurse must be tracked down to administer the IV. This can also be time consuming.

In patients usually already have IVs so they are ready for the exam. However, the technicians must leave the exam room and to go to the in patients hospital room to answer the required questionnaires, and administer the first does of oral contrast if necessary. These leave the exam room idle for a fair amount of time. A better system would be for contrast to be stored on the floors and the nurses should be trained to answer the questionnaires and administer the contrast.

MRI is also an important modality within DI. Patient flow in MRI was observed over a course of several weeks. The average out patient wait from arrival until they entered the exam room was one hour and twenty four minutes, while the average wait from appointment to enter the exam room was fifty four minutes.

All MRI patients must answer a questionnaire that is administered by the technician to make sure they do not have any metal inside their bodies. This is done in the MRI room. They do not need to ask for allergy medications for the contrast, because allergies to the MRI die that is used are extremely rare. A similar process applies to CT patients.

Claustrophobic patients and children under the age of six are sedated for the procedure. This is usually done an hour prior to the exam. Unfortunately, the babies often wake up when they are transferred to the MRI table and must be given more sedatives or they just are examined as best possible.

F.   Scheduling

In order to be effective, DI management must accurately manage the time of its resources and its customers. This involves scheduling of the staff, technicians primarily, and patient appointments. Success is measured by productivity of DI and satisfaction by patients and physicians.

Technician Scheduling

On average, four technicians come in each day that rotate between the CT, emergency CT, and MRI exams in the radiology department. All of the technicians are cross-trained so they are able to perform both exams, though some technicians remain at their specialty. Students who are currently enrolled in classes at the hospital to become certified technicians occasionally assist these technicians.

There are one or two technicians at the MRI and CT, and one technician assigned to the ER CT. The ER CT is used very little; because the regular CT is newer and produces better images. When the ER CT is idle, this technician comes up to the first floor and assists the technicians in the regular CT and MRI.

The technician's shifts begin at 6:30 am and end at 5 pm. Some shifts end at 3:30 pm and there are also later shifts from 3:30 pm to 11 pm and 11 pm to 6:30 am for emergency cases. The earliest out patient is scheduled at 7:30 for CT and MRI, leaving the exam rooms idle for at least an hour. Technicians attempt to examine in patients during this time, but the nurses change shifts at 6:30 am so no inpatients can be sent down until at least 7am. This usually results in an increase of inpatient orders around 7am and again at 3:30 pm, which is after another nurse shift changeover occurs.

During observation of scheduling it was initially noted that:

- Due to the great amount of time the ER CT is idle, it appeared that it could be used for more inpatients. This would allow the regular CT to only serve the out patients, which would decrease their wait and allow more to be scheduled in a day.
- To decrease the idle times in the morning the technicians should not come in until at least 7 am, if not 7:30 am.

Patient Scheduling

Outpatients:
Outpatients are scheduled throughout the day from 7:30am to 3:30pm. Sometimes the schedule ends earlier than 3:30, which leaves the exam rooms and technicians idle at the end of the day unless there are a great number of inpatient orders because the technicians' normal shifts do not end until 5 pm.

The outpatients are told to arrive 30 minutes prior to their appointment time in order to complete the needed paperwork. Once an outpatient arrives, they check-in with the clerk at the Check-In window. A Patient Service Representative then picks up the outpatient and completes

their registration. Once the registration is complete, the patient is given a beeper so that they can be called when its time for their exam. The beeper is paged when the technician is ready to do another exam; the patient goes to the dressing room where they are met with an escort. The patient then changes if necessary and is brought to the exam room.

If the outpatient is having an exam with oral contrast, they are called into a preparation room before they are paged to change, in order to answer the required questionnaires with the technician and consume the first dose.

Inpatients
Currently, inpatients are called down to the exam by the technicians whenever there is room in the schedule or an outpatient does not show up. The technician receives the order from the doctor via the hospital's information system who calls up to the nurse in the patient's unit when he/she feels there is time for the exam. The nurse must then prepare the patient and wait for the patient transport system to come pick the patient up and deliver him/her to radiology.

The patient transport system has a very large impact on the productivity of the MRI and CT examinations. Unfortunately, it typically takes over an hour for them to bring the patient down. By this time, the open time slot has passed and an outpatient is now waiting for the exam. Either the outpatient must wait longer or the inpatient must wait in the hallway – which is not uncommon.

A staffing consulting company along with a supervisor from the hospital was conducting a study at this time involving the patient transport and escort system. The intent was to determine if the escort system was overstaffed.

G. Patient Flow Data

Information about radiology operations was gathered during January through March consisting of interviewing related personnel, observing patient flow and gathering data from the hospital's information system. The was a time consuming step of interviewing many of the personnel, observing the patient flow and gathering various measurements of patient flow.

At the kick-off meeting the USC engineering team was assured that the hospital was implementing a patient tracking system, which would provide much of the statistics needed. The manager of patient scheduling was the leader of the patient tracking system project. It consisted of a "home grown" system utilizing web-based screens that gathered data on patient movement as it occurred by input from various staff in contact with patients. The team was told that the patient tracking system would be providing data within a few weeks.

Unfortunately, the patient tracking system was not able to report sufficiently complete data. It required considerable labor to input data and the data that was entered often were incomplete. One of the initial recommendations was to drop the patient tracking system since it's costs were not worth the effort and the software developers were unable to estimate when the software would be completed. Thus, the engineering team had to gather its own data on patient flow, such as procedure cycle times, patient wait time and patient no-show rates for scheduled appointments.

As noted above, patient flow statistics in radiology were difficult to determine. However, by observing individual patients it was possible to quantify the more important elements of patient flow.

In CT there is an average of 8.83 outpatients per day and 9.08 inpatients per day, giving an average of 17.92 total patients examined each day. Exam times range from two minutes (head without contrast) to twenty minutes (stomach and pelvis with and without contrast). The longest exams can last up to forty minutes.

In MRI, the average out patient wait from arrival until they entered the exam room was one hour and twenty-four minutes, while the average wait from appointment to enter the exam room was fifty-four minutes.

For a typical day, the volume was as follows:

	Sched.	Checked in	Resched.	Add on	Inpatient	Start	Last	Open hours	Pt/hr
Angio	8	7	1			7	3	8.5	0.8
CT	10	6				7.5	1.75	6.75	0.9
Mammo	3	3				9	11.5	3	1.0
MRI	7	5				7.5	3.25	8.25	0.6
NM 1	4	2				10	2	4.5	0.4
NM 2	2	0				10	11	1.5	-
Stress	1	1				11	11	0.5	2.0
Rad	5	4		1		8	11	3.5	1.1
U/S	12	7				7.5	3	8	0.9
Echo	3	3				8	11.5	4	0.8
PF	2	0				8	10	2.5	-
Vascular	1	1				9	9	0.5	2.0
Total	58	39						51.5	
		67%							
		33% no shows						ave.	0.76

The following is additional selected data regarding DI functions.

Average Patient Visit Times
MRI outpatients:
Arrival time to exam time = 1:24   Appointment time to exam time = 0:58
MRI inpatients:
Call to outside room = 0:54   Wait outside room = 0:13

Mammography patients:
Check in to exam time = 0:43
Appointment time to exam time = 0:07 (patients arrive early)

CT patients
Outpatients, Wait time from arrival to exam > 1 hour (sample was small)
Inpatients, Wait time outside room > ½ hour   (sample was small)
Room Empty, during day shift CT room > 25%

No Show Rate, Mammography = 30%

III. Analysis and Findings

A.   Problems Identified
The following problems were noted during the course of the project and were discussed with management and staff.

1. Workload fluctuates excessively
   a. The modalities have patterns where they are very busy and when they are generally idle. The mornings are much busier than the afternoons on a regular basis and which means that scheduling could do more to level the workload such as increase the schedule in the afternoon. Alternatively, it may be desirable to reduce working hours for some modalities to keep all areas busy and reduce costs. Work is generally more efficient and better quality when done at a constant pace.
   b. Scheduling does not accommodate the effect of no-shows, actual average procedure times and other factors. Idle time at the modalities occurs and wastes valuable resources and increases patient waiting.
   c. There does <u>not</u> seem to be an effective feedback loop, a connection, between the actual outcome of the scheduled day and the ongoing patient scheduling decisions.
   d. Scheduling and Pre Registration seem too separate regarding the authorization task. Perhaps they should be in the same physical area. Conflicts regarding the availability of doctor's orders and insurance authorization appear to occur.
      - An objective of the scheduling office, referred to as One-Call, is to provide the earliest appointment time. However they must coordinate the scheduling decisions with pre-registration regarding verification and doctor's orders and the technical knowledge within each modality.
      - When called, some patients do not seem to know about their appointments, particularly when the doctor has made the appointment. Pre-registration clerks often find this problem during the reminding patients but they cannot do anything with the appointment schedule so that the appointment remains in place, which increases the no-show rate.
      - When pre-registration clerks find some problems during the pre-registration process, they report to their manager who contacts the scheduling department, which adds time and intermediate steps.
      - There does not seem to be a wait list or list of on-call patients who could fill in time slots that occur due to no shows or cancellations.
2. Lack of operational information
   a. Throughput and productivity data is lacking. It seems difficult to manage the area if data such as the average total patient waiting time, room productivity, etc. are unavailable. Targets should be established but they would not be effective unless there was measurement of results.
   b. The patient tracking system and status board in the registration area does not seem useful
      i. Slow response time to input clicks makes it difficult to use
      ii. Is not being used by techs nor escorts so that significant data is missing
   c. The existing paper system may be adequate when used in combination with other existing computer systems such as the AS400 based system
3. Throughput of patients should be higher but complete statistics is unavailable.

a. In some cases were delays due to shuffling of outpatients postponed by inpatients or ER cases which may have been a higher clinical priority. No clear system is in place.

b. Resulting patient arrivals do not seem to maximize use of the available resources. Modalities appear empty at times. Staffed times could be shortened.

4. Staffing levels seem too high for workload
   a. Early hours staffing of CT (and MRI) are an inefficient use of resources since inpatients are not often be taken for an exam during the early hours of the CT shift.
   b. Lack of productivity and other operational measurement makes it difficult to make comparison to industry norms.
   c. Staffing for the escort function is high in comparison to the workload.
   d. The hospital should have a measurement (on a frequent basis) of exams done per room, patients seen per room and patients/employee for various positions and modalities & all these compared to benchmarks.

5. Physician & Patient experience
   a. The hospital ranks poorly regarding patient and physician surveys. Lack of coordination between departments may be a factor
   b. Wait time seems high, when including actual arrival time, and there seems to be a perceived lack of availability of appointments for the ordering physicians

6. High number of patient no-shows
   a. Some of the no-shows are due to doctor making appointment and not clearly getting the message to the patient.
   b. The definition of responsibilities may be unclear as to who is responsible for reducing no-shows and a measurement of the results against a target
   c. Hospital should check for doctor's orders earlier, more than the 1-3 days before appointment as is now done

7. Patient flow
   a. It is difficult for the technician to know when a patient is ready. There needs to be a system (pull or push) to assure prompt movement of patients and avoid any waiting when the patient and the modality are both available.
   b. It is not always clear within each modality that registered patients are queued up and waiting for their appointment
   c. Inpatient arrivals are slow due to messenger (transport) availability causing the modality to be idle while waiting for an inpatient. This may be caused by the modality not calling soon enough or clinical delays regarding the patient in the ward.
   d. Outpatients with appointments are not given priority resulting in patients who arrive early or on time still waiting a long time for an exam.
   e. Optimizing patient flow requires data regarding no-show rate, exam processing time and waiting time. None of which is tracked.

8. Other problems
   a. Mammography and MRI must share access to patient check in information terminal, causing walking for the Mammography tech.
   b. Some techs may start their shift too early, before inpatients are available or any outpatients scheduled. This is a waste of tech staff hours.
   c. Escorts call the techs to find if the room is available for the next patient, which causes interruptions during the exam.
   d. The changing area layout seems to be difficult to manage since the only way to know a patient is waiting is for an escort to be in the area. It is a bottleneck.

e. Registration makes errors when entering the facts regarding the doctor's order. Such errors would transfer to the PACS and billing if not corrected at the modality, which checks the paper Doctor's Order. Also, pre-registration documentation is sometimes lacking, doctor's orders missing said to be an ongoing problem in the registration area

f. The ER CT is frequently idle (although its availability in ER may be a necessity.)

B.   Recommendations and Alternatives

A recommended initial step was to set up a change task force to select recommendations for implementation and then actually implement the changes. This was a small group including a technician, supervisor, radiologist and others with authority to make changes. The USC engineering team participated as well. (It continued on for at least 6 months.)

Recommendations included several interrelated changes.

1. Set up a system to coordinate patient scheduling decisions with actual procedure times, no-show frequency and work load level. This could be done on a manual basis, if necessary, by readjusting scheduling rules on a regular basis, perhaps weekly. Also determine the desired pace for each modality and track conformance with that. Simulation models could help.
2. Simplify or drop the patient tracking system. The patient tracking system must be made effective by limiting it to only necessary value added functions. It is important is that techs record actual exam start and end times, which can be done within the existing AS400 system.
3. Accelerate the transfer of appointment information about patients so that DI can phone patients in advance of their appointments and thereby reduce the no-show rate.
4. Wireless (RFID) patient tracking may help data gathering on a temporary basis. Hospital should consider temporary no cost installation, USC will assist in data analysis
5. Reduce, eliminate or simplify the traffic control/escort position. Staffing levels seem higher than necessary. Perhaps combine positions with registration staff.
6. Consider reducing day shift inpatient procedures except when necessary on an emergency basis in order to reduce outpatient exam delays.
7. Review actual room utilization and reduce hours to the point where full utilization occurs. Related to this would be to postpone start times to a more realistic time of day.
8. There must be regular reports concerning operations effectiveness comparing WMMC to relevant standards. Such information should be shared with staff along with patient and physician surveys.
9. Implement a departmental dashboard (or scorecard) to compare performance to goals and circulate the report to all staff.
10. Let techs call escorts (or patients) when the techs are ready for the next patient, if not done now. Such a "pull" organization is done to reduce idle time between exams.
11. Research the reasons for no-shows, survey patients and doctors from a sample of no-shows, ask them why it occurred in their particular case. There may be a correlation between the time of day and the no-show frequency, which could be used to determine when to over book a modality. For example, if no-shows are more common mid day it may be appropriate to overbook in the late morning, but not late in the day. Similarly, differences between no

show occurrences by modalities may be occurring. A simulation model can quantify the potential benefits.

12. CT techs could mix contrast and bring it up to inpatients for the ward nurses to administer the first dose. The contrast materials could be stored, pre-mixed (or the nurses should be taught how to mix it) at the ward to reduce delays at the exam procedure area.

13. Infants may occupy the MRI for a long time because they must be sedated and they frequently wake up. Perhaps they should be more often done during the weekend or evening hours or on certain days to reduce the scheduling impact.

14. All of radiology uses the scanners in CT and MRI rooms. This crowds the exam rooms and adds unnecessary travel for the other modalities. Perhaps they could be relocated or additional equipment made available.

15. Consider use of CT in ER for use by non ER patients, perhaps for inpatients where scheduling is more flexible

16. Patient changing area (investigate is there a better way to handle patient flow)

17. Patient satisfaction program (some was already in place, resources are available from several sources).

18. Also, consider Six-Sigma training & Six-Sigma projects.

Next Steps

After receiving these recommendations, the hospital and the management engineering team planned the next steps, which were:

1. Report of findings and recommendations (+ additional data & research where requested)
2. Hospital reviews the recommendations
3. Implementation (USC team remained available to assist committee or management)

IV. Implementation

The hospital wanted to implement nearly all the recommendations but decided that the best approach would be to implement a few recommendations at a time. Once the first recommendations were completed they would move onto others.

A committee was established to implement the changes and monitor results. The group initially met every two weeks but later met monthly after several recommendations were completed. Some of the initial changes included dropping the patient tracking system, which consumed considerable data entry time but did not produce benefits commensurate with the cost. Moreover, the IT department could not give an estimate when software bugs would be removed. Therefore the system was dropped. It was expected that an electronic patient tracking system would eventually serve the same purpose. (Such a system is currently being implemented at the hospital.)

Another change was to accelerate registration materials to DI so that they could make reminder calls to patients a day or two before their appointment. Scheduling and initial registration was done in a centralized department for several hospital services, separate from DI. This meant that DI had to wait for paperwork to be able to make phone such calls. Reminder calls were critical for reducing the no-show rate. Reducing the no-show rate was critical to improve accurate scheduling and was necessary in order to increase the utilization of the department's resources.

The department tracked the percentage of complete documents received from scheduling (whereby remainder calls could be made).

Meeting of the implementation committee included a review of the dashboard, which was suggested as part of this project. An example dashboard report from November 2007 is shown below. This report shows what metrics the hospital implemented as well as the resulting trends. The graph "% Pre-reg. Complete" tracks the percentage of patient documents promptly received from scheduling so that reminder phone calls to patients could be made. This should correlate with the no show percentage since more complete documents should result in more phone calls which should result in fewer no-shows.

First Floor Dashboard 2007
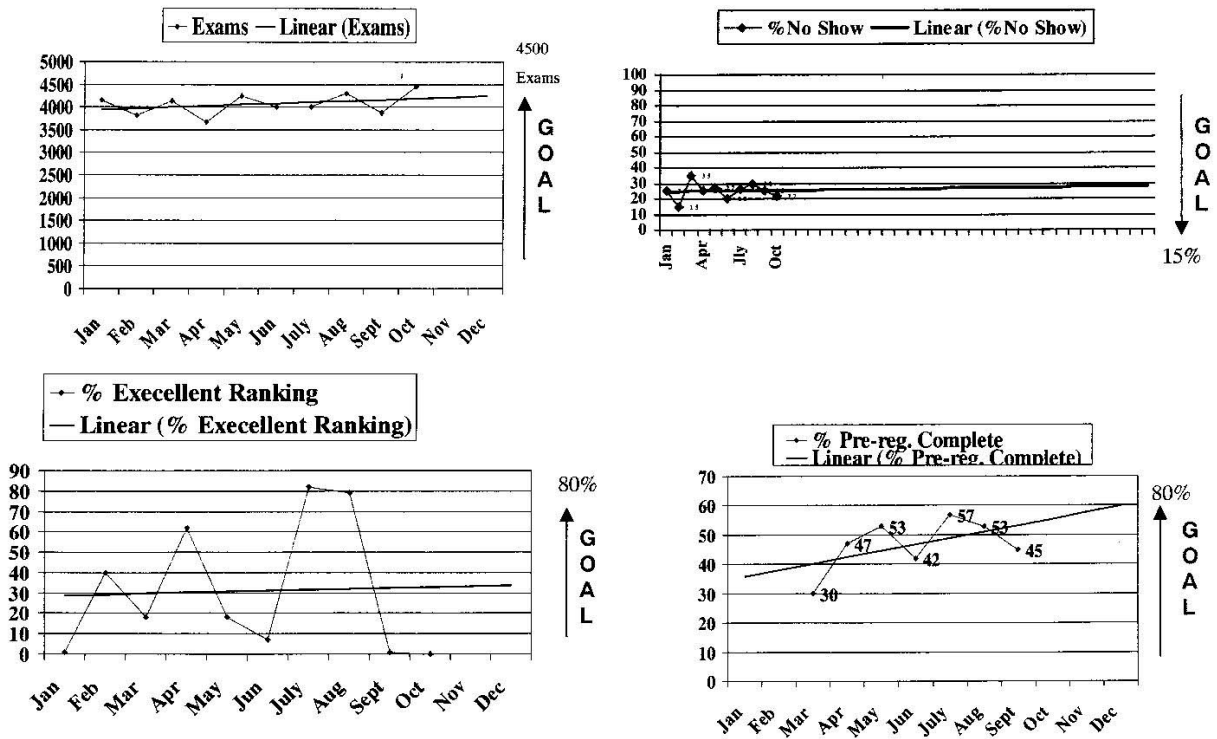
WMMC Dashboard Page 2

Radiology Utilization 2007
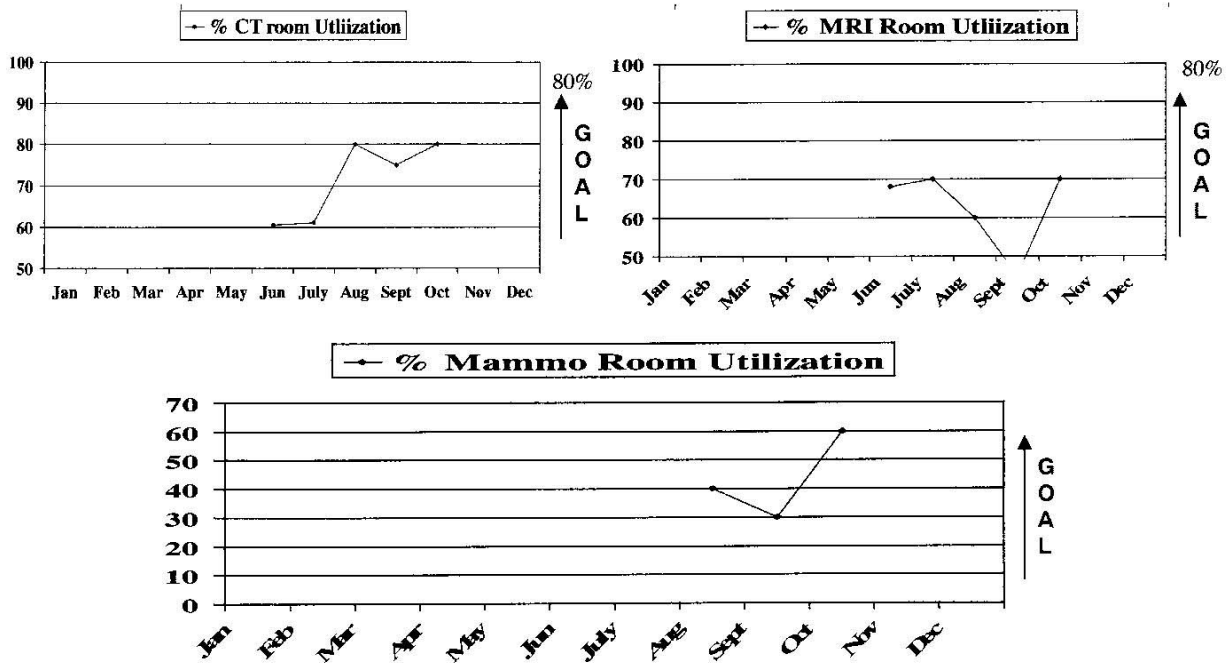
WMMC Dashboard Page 2

DI has continued to implement the recommendations and as of November 2008 it continues to meet regularly regarding implementation of suggested changes.

V. Appendix

Selected meeting notes follow to give a picture of the progress of making recommendations and their implementation.

A.   Meeting Notes 1/5/07

(This was a kick-off meeting with the senior executive of the area.)
The USC team met with Steven ___ to set up the basic parameters of the project and to discuss how to work together. Steve was given a memo of understanding, which he fully agreed with and signed. The only item he was concerned about was the availability of office space. He provided a walk through of the building and discussed the following:

1. The primarily objective is to reduce patient wait time. This does not necessarily mean increasing the throughput. The thought is that having a better control over the process will produce a better experience for the patients and doctors. Steve felt that reduced waiting would allow them to attract more doctors and patients as a result. A secondary objective is to better manage the related issues of the no-show rate and the leave without being seen rate.
2. Steve mentioned several times that waiting is complicated by the local culture which results in people being less concerned about time and arriving late for appointments.
3. The scope of the project is the new outpatient building. The services of concern are all on the first floor.
4. Radiology includes; diagnostic mammography, breast bio., CT, MRI, Nuc. Med. and others

5. The new building will eventually serve as the main entrance to the main hospital. The planned changes and construction were complex and confusing although they may not matter much given the scope of the project.
6. The focus is on radiology but Steve felt that solutions for radiology will also likely serve for the other services, such as day surgery. (This may not be true.)
7. There are three managers which will serve as useful contacts. The Director of Radiology, and others such as the scheduling coordinator
8. A kick off meeting was scheduled which will describe the project and its objectives.
9. Regarding the information system, they use Cerner for much of it and for scheduling One-Call from ORSOS.
10. Steve will arrange for a meeting with the CEO
11. Steve's office assistant Elva ___ will be available to help regarding logistics.

B.   Meeting Notes 1/12/07

Staff Meeting

We met with Steven and various supervisors from the Radiology Department. The USC team was given names and contacts regarding the staff and arrangements were made for an office and ID badges, which will be finalized next week. The following was discussed:

1. Responsibilities of various people were explained:
    a. Gina, was not there, she is the overall director for outpatient
    b. Dedra, admitting, registration, works for Louis
    c. Ricky, Erica, various radiology modalities
    d. Sergio, call center

2. There is a department of organizational excellence at WM. Mara ___ manager.
3. There is a new system that tracks the timing of patient flow during the day. However, it was not clear that this system is fully implemented or provides accurate data although it may in the future.
4. They have done studies/sampling of wait times. [see Sergio.]
5. Adventist system provides little specific direction, except "Gold Standards".
6. Apparently there is not a staff shortage in the sense of unfilled positions.
7. Issues were noted regarding the small offices used for financial information gathering from patients at check in.
8. Most of Rad is open 7 to 5 with the last appointment at 4:40.
9. Overall issue is balancing needs of patients and doctors when scheduling.
10. Cardiac CT is a service being added. They are adding services generally and hope for a growing outpatient volume.

C.   Meeting Notes 3/29/07

In attendance, from USC
From WMMC;

Meeting was held to provide an update on the findings and recommendations from the USC group regarding the radiology department. The following was discussed:

1. Several problems were noted by USC and were discussed by the group, including: no-shows, the follow up process to remind patients of appointments, the processing of doctor's orders.
2. USC: Coordination between scheduling and registration and actual events at the modalities needs to be improved. The schedule should reflect the actual experience of patient arrivals (and no-shows) and actual procedure times. Data collected thus far seems to indicate a relatively large number of no-shows and idle time at some modalities. Reminders should be done sooner so patients are actually reached and have time to fit into their schedule.

3. USC: Gathering data has been difficult. It seems that operational data is lacking which is needed to prepare an appointment schedule and track performance.
4. The idea of a "dashboard" was discussed. This is a typical device for managing a functional area such as radiology. While the patient tracking system may provide it – it could also be done manually.
5. The so-called status board or patient tracking system was discussed. It was referred to as the solution to a number of the problems of operational data. Full implementation of the system has been delayed. Current use of the system results in very slow response times.
6. There will be a meeting next week to review the status of the patient tracking system with Sergio and users of the system.
7. Rescheduling capability by the registration staff would be a good idea.
8. According to Gina, CT and other modalities are now properly recording exam start and end times and data will soon be available.
9. USC indicated that they observed that overstaffing seems to occur in terms of the escort function and CT & perhaps other modalities. It was noted that some of this staffing is stand by in case of emergencies.
10. USC noted that wait time is about an hour for most patients. The time from the appointment time to the exam may be short but what matters to the patient is how long they must wait in the waiting room. Blanca noted that they track wait time in terms of the time from check in until registration. However, this is only part of the total wait as it does not include the wait after registration until the exam starts.
11. The problem of keeping each modality busy was discussed in the light of no-shows, overbooking and call down of inpatients. USC suggested that the hospital ought measure and monitor how the hospital achieves keeping each modality busy while not building up too long a queue and increasing patient wait time. (room utilization and total wait time)
12. The hospital used to keep track of the No Show rate in Mammo. This led to calling patients to remind them of appointments, which decreased the No Show rate by 10%.
13. USC noted that one step might be to have inpatients given contrast at the ward rather than pulling the tech up to the ward. This could reduce procedure room idle time.
14. The issue of separating scheduling and registration was discussed. It was said to be the result of "best practices' info from HFMA. The communication of doctor's orders (DO) between the groups was discussed. Sergio said they were working on a system from Xerox but it is not operational. The use of a label printer was discussed. Perhaps taxing the DO to registration could work.
15. The need for a "pull" system was discussed. USC noted that often this is preferable rather than to "push" patients to the exam rooms by an escort. The idea is to have the tech pull in the next patient so the exams are done without a time gap between them.
16. USC: Mammo & Ultra Sound coordination of scanner arrangement could be revised.
17. The DO form was discussed. In effect, it is one of the few ways the hospital communicates with the doctors who are key to maintaining an effective schedule. Perhaps there should be a check box (or something) on the form to assure that the doctor has verified that the patient is aware or committed to the appointment that has been scheduled. Apparently the hospital address is incorrect on the form.
18. Brochures explaining the various procedures could be given to Doctors Offices so patients are not confused when they arrive for their appointments.
19. A "Show Me the Money Committee" was recently created, members include Sergio and Blanca, and was discussed.
20. The patient changing area was discussed as a problematic design but no correction is evident.
21. It was agreed that the three priorities are:
    a. **Coordination of Scheduling and Registration (to maximize patient flow)**
    b. **Improvement of the Doctor's Orders process (to reduce problems)**
    c. **Reduction of the no-show rate**

Steve suggested a group meet regularly (perhaps monthly) to implement suggested changes.

D.　　Meeting Notes 7/11/07

After May 2007 WMMC organized its own implementation task force. This is a typical agenda for these meetings.

Agenda
1st Floor Throughput Team

Wednesday, July 11, 2007

Commitments
      No Show Rate Update (Due May)   Pascual
            Current no show rate
            Graphic of No Show Rate

      Process Time Measurements (Due May)   Genena/David
            Exam time presentations
                  CT
                  MRI
                  Mammo

      Room Utilization Measurements (Due May)   Genena/David
            Percentage of room time used
                  CT
                  MRI
                  Mammo

      Schedule Redesign Progress (Due June)   Genena
            CT Changes
            MRI Changes
            Mammo Changes
            Criteria for exam length

Dashboard Progress
      Integration   Luis
      Design   Steve