A Study of Organizational Alignment at a Boston Area Hospital and Its Effects on Patient Throughput in the Peri-operative Areas.

by

Sarah K. Campbell

B.A. English
University of New Hampshire, 1994
M.S. Nursing
Massachusetts General Hospital Institute of Health Professions, 2005

SUBMITTED TO THE MIT SLOAN SCHOOL OF MANAGEMENT IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF SCIENCE IN MANAGEMENT
AT THE
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

June 2007

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Signature of Author: ____________________________

Sarah K. Campbell
MIT Sloan School of Management
May 11, 2007

Certified by: ____________________________

Gabriel Bitran, Thesis Advisor
Nippon Telegraph and Telephone Professor of Management Science
Sloan School of Management

Accepted by: ____________________________

Stephen Sacca
Director, Sloan Fellows Program in Innovation and Global Leadership
A Study of Organizational Alignment at a Boston Area Hospital and Its Effects on Patient Throughput in the Peri-operative Areas.

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Sarah K. Campbell

Submitted to the MIT Sloan School of Management on May 11, 2007 in partial fulfillment of the Requirements for the Degree of Master of Science in Management

Abstract

Capacity is an ongoing issue when managing hospital resources. Looking at the hospital as a supply chain of care services provided to the patient enables us to better evaluate problems such as delays on a systems level. A Boston Area Hospital has been experiencing delays in the operating rooms when moving patients into the post-anesthesia care unit (PACU). As the different services of the hospital are inherently reliant upon each other, this issue cannot be isolated and resolved in this one hospital area.

As this is the initial year of this research collaboration, the purpose of this work is to serve as a map of the surgical patient’s pathway through the hospital, with emphasis on the patients that move through the PACU, and identify areas that merit further research and study. Reasons behind delaying factors have been identified through interviews of different members of the organization and direct observation.

Applying a the congruence model in evaluating the alignment of objectives, resources, critical tasks and vision is a useful model for identifying potential areas of disconnect in the system. A pilot social networking survey was also conducted in the PACU and produced data that showed it is a useful tool in evaluating the informal communication structure and organization it relates to accomplishing critical tasks. Applying these tools and models will be useful in evaluating different areas of the hospital, identifying problem areas, and aligning the objectives of the different units, departments and professions to a more unified, strategic vision that fosters change.

Thesis Supervisor: Gabriel Bitran

Title: Nippon Telegraph and Telephone Professor of Management Science
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Chapter 1

Introduction

XYZ Hospital (XYZ) is consistently recognized as one of the leading research and teaching hospitals in the United States. It has approximately nine hundred beds that reported an average occupancy rate of 82.92% in FY04. For that same year, XYZ reported 34,072 surgical cases with 18,628 of those cases performed on patients staying in the hospital (inpatient). [1] It is the largest non-government employer in Boston, with 19,500 employees including 4,300 registered nurses and 3,900 members on its medical staff such as physicians and surgeons. [2]

The sequence of care at XYZ can be seen as a supply chain of services, or queuing network within the organization. As it is a general hospital, there are multiple services that the hospital provides, each with their own path or supply chain within the hospital. Each of these services overlap in different areas of the hospital, as it does with radiology consultations or on the patient care floors. For the purposes of this study, we are specifically considering Operating Room (OR) delays that result from the Post Anesthesia Care Unit (PACU) reaching its maximum capacity which, in turn, cause patients to back up into the ORs until bed slots become available in the PACU.

This research expands on the initial work of Tor Schoenmeyr, *System-wide Analysis of XYZ Operating Rooms as a Queuing Network*; it was conducted in conjunction with two
other Sloan Fellows from the Massachusetts Institute of Technology (MIT), Dairuku Hozumi and Chandrika Samarth. Each person researched different aspects of the OR delay and elements of the hospital organizational structure. This particular thesis maps out and discusses some of the overall issues in the context of a service supply chain, applying the congruence model for organizational alignment and strategy. Data collection methods consisted of semi-structured interviews conducted with different members of XYZ involved in the operational movement of patients from the Peri-operative Units through the PACU to the Inpatient Units (IU). A pilot social networking study was conducted in the PACU in collaboration with Chandrika Samarth in which we surveyed people to track the interactions during the busier times in the PACU. As this is the initial year of this research collaboration between MIT and XYZ, the purpose of this work is to serve as an overall map of the pathway of the surgical patient moving through the PACU to the Inpatient Units, discuss the present state of alignment of objectives in the organization, and identify some areas that merit further research and study. This thesis research is limited to surgical patients that are moving through the PACU into the Inpatient Units and excludes cardiac patients and patient moving directly to an Intensive Care Units (ICU) that bypass this step. There are many other patient pathways through the system that are not covered in this particular research.

The Problem

Each day, there is a backup of patients after their surgical procedures, waiting to get a slot in the PACU. The PACU in turn is waiting for Inpatient Unit (also called the floor) to discharge patients and clear beds so that they can move their patients out of the PACU and free up slots for incoming patients. The problem progressively worsens throughout the week with Friday being the busiest day and having the longest waitlist. Patients waiting to get into the PACU stay with the OR Circulating Nurse and Anesthesiologist in the operating room (OR) until they can get into the PACU.
The two time bands of between 1 – 3 pm and 4 – 5:30 pm when the length of stay is significantly higher than the average time of 3 hours and 10 minutes. There is a delay on Thursday due to meetings that result in an OR start time of 10 am rather than 8 am. Data from March 2007 looking at a delay in bed availability in an Inpatient Unit accounted for 99.6% of the delays. [3]
A minimum delay of 1 hour and 40 minutes coincides with the peak times that increase the average length of stay, providing a strong correlation between these two issues. A long waitlist has a demoralizing effect on the staff and pushes the stress of working to a point that changes a highly productive environment to one where there is a struggle to safely manage all the patients with the resources available. [4] [5]

This problem cannot be addressed as a singular issue in the peri-operative area of the hospital. The formal structure of XYZ has created a departmental approach to problem solving that in the past, may have led to a culture of studying each territory or sub-system within the hospital as there is a strong perception of belonging and control in each group’s individual unit, but not beyond that. The reason is that there is much more social and political maneuvering involved when moving beyond a person’s primary unit of employ. Studying the issues of PACU and OR delays as they fit into the system or supply chain of services that XYZ offers quickly transformed the problem in one of hospital capacity. The different units and departments of the hospital are highly inter-related and a delay in each part of the supply chain has an exponentially higher effect upstream. Incongruence and lack of alignment of objectives is an important issue in this problem.

<table>
<thead>
<tr>
<th>No. of patients (per month)</th>
<th>239</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum delay (hrs)</td>
<td>1.67 (1:40)</td>
</tr>
<tr>
<td>Cumulative delay (hrs)</td>
<td>399.13</td>
</tr>
<tr>
<td>Average length of stay (hrs)</td>
<td>3.16 (3:10)</td>
</tr>
<tr>
<td>Increase in patient throughput from 100% reduction in delay (per month)</td>
<td>$\frac{399.13}{3.16} = 126$</td>
</tr>
<tr>
<td>No. of patients/PACU bed (per month)</td>
<td>$\frac{1398}{29} = 48$</td>
</tr>
<tr>
<td>Bed capacity released due to 100% reduction in delay (# beds)</td>
<td>$\frac{126}{48} = 2.6$</td>
</tr>
<tr>
<td>Increase in efficiency for existing 29 beds (%)</td>
<td>$\frac{2.6}{29} = 9$</td>
</tr>
</tbody>
</table>

*Table 1 – Effects of Downstream Delays in the PACU [3]*

Table 1 shows the effects of the minimum delay as it relates to the availability of beds in the PACU. This is a conservative estimate, using the minimum delay. [3] However, it is not taking into account the availability of overflow PACU beds in the Same Day Surgery
Unit. These extra recovery beds are available only as resources (staffing along with physical bed availability) allow in this unit on the particular day.

*Figure 3* is a conceptual map of upstream to downstream flow in the hospital.

![Pre-operative OR PACU Inpatient Unit (Floor) Discharge](image)

*Figure 3 – General Conceptual of Patient Flow*

**XYZ Executive Leadership, Strategy and Vision**

The XYZ mission is *to provide the highest quality care to individuals and to the local and distant communities we serve, to advance care through excellence in biomedical research, and to educate future academic and practice leaders of the health care professions*. [6] It is a well-articulated vision of patient care and safety throughout the different levels of the organization. Employees at all different levels of the organization understand this vision and can articulate it. The XYZ spends over $463M per year in research and personnel recognize that health care research and learning as an important organizational objective.[2]

Members of the peri-operative administration set the vision and strategic plan for the services. They lead a staff of between 12 and 300 people, depending on the service. The administration provides support to the front line management staff, coordinating capital and human resources.

*The strategic vision for the organization is that quality and safety for the patient comes before anything else.* This strategic vision translates into practice with following the universal protocol (checking patient, checking ID, checking order) to ensure proper delivery of medications and other treatments. In the OR there is a goal of “no wrong site or retained items” during surgeries. They want to incorporate teaching as part of their
general organization operations to better insure a more highly trained staff in this critical care environment.

Reducing cost and finding ways to save money in the hospital is not a strategy; members only look at financial considerations when they are project specific. The hospital is not in a poor financial state or crisis, so their efforts are primarily focused on quality and safety. However, it is a goal to grow surgical services in the hospital, as it is an important source of income and there is an understanding of the cost of resources in the OR. [7]

There is a no XYZ articulation of the organization as one body working together to take care of each patient. Each department or unit acts within its own governance and culture separated not only physically in the hospital, but also by processes and information technology (IT). There is a lack of communication and understanding about the issues and processes between the different units in the hospital. Movement of the patient between the units requires an extraordinary coordination and effort.

At a high level, we can look at this problem using the Congruence Model (See Figure 4). This model is used by other industries to assess the alignment of their strategic vision with what is actually happening within the organization. Aligning the strategy and vision of the organization with the operations will have a positive effect on the culture and make the organization more innovative and competitive. Each chapter of this thesis will look at the different elements of this model and how it applies to XYZ.
Figure 4 – Congruence Model[8]
Chapter 2

The Formal Organization

The formal organization of XYZ is managed in two ways. There is the organization of the units or departments as well as the organization of the different professions or services that work within these units and at different points in the supply chain of care. To name a few, these include physicians, anesthesia, radiology, respiratory, physical therapy, and nursing. Services differ depending on the unit needs. The services work within their own hierarchy to perform their critical tasks as it relates to each unit. In general, nursing manages the direct, ongoing care of the patient and the operations and flow of each unit, coordinating services to patients by the respective services.

![Diagram showing the formal organization of a unit at XYZ](image)

*Figure 5 – Example of some of the service inputs into a unit at XYZ*

This example of strategic grouping is similar in many of the units with some variation depending on the point in the service supply chain. With each group aligning to the objectives of their particular service, patient care and safety is the objective shared by all.
Beyond this objective, personnel look to their own respective services for strategy and further objectives in their work.

**Linking Mechanisms**

To move a patient through the supply chain of services at XYZ requires a number of linking mechanisms. These include the face-to-face interactions between the patient, nurses and other services, along with IT linkages of orders, notes and operations software such as C-BEDS, and the physical patient chart. The physical chart is often used when patient information is not immediately available in the electronic record. Information reliance moves from the electronic record to the hard copy of the chart as the patient moves downstream in the hospital.

The linking mechanisms between the services are often the objective of the individual units, with the nurses of the units as the coordinators of the objectives, as they relate primarily to the patient and secondarily to the system and process as a whole.

**In the PACU**

These linking mechanisms coordinate inside and outside the unit with face-to-face and telephone contact between the services, and telephone conversations and an 11am meeting between the ORs and the PACU, the PACU, Admitting, and the Inpatient Units. During the time of this study, there was a new initiative to have an additional face-to-face meeting and telephone conversation with Admitting to collaboratively look at the PACU patient inflow and make placement decisions. Beyond this initiative, there is no personal integration of these functional areas. A majority of the communication of the communication of the units occurs through C-BEDS and the telephone.
Formal Reward, Measurement and Control Systems

Measurements and rewards are managed through the services. Physicians, anesthesiologists, radiologists, and other services manage themselves within their vertical and provide the rewards and promotions. The Nurse Manager for each unit manages the performance of the nurses and operations staff within the unit. Nurse managers receive performance reports about their unit with information such as capacity and length of stay.

High performance units that operate efficiently and work well within the system as a whole must be recognized and rewarded. Lower performing units that have difficulties working within the system must also be recognized and there must be some intervention from the administration to improve their management and processes.
Chapter 3

Critical Tasks and Work Flows

Process

To understand the patient backup into the PACU, it is important to consider all of the paths that different patients take before entering the OR. See Figure 6 for a conceptual picture. Patients are admitted into the hospital through the same day surgery department, the emergency department, as a transfer from another hospital, and directly from the physician. The same day surgery patients will go directly from this location into the OR while other patients may or may not get admitted to an inpatient floor and then go to surgery, coordinated again through the admitting department. Patients who enter the OR for surgery can come from all of these places as well as having been admitted to the hospital for other medical issues and moving to the OR as a result of medical workup and diagnoses while they are on the inpatient floors. Depending on the clinical need for surgery, a patient from the inpatient floor will either get scheduled for surgery or be put on a waitlist. Patients may be on a waitlist for several days, taking up hospital capacity. In anticipation of surgery, they are connected to IV fluids and not allowed to eat any food until later in the day when surgeons make the decision about whether they will perform the surgery.
In order to understand the extent of the problem, it is important to look at each individual process input into the OR as well as what happens to the patient after their surgeries.
* Unexpected Clinical Change or Need necessitates this flow
** This is a flow through the IT system administration of the hospital. All patients do not physically move through the Admitting

Figure 6 – Conceptual Map of Surgical Patient Flow (excluding Cardiac)
Admitting

Critical Task

Admitting is usually the gateway of a patient entering the hospital. Admitting at XYZ, however, is also involved with bed management of the patient as they move the patient through the system.

Work Flow

The Admitting department is reciprocally interdependent with the different units in the hospital. This means that each component task is inherently linked to other tasks and that the completion of one component task is dependent not only on the preceding task, but also those that follow. These complex interdependencies require collaboration, teamwork and trust because their work process demands mutual adjustment. Innovation in organizations involves reciprocal interdependence. [8]
Entering the System

![Conceptual Map of Entering XYZ]

A patient can be admitted into XYZ through Same Day Surgery Unit (SDSU), the Emergency Room (ER), the coordination of a Physician’s office, transferring from an Outside Hospital. Admitting works with the Nursing Supervisors for clinical guidance as they assess the clinical needs of the patient in comparison with what the services available at the outside hospital. [9] Admitting also works with the nursing supervisors when setting up the Admitting priority. Admitting is not staffed with people who have this clinical expertise. [10]

Admitting manages the IT of registering a patient in the system and coordinating the process of placing the patient into a bed on the Inpatient Surgical Unit (Floor), if required prior to surgery.
Patients can also arrive at the hospital on the day of their surgery. They check-in to the hospital in the Same Day Surgery Unit (SDSU). Patients that check into the SDSU who need inpatient beds after their surgery get triggered in the Admitting IT system, which then puts the patient into “the radar” of the bed manager system.

**Moving from the OR through the PACU and onto the Inpatient Surgical Units**

Each morning there is an 11 am meeting between Admitting and a Nurse Manager and either Operations or Charge Nurse from the Inpatient Surgical Unit, along with the nurse manager or operations representative from the PACU. The purpose of this meeting is to assign beds to units as soon as possible in order to get the information to the PACU in C-BEDS. C-BEDS is an integrated software system used by Admitting, the PACU, and Inpatient Units or Floors to assign patients to beds on the Inpatient Units. Admitting does not want to get the information to the PACU too soon, however, in the event there needs to be a change.[11] This conflicts with the Floor Walker’s need for information at 6am (Further description of job titles can be found in Chapter 4, as well the Glossary of Terms) The Floor Walker is looking for status information by 6 am that is often not available until 2pm. [9] Admitting will assign a patient to a floor that has empty beds appearing in C-BEDS, but then the floor Operations Assistant (OA) will assign the patient to the bed. [12] If a patient has been assigned to a bed and needs to be moved to another bed, this change must go through Admitting. Admitting must also update the system with patient assignments once the Inpatient Unit OA has updated the system with their discharges.
Each time a patient is admitted to an Inpatient Unit from another unit in the hospital, he or she is coordinated through Admitting. This includes patients moving from the PACU, the ICU, or other surgical floors as well as from Outside Hospitals, the Emergency Department and direct physician referrals.

C-BEDS was implemented in January 2007 has been a big step for XYZ in making the patient flow process more transparent and enabled more open communication between the PACU and the floors. Nurses can now see the specific floor that their patient is going to and check that status of the bed (whether it is occupied, getting cleaned or ready).

Unfortunately, the updating of C-BEDS needs to occur in the Inpatient Units as well as in Admitting for assigning additional people to the floors. Admitting sees the new PRISM (PACU Real-Time Integrated Slot Manager) system as a positive step in coordinating the OR Dynamic and C-BEDS.
Some Issues with Admitting

- Admitting has an inconsistent reputation from the staff on the floors and PACU who directly communicate with them regular basis. Several people interviewed commented that admitting can be a difficult group to communicate with and find that they must communicate with specific Admitting staff members in order to feel that a genuine effort was being made to get their task accomplished. This cultural aspect is a core issue to this department’s function as it presently exists as a key communications center for patients coming into the hospital as well between the Inpatient Units and every other department or unit in the hospital.

- Several people commented that sometimes there is a delay in getting the patient into the C-BED system and moving them around within the system.

- Unlike other hospitals, the XYZ Admitting staff do not have clinical training. This adds an additional step and time in any bed selection process. Accordingly, they must communicate with the Nursing Supervisors when managing transfers from outside hospitals.

- Further research looking at the formal structure, organization, critical tasks and informal social network in Admitting will be useful in order to see how its culture and critical tasks align with the hospital units that it works with as well as the rest of the hospital.
**Same Day Surgery Unit (SDSU)**

*Critical Task*

The Same Day Surgery Unit (SDSU) acts as a check in point for surgical patients scheduled to return home on the same day as well as the surgical patients who will be staying at the hospital after their surgery. The SDSU has its own PACU for patients to recover from anesthesia before returning home.

*Work Flow*

![Conceptual Map of Same Day Surgery path to OR](image)

In theory, the SDSU is set up to be a sequentially interdependent in the system. Ideally, the patient should have all of their pre-operative workup and paperwork administration finished prior to the patient checking into the hospital. Unfortunately, due to the lack of process standardization for OR scheduling, the SDSU is expected to act as more as a reciprocally interdependent component in the supply chain. Often there are patients arriving for surgery that may not have acceptable blood chemistry values or they are missing an important consult (for example cardiac or renal). The resources in the SDSU are limited and patients requiring additional data prior to surgery will cause delays in the OR schedule. There are presently two nurses, each working part time (equivalent to one full time employee) mitigating first case start delays for the following days. They assess each individual patient chart and coordinate with the different administrators from the surgical offices to get the administrative paperwork in order for the next day. If they have some time, they will call the patients to remind them of their pre-operative protocol (no
food after midnight, etc.) and answer any last questions. Unfortunately, there is not enough time to contact all the patients coming to XYZ for surgery the following day and prevent delays due to patient education and understanding of what is expected from them to prepare. [13]

Patients will arrive to the SDSU beginning at 6:30 am for a first case that begins at 8:00 am. Patients scheduled later in the day are asked to arrive 2 hours prior to surgery. Patients receiving outpatient surgery get admitted into the system when they check into the SDSU and then get prepared for surgery by the nurses who work in the area. The patient checking in initiates their slot in the OR Dynamic – a software package that tracks the patient through the OR into the PACU. Patients at this point should have already been through the Pre-Admission and Testing Area (PATA), where they would have received the different consults requires (anesthesia, surgical and other consults as required such as cardiac and renal, for example). The patient changes into their hospital gown, the nurses take their vital signs and double check that pre-operative procedures have been followed. From this area, the patient is transported to the OR. By 7:30 am, the patients are usually outside the door of the OR.

![Figure 10 - Conceptual Map of Path from OR to SDSU and Discharge](image)

After their procedure, they return to the SDSU to recover from anesthesia and then get discharged to return home. An average patient takes approximately 2 -3 hours to recover from anesthesia. The post-anesthesia recovery area in the SDSU also serves as an overflow area for the general Post Anesthesia Care Unit (PACU). [13]
Issues Potentially Causing Delays in the SDSU

- Chart not fully prepared and reviewed by surgeon’s office prior to procedure. There are no standards such as 24 – 48 hour requirement for preparedness of charts for elective cases prior to surgery. Patient may need additional labs or other data prior to receiving surgery.

- The SDSU is not staffed to handle the coordination capacity of the pre-admission testing area (PATA), and if a patient arrives with an incomplete pre-operative work-up prior to surgery that day, there will be a delay.

- Patients that arrive for surgery and have not followed pre-surgical protocol (such as not eating from midnight the night before) will have their cases canceled.

- Patients that arrive to the SDSU and do not check-in due to lack of understanding, confusion, or disability (such as blind/deaf).

- Smoothing of the OR schedule – case time, specialty, and patient outflow needs to be taken into consideration when structuring the schedule. Presently, there is no algorithm for scheduling as it relates to capacity.

- Interpreter services were often not available for patient.

Chart preparation, pre-operative workup for the patient, smoothing of the OR schedule as well as interpreter services are the two issues that can be addressed at an organizational level. Further research into the systems that different surgeons use for scheduling a patient for surgery and ensuring that the background medical workup is ready by the day of the procedure will help to identify the specific sources of inconsistency. This is a problem that could be addressed with a well-conceived, easy to use, web-based IT application that surgeons’ offices use to schedule cases will provide the hospital with a
standardization of inputs for patients coming into the system, as well as an indication of the numbers of types of patients that will be entering the system. Developing the system will take time and collaboration with the surgeons in order to create a program that is used and not bypassed.
Operating Room (OR)

Critical Task

Safely induce patient into anesthesia and perform surgery.

Work Flow

The OR is a sequentially interdependent component in the supply chain (though the actual surgical process is highly reciprocally interdependent among the personnel inside the operating room). The patient and the surgical staff are separated from the rest of the bustle of the hospital during the procedure. The Circulating Nurse provides the only link to the rest of the hospital by taking telephone calls for the surgeon, updating the OR Dynamic Schedule on the computer, and calling the PACU to get a bed slot for the patient. Pre-operative tasks and procedures must be completed before a patient is clinically “cleared” to receive surgery.

Inflow – Outflow Logistics

The OR works on a Monday – Friday, approximately 8 am – 6 pm schedule, with cases running over due to various delays and emergency cases added to the schedule. On Monday, Wednesday and Fridays, surgeons begin procedures at 8 am and they will begin procedures at 10 am on Thursday, following OR meetings and grand rounds. Surgeons will perform surgeries on Saturdays to either catch up with cases that for whatever reason did not make it into the schedule in the previous week, or to handle emergency cases. In general, however, surgical procedures are not scheduled for Saturdays or Sundays. Operations are significantly reduced to a minimal weekend staff.
There is an 11:30 am meeting each day to review the 24h and 48h schedule. Patients can arrive at the OR from SDSU, the Emergency Department (ED), or the Inpatient Unit. The patient is then transported into the anesthesia induction room and then into the OR. The OR dynamic captures the different stages of the operation and provides a color-coded guide that can be accessed throughout the peri-operative area. This enables the PACU, the Help Desk and the coordinating staff to see what is happening in real time. The OR Help Desk is comprised of nursing, surgeons and anesthesia placing cases.

Any change in the OR schedule for the same day must go through the Anesthesia Staff Administrator, otherwise known as the Floor Walker. The Floor Walker coordinates the flow of patients with PACU OA, PACU Charge Nurse, Surgeons, and the Neuroscience and Surgical ICU Charge Nurses.

In the OR, there is an anesthesiologist, a surgical team often comprised of a combination of surgeons in their residency along with attending physicians (surgeons). There is a scrub nurse who works with the team in the sterile area and there is a circulating nurse who manages the operations of the OR environment outside of the sterile field.
The circulating nurse manages communications in and out of the OR during the surgery, tracks the procedure in the OR Dynamic, is responsible for entering causes of OR Delays, and coordinates movement of the patient out of the OR with the PACU. If there is a waitlist at the PACU, the OR circulating nurse is often the person negotiating with the PACU for a slot. In this circumstance, the circulating nurse and the anesthesiologist will stay with the patient after the surgery, until a slot opens up in the PACU.

Some Potential Delays in the OR

- First case delays can be caused for a number of reasons including: a patient’s chart is not fully prepared, patient has a misunderstanding of what is required of them for the OR, or failure of the patient to check in, as well as many other factors.

- The XYZ 80 hour work-week requirement reduces the availability of residents to get surgery consent.

- There is on average a ½ to 1 hour delay from start to end time in the OR.
There are delays getting into the PACU due to capacity.

The OR Dynamic does not automatically update the start time of the rest of the cases if there is a first case delay.

Many of the issues surrounding first case delay are covered in the previous section. Possible delays due to the reduction in availability of surgical residents to get consents from patients in a timely manner prior to surgery is an important issue that can be further explored in a future research study.
Intensive Care Units (ICUs)

Critical Tasks

The ICU manages the intensive care of critical patients that require more specialized and high-level resources available 24 hours a day.

Workflow

ICUs also can be represented as a reciprocally interdependent component of the entire supply chain of care at XYZ. ICUs rely on coordination and communication with the surgeons, anesthesia and other services for these critically ill patients, many of whom will receive multiple surgeries and/or move to and from the floors.

Patients moving from the OR directly to the ICUs do not go through the PACU, except in certain situations. The Intensive Care Units (ICUs) are units that provide one to one nursing and have surgical and anesthesia residents available in the unit at all times. XYZ has surgical, cardiac, neurological, pediatric, medical and neonatal ICUs. The patient’s pathway through this service chain is managed by their surgeons, the Floor Walker, the Nursing Supervisor and the ICU.

Figure 13 – Conceptual Map of pathways into the ICU from the OR
Patients that may need ICU care on the short term (overnight) will go into one of the four available bays or “slots” in the overnight area of the PACU. These patients will receive the one-to-one nurse to patient ratio and have access to the surgical resident and staff anesthesiologist in the PACU. The PACU overnight area is an expeditious way of moving the patient that needs only short-term intensive care to the Inpatient Unit. Other patients may become more clinically unstable in the PACU and will move to an ICU rather than the Inpatient Unit as initially intended. This requires the coordination of the Floor Walker, the Surgeon, the PACU Charge Nurse, the ICU Charge Nurse and the Nursing Supervisor.
Post Anesthesia Care Unit (PACU)

Critical Tasks

The PACU accepts patients from the OR and provides the nursing care and medical resources necessary for patients recovering from anesthesia.

Work Flow

PACU patients usually move to the Inpatient Units or Floors once they have recovered, except for the four patients that they keep in the overnight ICU area. The PACU is a reciprocally interdependent component in the XYZ service supply chain and is the gateway from the peri-operative area to the rest of the hospital. Managing the unit requires vertical management within the organization as well as management of the unit.

Patient Inflow

Figure 14 – Conceptual Map of pathways in and out of the PACU
The PACU is a large room with "slots" which are bays wired to a monitor that a patient on a stretcher gets rolled into after their surgery. In most cases, the patient gets "handed off" by an anesthesiologist and a surgical resident to a PACU nurse. This handoff represents the transfer of the patient from the medical staff to the nursing staff. The nursing staff manages the movement of the patient through the organization from this point forward. Each PACU nurse must complete approximately 20 minutes of admission documentation upon receiving a new patient. This summary is completed on paper. The patient's orders are available on the computer and will be activated as "Post-Op" orders once the patient is in the PACU.

Peak inflow of patients into the PACU begins at around 11 am to 12 pm, with 1 pm – 3 pm and 4 – 5:30 pm as potential times for the PACU to reach capacity and all of its slots to be full. Between 2 pm and 4 pm, many patients will move to the Inpatient Units simultaneously with another surge of patients coming into the PACU. Often nurses and sanitation staff barely have time to organize and clean the slot before they receive another patient during this time. Patients from the OR who need beds in the PACU will be placed on a waitlist based on a first come, first serve basis, unless changed by the Floor Walker. Surgeons will continue to begin new procedures even with patient delays getting into the PACU.

Some Issues that Emerge with Patient Inflow/Bottleneck.

- Once there is a PACU waitlist, the circulating nurse in the OR will often call ahead of time in order to secure a PACU slot. Often times this action will add to the bottleneck, as the patient will get a slot assigned and then may not be ready when the slot opens up. Then there is often another negotiating process between the PACU OA, PACU Charge Nurse, OR Circulating Nurse, Surgeon and Floor Walker as the decision needs to be made about whether to slip the patient back on the waitlist and take a patient that is ready and waiting, or to wait another 5 minutes and hope it does not turn into 20 minutes.
• There will be changes to the priority of patients on the waitlist coming into the PACU.

• Extreme capacity issues will not stop more patients entering the system and needing services as surgeons will continue to perform scheduled procedures.

In the PACU

The PACU is run on a team-nursing model. Nurses in the PACU work on a staggered schedule, with many of them arriving from 11am onward. Each nurse will take up to two patients, depending on the clinical need of the patient and nurses will aid each other in situations where extra clinical attention is needed. For example, if a patient’s blood pressure begins to climb and the nurse has to work with the anesthesiologist and/or surgeon to provide an IV anti-hypertensive, another nurse will support this nurse by caring for his or her second patient until the first patient becomes more stable.

The PACU also will support 4 overnight patients that need ICU level, one to one (one nurse to one patient) nursing for patients that are predicted to need this type of care on the short term. This helps to free ICU beds from patients who may only require one night of this level of care before moving to an inpatient surgical floor, which has a one to three or one to four nurse to patient ratio. This PACU will staff each of these beds overnight, along with additional PACU nurses, depending on the projected flow of patients of emergent and/or emergency cases.

It usually takes approximately 2 – 3 hours for a patient to clear their anesthesia and be ready to be transferred to an inpatient unit. In order to transfer, the patient must have achieved a number of clinical benchmarks. At this point the PACU nurse will get the resident physician to sign off on the patient, and then the patient is ready to transfer to the inpatient unit (surgical floor). It is important that the appropriate clinical criteria has been reached in the PACU, as once the patient is transferred to the floor, the nurse to patient
ratio is significantly lower and there is not the immediate availability of anesthesiologists and surgeons.

**Patient Outflow from the PACU**

Each morning, the PACU will receive a report from admitting that is organized by floor. It provides the patient capacity and daily average of patients by floor. Admitting also give the PACU access to hospital capacity at 11 am, 2 pm and 5 pm each day. This is not connected with the recently implemented C-BEDS bed manager software system. Patients in the PACU may or may not have an inpatient bed assigned to them. Sometimes they will appear on the bed manager software when they arrive and check into SDSU. The Admitting Department will assign the patient to a floor, and the Operations Assistant (OA) from the floor will assign the patient to the actual bed in the C-BEDS system. Often a patient will not have a bed assigned to them and therefore will be relying on the coordination that takes place between the PACU Charge Nurse, Admitting, and the Inpatient Surgical Units to get a bed assignment. This requires an extensive amount of coordination by phone and through direct, daily meetings and is not presently adequately managed through the IT system (C-BEDS) alone. During the weeks of this study, the nurse manager of the PACU was piloting a new process by which a member of admitting would physically come to the PACU and work alongside him and the Charge Nurse to find beds for their patients in the hospital.

Once a patient is assigned to a floor by Admitting, the PACU nurse can check the status of the patient's bed in the Inpatient Unit on C-BEDS. The transition of the patients from the PACU to the Inpatient Units is a critical point in the supply chain of providing service at XYZ. At this point there can be up to eight people involved in the direct coordination effort of one patient moving from the PACU to the Inpatient Unit, especially if there is a delay. These people include the PACU Charge Nurse, the PACU OA, the PACU OS, the PACU Staff Nurse, a person from Admitting, the Inpatient Unit OA, the Inpatient Unit Staff Nurse, the Inpatient Unit Charge Nurse. Nursing Supervisors and Floor Walkers can also get involved as any issues emerge.
Some Problems with the PACU Outflow

- Nobody knows actual bed availability. The C-BEDS system has had some inconsistencies and therefore is not fully trusted yet. Additional training along with the new version of C-BEDS will help to address this issue.

- C-BEDS is not updated on the floors. The Inpatient Units must update the system when a patient is getting discharged. Failure to update CBEDS may be happening for a number of reasons including poor communication among the staff on the floor, training issues with the OA from the floor, poorly organized or limited nursing resources on the floor that cannot accept a new patient.

- Data is not distributed throughout the organization. Transparency of data is important people to understand the critical factors of the day and begin working towards finding solutions. A dashboard system for Inpatient Unit OAs showing the capacity of the PACU will make the problem more real to them in their daily routine. Access to the bed availability of the different floors for the charge nurse in the PACU will also help to improve bed placement.

- Changes in bed assignments are not always implemented by Admitting in a timely manner. Management of C-BEDS when moving a patient’s room within the Inpatient Unit must go through Admitting and can get delayed with the extra step.

- Lack of transparency in C-BEDS as to clinical reasons why a bed may be closed.

- Block changes in OR schedules creates an influx of a certain type of patients (for example, orthopedic patients), more than the orthopedic Inpatient Units can accommodate. For example, if a neurological service attends a conference, they may give the orthopedic service their OR time for that week, without other members of the hospital knowing about this change.
Learning curves for using the C-BEDS application. C-BEDS was implemented in January 2007 and people are still learning how to use the program its full capabilities. There was two days of training during its initial implementation in December 2006. Additional follow-up training seminars will improve user skills with the system now that they have had some experience with it.
Inpatient Units or Inpatient Surgical Floor or Floor

Critical Tasks

Inpatient Units or floors provide acute rehabilitative care to prepare them for discharge from the hospital.

Work Flow

Inpatient Units are components that have more sequential interdependence in the supply chain. Patients must meet the clinical criteria to move to the floor as the nursing ratio drops to one nurse per three to four patients, and physicians and anesthesiologist are not readily available on the floor to quickly troubleshoot a change in status.

Most patients in the PACU are intended to move to the Inpatient Units. These units have a ratio of approximately a 1 nurse to 3 – 4 patients. These are the floors from which patients are usually discharged from the hospital. The length of stay on the floors varies with the type of surgery a patient receives, the clinical severity of their condition, along with the management of co-morbidities (other medical risks and issues that may or may not have been affected by the surgery).

The day in the Inpatient Units begins with an OR list that is delivered to the unit between 5 am – 7 am. Early in the morning, the charge nurse will be contacted by admitting and have a conversation about bed availability for the day. There is also the bed management meeting with admitting, representatives from other surgical Inpatient Units and the PACU as was previously mentioned. The rooms in the Inpatient Units are primarily double occupancy rooms with one or two single rooms. Single rooms are often fitted with environmental controls and priority is given to patients with a communicable disease, such as tuberculosis. Patients with other infection precautions such as those who tested positive for Methicillin Resistant Staphylococcus Aureus or MRSA (an antibiotic resistant bacteria) will require either a single room or the second bed in the double room.
will be closed. Some of this clinical information and reasoning behind the bed closing is not immediately apparent in the C-BEDS system.

On the Inpatient Units, the Operations Assistants (OAs) are the primary users of C-BEDS. OAs will see the patients that Admitting has assigned to their floor along with a graphic representation of the beds on their unit and their status. OAs work closely with the Charge Nurses for the day on the Inpatient Unit for deciding the patient bed assignment. Often times, the Charge Nurse will move patients within the unit or will shift patients around after discharges in order to be able to change the sex of the room (male room to female room) or to move a patient to with a clinical need for elevated supervision to a room that is closer to the nurses' station. Nobody in the Inpatient Unit can change the bed assignment in C-BEDS, the OA must contact Admitting to make this change.
Patient Flow onto the Inpatient Unit

Inpatient Units will admit patients from the PACU, the Emergency Room (ER), as a physician referral (Front Door), from the ICU, and from other Inpatient Units. A key issue in the patient backup into the inpatient units is the rate at which C-BEDS is updated with the discharges. There are a number of factors that may go into this problem.

Some Inpatient Units with Chronic Management Issues

- In moving patients through the system, there are several Inpatient Units that consistently have difficulties accepting patients onto the units and discharging patients. This may be the result of the management, culture and/or resources available to the floor or a combination of the three components. Inpatient Units with these bottleneck issues need some management guidance and training from colleagues and mentors within the organization in order to improve workflow consistency on these floors. Inpatient Units with these management issues may have some of the following issues:

Differing levels of expertise of the OAs and Charge Nurses between the Inpatient Units

- There can be a great disparity in expertise between OAs and Charge Nurses within the Inpatient Unit and among the different floors in their ability to communicate and organize their individual floor capacity. Though patient assignment is organized by the Charge Nurse on the Inpatient Unit, the OAs on the Inpatient Unit are the connection to the rest of the hospital and their ability to manage the communication and patient movement through the unit is critical, especially during busy times.
Change of Shift

- Peak times for patients moving from the PACU to the Inpatient Units coincide with the change of shift for nurses, leaving the floors at 3:30 pm. Nurses trying to finish up their patient care, write their notes and give report before they leave at 3:30 are receiving calls from the PACU. The next shift of nurses must take report and check on their patients as soon as they arrive. This makes the 3 – 4 pm time period a difficult time for nurses to take on a new patient, as it can take 30 minutes to an hour to settle a patient in, ensure that their basic care needs are met, transcribe their orders, ensure medications are available, and write a transfer note.

Resource Limitations

- Admitting and discharging a patient will take the least clinical priority for a nurse who may have more critical issues to attend to with other patients. Discharges may get delayed as the process and paperwork can be time consuming. Inpatient units that continuously have difficulty in taking patients, may have management issues that affect the resources available to the nurses during these busy times.

- Discharge orders are written by the physician, the resident or the nurse practitioner from the medical or surgical team that is caring for the patient. Physicians who are not based at the hospital will often not write discharge orders as promptly as the regular physicians. The Case Managers often need one to two days to coordinate the discharge of a patient into a rehabilitation facility or to coordinate services that will come to the home. In order to be discharged, a patient often must see a physical and occupational therapist for evaluation of the safety their home environment. A delay in putting the discharge order into the system can keep the patient on the Inpatient Unit for extra days while they wait for these services to get put into place. [10]
People – Human Resources

Four aspects of the organization’s human resources should be assessed: competencies (What are they good or bad at?), motives (What rewards are most effective in motivating them?), demographics (How long have people worked together?), and national origins (What is the cultural mix?). [8]

Managers must gather competencies for not only direct reports, but also about themselves, their supervisors, their peers and colleagues. This is important for not only managing the unit’s critical tasks, but also understanding strength and weaknesses as well as the style of people around and above them in the organization. Aligning a rewards system to individual motivations and the critical tasks will be more effective than adhering to a blanket rewards system. [8]

General PACU observation showed the personnel practicing at a high clinical level, working together well, and handling critical patient issues calmly and effectively. For example, an issue arose on a couple of occasions about transferring a patient to a specific floor. The PACU seems to continually have problems getting patients to this floor and several different nurses remarked about their difficulties with communicating and moving patients to this floor. During one of my visits, an Inpatient Unit delayed a patient from being transferred for four hours. This particular floor seems to have ongoing difficulties
in taking patients in a timely manner. These delays not only take up the resources of the PACU bed slot, but also cause an enormous amount of time in negotiation among many people between the two units, taking time away from direct patient care.

When situations like this arise repeatedly within certain units, management needs to spend some time assessing the unit individually and applying some of the congruence methods to the unit on a micro level. Each unit must align its operation with the organization objectives in order for the entire system to function properly.

**Direct Participants in Surgical Patient Throughput to Inpatient Units**

**In the OR**

**Surgeons** – Each surgeon belongs to a different practice affiliated with XYZ. The individual practices manage themselves within the XYZ system. Surgeons own their OR time blocks to book procedures for up to 5 days prior to surgery. Five days before surgery and less, free OR times become available for other surgeons to use. Practices may function differently, depending on how the surgeons choose to run them. As it is a teaching hospital, there will be Attending Surgeons who oversee the medical residents, nurse practitioners and physicians’ assistants involved in the practice. Attending surgeons have final responsibility for the patient. Surgical Residents are working as part of their medical school residency and handle much of the day-to-day patient activity.

**Anesthesiologists** – Perform the anesthesia during the operating procedure. Anesthesia took over management of the peri-operative area from the surgeons in 2000 and acts in the role of Floor Walker as described below.[14] Anesthesia acts as a liaison for other services including the management of biomedical research areas in the hospital.

**Staff Administrator a.k.a. Floor Walker** – The Floor Walker is the Anesthesiologist on call that day to coordinate the patients between the OR, PACU, and ICU. 48 hours prior to OR, they consolidate the procedures and tighten the schedule. 24 hours prior their OR
day of management, they finalize the schedule. In the morning they re-review the schedule for anesthesia and coordinate the ICU schedule with the ICU Resource Nurse and the Nursing Supervisor. The Floor Walker roams the floors of the peri-operative area and the ICU and acting as the coordinator for moving the patients through the area for the day. The Floor Walker will make prioritization changes on the waitlist of patients trying to enter the PACU from the OR, if necessary. The Floor Walker may also coordinate with Admitting Staff to try to move patients to the Inpatient Units. When the waitlist to the floors persists into the evening, the Floor Walker assigns patients waiting for beds on floors to overnight stay in either the PACU or ICU depending on criticality of nursing supervision required.

**OR Circulating Nurse** – The OR Circulating Nurse is the nurse in the OR that is not scrubbed in and in turn coordinates the communication in and out of the OR. At the end of the case, the Circulating Nurse coordinates the PACU slot with the PACU OA.

**In the PACU**

**PACU Nurse Manager** – The PACU Nurse Manager manages the operations of the PACU at a high level. He/she coordinates the staffing of the nurses, OAs and other support staff. He/she also provides support to the Charge Nurse and other nurses for any coordination needs involving the patient flow.

**PACU Charge Nurse** – The Charge Nurse organizes the staff assignments for the day and coordinates the patient flow through the PACU. In coordinating patients in and out of the PACU, the Charge nurse speaks with the OA, OR Circulating Nurse, Admitting, and Nurses in the PACU. They have a responsibility to keep as many bed slots open as possible while ensuring patient safety.[15] There will be a day and evening Charge Nurse. The evening charge nurse often actively helps the daytime charge nurse during lunchtime and after.
PACU Operations Supervisor (OS) – The OS manages the general operational support structure of the PACU including the OAs, supplies, equipment problems and shortages and overall general environment. The OS also supports with patient throughput issues during waitlist and busy times. [15]

PACU Nurses – The Nurses primary responsibility is to provide care to the patients and ensure patient safety. They care for up to two patients in bed slots located next to each other. The four beds in the PACU overnight area and pediatric patients require a ratio of one nurse to one patient. PACU Nurses receive report about the incoming patients from the anesthesiologist and surgical resident involved in the surgical procedure. Once the patient meets the discharge criteria to leave the PACU, they call the Inpatient Unit and provide report to the nurse who will be accepting the patient into their care. PACU Nurses practice team nursing where they work as a team to support the care of the patients in the entire PACU as well as the specific patients to which they have been assigned. [16]

PACU Operations Assistant (OA) – The OAs manage the handling of the computer systems and phones and assign slots as they receive calls from the OR Circulating Nurse. Most of the communication in and out of the PACU is by telephone. There is a second OA that supports the primary OA during busy times and also has been trained to transcribe the medications and orders for the PACU overnight patients.

Staff Anesthesiologist – There is always a Staff Anesthesiologist available in the PACU. The Staff Anesthesiologist works directly with the PACU Nurse to manage the patient’s vital care and also provide adequate pain management. An anesthesia resident is always available in the PACU and the Attending Staff Anesthesiologist circulates in throughout the day.

Surgical Residents – Surgical Residents along with Anesthesiologists will pass off patients to the PACU nurses.
On the Inpatient Surgical Units or Floors

**Floor Charge Nurse** – The Charge Nurse for the day coordinates the patient inflow and discharge from the Floor. He or she coordinates with the OA and Admitting for assigning patients to beds.

**Floor OA** – The Floor OA coordinates with Admitting and the Floor Charge Nurse for patient bed assignments and bed changes on the floor. The Floor OAs also handle medical administrative tasks such as transcribing orders and ordering equipment as needed for the patients on the floor.

**Floor Nurse** – The Nurse on the floor takes report from the PACU nurse and accepts the patient into his or her care when they are transferred to the unit. Floor nurses will care for between 3 – 4 patients on average during day shifts and 5 – 6 patients during night shifts (depending on the unit).

In Admitting

**Admitting** – Personnel in admitting primarily speak to people by phone and update the system as required. Admitting is involved in this process as people check into surgery and then again when a patient needs a bed on a floor. During the weekdays, a person from Admitting meets with either the Charge Nurse or OA from the Surgical Units or Floors along with the PACU Nurse Manager or Charge Nurse to discuss allocation of beds for the day.

A new initiative by the PACU Nurse Manager and Admitting is to have a person from Admitting physically go the PACU to work together on the C-BEDS system and find more beds for patients. This face-to-face exposure of the nurses to the admitting person has provided a valuable connection in their communication. Both parties commented that they found it useful and in working directly together, they were able to locate some additional beds for PACU patients in the hospital.
Chapter 5

Culture and the Informal Organization

Beyond the formal structure of XYZ, the informal organization and culture of the organization is critical in achieving the critical tasks of each individual unit and the organization as a whole. Informal interactions between personnel drive the communication network within the system. [8] Cultural norms and values act as a social control system. These norms can have a positive and a negative effect on the organization, depending on the norms. It is important for a manager to look at the culture of the unit to see how it fits with the critical tasks. Compliance with the norms will be rewarded within the informal organization while non-compliance will be punished through social behavior and interaction.

Managers can observe the norms by noting the way newcomers are treated and what the group approves and disapproves of in the actions and attitudes of the new person. Widely shared norms throughout the organization show a consistency of attitude and behavior. Congruence in what everybody considers to be important, reflects strong core values and a strong culture within the organization.
At XYZ, there is a strong culture of clinical training and knowledge. Each person interviewed vocalized an organizational objective to be patient care and safety. It is an objective that is deeply intertwined in the culture of the organization and understood as a given by the different members of the organization. It is a hospital that has a long and history and still carries much of the more traditional bureaucratic structure. This history along with a partly integrated IT system makes a culture that still relies deeply on telephone conversations and face-to-face interactions.

**Social Networking**

Social networks are the informal communication networks that exist in a group, or unit of personnel. They provide insight into the informal power. Members of the group rely on each other to help solve problems, answer questions and provide insight into how to get tasks accomplished. Informally powerful people have expertise and strong interpersonal skills to communicate their knowledge across the social network.

**Background**

Organizations are now evaluating the social network of business units to get an idea about the structure and power of informal networks as they relate to the formal structure. There is an effort to transform organizations into more collaborative networks as an engine for driving innovation. A Collaborative Innovation Network (COIN) is a cyber-team of self-motivated people with a collective vision, enabled by information technology (IT) to collaborate in achieving a common goal by sharing ideas, information, and work. Members of COINs are normally cross-departmental or organizational boundaries. They work as teams and embrace change while continuing to conduct their work according to accepted ethical principles. These networks are self-organizing and members communicating with each other in a “small world” structure where members can be reached quickly. [17]
The small world structure of a network (B) provides direct connections through a network without having to pass through intermediaries.

*Figure 16* is a conceptual picture shows the core properties of COINs on the individual, team and organizational level. Swarm intelligence and creativity is a concept of people sharing ideas openly and equally. It is the idea that the sum of the intelligence and ideas of a team or collaborating group of people is exponentially more than the sum of the intelligence of the individuals. An example of swarm intelligence and creativity can be the open collaboration that occurs among the nurses, surgeons and anesthesiologist when a patient becomes clinically unstable. In order to collaborate and achieve swarm creativity, individuals must possess an ethical conscience, teams or groups of people follow a code of ethics and the organization is consistent with its vision and purpose. Transparency of information provides a basis of trust among the members of the organization and promotes knowledge sharing among its individual members.
In conjunction with Chandrika Samarth and Peter Gloor from the MIT Sloan Center for Collective Intelligence, we conducted a pilot study on the PACU Nurses during the peak time intervals over a period of two weeks in March 2007. For the survey, we asked nurses and operations staff to record the number of interactions and the people with whom they interacted over a 30 minute period of time and to indicate the level of business of the environment at the time (Not busy at all, Somewhat busy, Really busy, Maxed). See Appendix 1 for a sample survey. Data was gathered between 12 – 2 pm and 4 – 6 pm in an effort to capture the communication patterns of the PACU during waitlist times. The survey was administered on the following dates in 2007:

26<sup>th</sup> March: Monday
27<sup>th</sup> March: Tuesday
4<sup>th</sup> April: Wednesday
5<sup>th</sup> April: Thursday
6<sup>th</sup> April: Friday
The week of the Monday, 26th March had less cases and more available beds than usual, thereby not causing a waitlist situation in the PACU. Therefore the surveys were continued the following week. A total of 2261 interactions were recorded. Tabulation of the survey results was done using Microsoft Excel and a log was obtained of the number and type of interactions that certain roles perform with others during the two time bands of the day over a week. Peter Gloor then loaded the data into the Condor (formally named TecFlow) software. Condor maps the interactions between people who took the survey and the people with whom they spoke.

![Diagram of PACU Social Network Map of Somewhat Busy Time]

*Figure 17 – PACU Social Network Map of Somewhat Busy Time*

The dots on the map represent people and the lines represent the interactions that connect them. The numbers and slider at the bottom represent time in hours. In *Figure 18*, the left graph shows the *betweenness*, which is a term used to describe the power and centrality of people in the group. People with a high level of betweenness centrality are in a central position in the group. The Charge Nurse consistently had the highest betweenness centrality.
The graph on the right in *Figure 18* indicates the density of the interactions. The red spikes on the right correlate directly with Really Busy times with a waitlist of patients trying to get in and out of the PACU.

*Figure 18* Betweenness Centrality in the PACU (left), Density of Interactions (right)

The Condor software captures the differences in the social network as the PACU becomes increasingly busy and captures the change in the structure and the additional people who become central at this time. During waitlist times, there is a high level of communication and negotiation with the ORs for patients needing to come into the PACU and Admitting and the Inpatient Units to get the PACU patients moved along the system.

These maps of the social networks also provide some insights into the central people involved at different times in the PACU. Paper surveys like the ones we used only capture snapshots of time and will not be filled out by people who are extremely busy with patient care and service coordination. A follow up study using small tags that communicate to each other via radio frequency (rf) and record the number of interactions provide much better social networking data, especially during the busy times.
Chapter 6

Managing Capacity through the Supply Chain

XYZ shares many of the same issues of other service organizations in its supply chain management. Waiting time is seen as an unfavorable situation that results in idle capacity. Comments from some of the different members of the OR staff describe the situation as demoralizing to the staff as it is a chronic problem that has not been fixed. The queues that develop in the OR as a result of full PACU capacity have a stronger emotional effect on the staff rather than the patient, and a cost effect on the hospital. The patient recovering from anesthesia is not at a safety risk, as he or she is accompanied by an OR nurse and anesthesiologist.

Two of the main mechanisms used to reduce waiting time in other service industries include increasing capacity of the service providing system and shifting demand from peak to off-peak periods[18]. The physical capacity of XYZ is limited and the PACU presently uses the limited space that it has in an efficient manner. Patients are rolled into slots and lie approximately two yards apart from each other for the 2 – 3 hours while they are in the PACU. There is additional PACU space that can be used in Same Day Surgery, depending on their capacity and availability of nurses. The operational efficiency has
some room for improvement further downstream with patient discharges from Inpatient Units and movement of the patients into the Inpatient Units.

**Modular Facility**

Physical capacity is an issue with the low PACU bed to OR ratio at XYZ. A modular facility is an important component to consider in easing backups, especially with the construction of the new facility and PACU. Having an overflow area that can be staffed by floating and cross-trained PACU nurses during the peak flow times will be a way to ease capacity outflow from the ORs. Presently, the SDSU acts as an overflow unit, providing extra PACU slots beyond their existing capacity. The SDSU is located in a different building than the PACU making commingling of nursing and support resources between the two units impossible.

**Floating Staff and Cross-Training**

An alternative tactic to coping with physical capacity limitations is to have additional mobile or distributed PACU nurses available during peak, waitlist times, or have cross-training of OR nurses to be better skilled at clinically clearing a patient for the Inpatient Unit. Presently, patients recuperating in the OR must still go to the PACU in order to be cleared for transfer to an Inpatient Unit. Inpatient Units are wary of taking patients directly from the OR, as OR nurses do not have the same skill set as PACU nurses and have sent these patients to the floors prematurely in the past, where there is not the resources to cope with a patient in a more critical condition.

Distributed nursing services comprised of a highly cross-trained group of individuals can also work for the Inpatient Units in moving their patients ready for discharge out of the hospital and accepting new patients into the Inpatient Units. Nurses on Inpatient Units will see a discharge as a lower priority than a patient requiring more critical, clinical care. During busy times and change of shift on Inpatient Units, a group of centrally distributed nurses can go to the busy Inpatient Units to discharge and admit patients as needed. The
Rapid Response nurses that work under the scope of the Nursing Supervisors already act as an organizational resource to the floors for support with managing patients who have become acute as well as for providing transport services to patients who clinically require the presence of a nurse when they leave the floor to get services such as a CT scan or x-ray. This will free up the beds for the PACU patients to then move onto the Inpatient Units.

**Technology to Save Time**

Many members of the staff at XYZ do not see the need to provide increased, time-saving technology to the staff that are scheduled to be present for a certain number of hours. As their productivity and cost is not directly correlated with the time that they are scheduled to work, there is a lack of interest in making this time more useful and effective through technology improvements. For example, the admission and transfer process of a patient onto an Inpatient Unit is cumbersome and requires different handwritten notes and papers to be created and filed into the chart as the patient arrives on the floor. In addition, operations assistants and nurses must transcribe the medications from the computer into books rather than using an electronic source for medications. This becomes an issue in times of full capacity as the redundant paperwork impedes the actual flow of patients in and out of the Inpatient Units.

**Information Systems**

Further integration and improvement of the information systems at XYZ will be critical for the hospital in maintaining a competitive advantage. C-BEDS has been recently implemented in order to better manage patient flow to the inpatient units and create a more transparent process. The PRISM system will soon be implemented as an interface between the OR and the PACU, assigning PACU bed slots to patients automatically. The PRISM system will provide greater visibility to the ORs and transparency of the prioritization of the PACU. [11]
Standardization - Preprocessing

Physicians independently run departments and do not have an overall institution standard to follow when admitting patients into the hospital for surgery. Standardization of the process for OR preparation from the physicians offices is an important component to reducing OR delays from the upstream side. Presently XYZ accommodates the different surgeon’s offices and the different levels of preparedness of a patient when admitted into SDSU. Unlike other hospitals, a patient’s chart with all of their pre-surgical work-up and data is not required by physicians to be ready 24 – 48 hours in advance of surgery. XYZ instead employs people to go through the patient’s chart the day before surgery and contact the surgeon’s administrators to provide information that was omitted. Instituting a policy of standardization with an easy to use IT system that the surgeon’s administrators must use to schedule their patients will provide a standard operating procedure and create better uniformity of patient entry into the system. [13]

Setting a standard for physicians to write discharge orders for patients entering the Inpatient Units after surgery will also prevent delays in the system due to patients remaining longer in the hospital in order to secure a bed in a rehabilitation facility or home services. Presently there is no recourse for an outside physician’s delayed discharge. [10]

Dynamic Scheduling: “intelligent” scheduling

Implementation of scheduling software that uses operations techniques such as network design, routing algorithms and heuristics will help to accommodate changes in the system. [18] Developing algorithms that take in multiple factors such procedure types, typical times for the specific surgery and surgeon, severity of co-morbidities can help to better predict patient flow in the hospital. Presently, the OR Dynamic System provides a color-coded view of the patient’s progress through the OR. However, if there is a first case delay, the schedule of the remaining procedures does not adjust for the previous delay. [5]
Chapter 7

Conclusion and Recommendations

The OR delays are not isolated issues that can be managed and resolved only in the peri-operative area. Though XYZ has a low PACU bed to OR ratio compared to other hospitals, there are a number of operations and management issues that can be changed to improve the system. A combination of “big picture” and small, incremental changes in the organization will help to improve the overall capacity of the hospital.

Vision to Unite

From the interviews and observations, the different personnel articulated the present vision of patient safety and care with the acknowledgement that it is a teaching hospital and environment. This is a noble vision that has been well-executed in the hospital. It is time, however, to take this vision one step further in aligning the organizational strategy to its needs. XYZ has done an extraordinarily good job of articulating the objective of patient safety as well as providing an academic environment for clinical education and learning.

Individual fiefdoms of power, poor communication between the different hospital units, and mistrust among the services contradict the organizational needs of ensuring smooth patient flow through the system. A vision that articulates how the unified services of
entire hospital provides the exceptional patient care will be important in guiding a culture more collaborative in all the services provided to the patients. In addition, a unifying vision articulating that everyone is working for one organization and for one person (the patient) needs to be implemented and standards must be aligned to this strategy and vision. Moving to this strategy will provide an environment of organizational learning and development with more initiatives to improve processes and systems within the hospital. A financial and organizational commitment to improved system-wide IT is a critical part of implementing process improvements.

**Look Upstream and Downstream**

Standardization of the patient preprocessing before they arrive at XYZ is a key component in preventing non-random delays on the day of surgery. Implementing an IT system that surgeons’ offices log into to schedule and prepare patient information for surgery is an excellent method of bringing everyone to a standard. For example, an IT system can prompt the surgeon’s offices to provide any missing information 48 hours prior to the scheduled surgeries and require these criteria be met before final confirmation of the OR time 24 hours before the surgery day.

There also must be a commitment to improving processes on the Inpatient Units. Although they are the last stop before the patient leaves the hospital, they coordinate a number of different factors in patient care before they are discharged from the system and are a critical component of the service supply chain. The floors continue to operate in a hybrid system of computers and paper in patient management. Patient charting is on paper and medications are transcribed from the computer onto paper. Using IT to improve these processes and the patient admission to these floors will improve patient flow onto these units during busy times.

Staggered shifts of nurses on the floors is also necessary in managing the movement of the patients out of the PACU. Having a shift where several members of the staff arrive and leave at times later than the standard 7 am to 3:30 pm schedule provide an adequate
number of people to accept patients during the peak times that the PACU is moving patients onto the floors. Adding some resources to the Rapid Response nurses and using them to help with discharges and admissions onto the busy floors during the peak times will also help with the patient flow.

Finally, standardization of discharge orders will prevent patients remaining in the hospitals only to wait for the coordination of services and a discharge facility is important. Physicians should enter an expected date of discharge along with expected service needs of their patient as part of scheduling them for the surgery, with the ability to update or change this information at any point during the patient’s stay. Having this information in the system enables the case manager to organize the discharge services so that they are in place when the patient is ready to leave the hospital. Some services already practice these methods.

**Transparency of Information**

Transparency of information between the units will help in managing patient flow through the system and improve overall performance of the different units. This includes performance measures and operational information. Units who are performing well need to be recognized across the organization and units that are not performing well need to be recognized and addressed immediately. Ready availability of information on the computer network such as the number of surgical cases 24 hours in advance is important for the Inpatient Unit OAs and Charge Nurses to understand when they are managing their present bed capacity and resources for the following day. Having this information ahead of time also provides them with better information when collaborating with the physicians during morning rounds. A computer dashboard indicating real-time PACU capacity status on Inpatient Units will alert them as to the upstream organizational needs.

Additional training will be required for personnel to have a more complete understanding of the meaning of the information as it relates to their unit and patient needs in the overall needs. More informed individuals within the system will work together in a manner that
aligns with the overall objectives of the organizations. Transparency of information backed up with adequate training provides an environment where people trust each other’s decisions and collaborate to solve problems more openly.

**Informal Networks**

Studying the informal networks at XYZ is critical in looking at the structure of communication in a unit and also uncovering the key people that serve as resources of information. People who solve problems speak to more people and have more people speaking to them. These people need to be integrated into the operations structure of the hospital. For example, in the PACU, the people who informally assist with patient care and flow through the unit can be integrated into a slightly more formal support team for the Charge Nurse on particular days and help with the problem solving efforts and patient placement onto the floors. Recognizing the value of the collaborative effort of these individuals will help to ease the pressure on the Charge Nurse during busy times while creating a small network of people to work together and find innovative solutions to their problems.

**Conclusion**

For OR delays, increasing the physical number of PACU beds may alleviate some of the immediate bottleneck, but it will not last as some of the underlying organizational operations processes need to be updated and changed in order to function more smoothly. This initial research serves to show some of the many factors that contribute to a patient’s delay in moving through the XYZ supply chain of services. Integrating changes across the organization requires strong guidance from the XYZ administration along with some new methods of organizational structure and communication. Researchers at MIT have practical models and tools that have been used and vetted in other industries for many years in their organizational strategy and reform. These models can be directly applied to XYZ and its current capacity issue.
Glossary of Terms

**Floor** – See Inpatient Unit.

**Floor Charge Nurse** – The Charge Nurse for the day coordinates the patient inflow and discharge from the Floor.

**Floor OA** – The Floor OA coordinates with Admitting and the Floor Charge Nurse for patient bed assignments and bed changes on the floor.

**Floor Nurse** – Floor nurses will care for between 3 – 4 patients on average during day shifts and 5 – 6 patients during night shifts (depending on the unit).

**Floor Walker** – see Staff Administrator.

**ICU** – Intensive Care Unit – critical care inpatient units with one nurse per patient ratio and more immediate availability of medical staff.

**Inpatient Unit** – Also called a floor. Hospital floors that the patients go to from the PACU to recover and eventually get discharged from the hospital.

**Nursing Supervisor** – Nurses that circulate the hospital organizing direct patient capacity and providing clinical guidance to admitting for hospital transfers.

**OR Circulating Nurse** – The OR Circulating Nurse is the nurse in the OR that is not scrubbed in and in turn coordinates the communication in and out of the OR.

**PACU** – Post Anesthesia Care Unit. Unit where patients recover from anesthesia prior to transfer to the hospital floor.

**PACU Nurse Manager** – The PACU Nurse Manager manages PACU operations.

**PACU Charge Nurse** – The Charge Nurse organizes the staff assignments for the day and coordinates the patient flow through the PACU.

**PACU Operations Supervisor (OS)** – The OS manages the general operational support of the PACU.

**PACU Nurses** – The Nurses primary responsibility is to provide care to the patients and ensure patient safety.

**PACU Operations Assistant (OA)** – The OAs manage the handling of the computer systems and phones and assign slots as they receive calls from the OR Circulating Nurses.
PATA – Pre-admission testing area

Rapid Response Nurses – Rapid Response Nurses will support the Inpatient Units that need additional nursing resources for a period of time.

SDSU – Same Day Surgery Unit

Staff Anesthesiologist – The Staff Anesthesiologist works directly with the PACU Nurse to manage the patient’s vital care and also provide adequate pain management.

Surgical Residents – Surgeons completing their medical school residency.

Staff Administrator a.k.a. Floor Walker – The Floor Walker is the Anesthesiologist on call that day to coordinate the patients between the OR, PACU, and ICU.
References

1. Source Withheld
2. Source Withheld.
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