

The Effects of Reengineering Operating Room Case Scheduling

at Madigan Army Medical Center

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13. ABSTRACT (Maximum 200 words) THIS STUDY WAS DESIGNED TO EVALUATE THE EFFECTS OF REENGINEERING OPERATING ROOM CASE SCHEDULING AT MADIGAN ARMY MEDICAL CENTER. THE GOAL OF THE REENGINEERING INITIATIVE WAS TO REDUCE THE VARIATIONS LEADING TO INEFFICIENCY, THEREBY IMPROVING THE PROCESSES AND ALLOWING FOR INCREASED THROUGHPUT IN THE OPERATING ROOM COMPLEX. FIVE VARIABLES, OPERATING ROOM TURN OVER TIME, SURGEON TIME, SURGICAL CANCELLATIONS, SURGICAL REFERRALS, AND SURGICAL BACKLOG WERE ANALYZED. DATA COLLECTION OCCURRED IN TWO PHASES. THE FIRST PHASE WAS RETROSPECTIVE AND CONSISTED OF THE TIME PERIOD FROM JUNE 1, 1997 THROUGH AUGUST 31, 1997. THE SECOND PHASE WAS CONCURRENT WITH THE IMPLEMENTATION OF THE REENGINEERING INITIATIVE AND CONSISTED OF THE PERIOD SEPTEMBER 1, 1997 THROUGH NOVEMBER 30, 1997. INDEPENDENT-SAMPLES T TESTS INDICATED NO SIGNIFICANT DIFFERENCES ($p=.01$) IN THE VARIABLES AFTER IMPLEMENTATION OF THE REENGINEERING INITIATIVE. DECREASED VARIATIONS WERE SEEN IN THREE OF THE VARIABLES: OPERATING ROOM TURN OVER TIME, SURGEON TIME, AND SURGICAL CANCELLATIONS. THE RESULTS OF THIS STUDY INDICATE IMPROVEMENTS IN THE OPERATING ROOM COMPLEX WERE REALIZED AFTER IMPLEMENTING THE REENGINEERING INITIATIVE.				
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Abstract

This study was designed to evaluate the effects of reengineering operating room case scheduling at Madigan Army Medical Center. The goal of the reengineering initiative was to reduce the variations leading to inefficiency, thereby improving the processes and allowing for increased throughput in the operating room complex. Five variables, operating room turn over time, surgeon time, surgical cancellations, surgical referrals, and surgical backlog were analyzed. Data collection occurred in two phases. The first phase was retrospective and consisted of the time period from June 1, 1997 through August 31, 1997. The second phase was concurrent with the implementation of the reengineering initiative and consisted of the period September 1, 1997 through November 30, 1997. Independent-samples t tests indicated no significant differences ($p=.01$) in the variables after implementation of the reengineering initiative. Decreased variations were seen in three of the variables: operating room turn over time, surgeon time, and surgical cancellations. The results of this study indicate improvements in the operating room complex were realized after implementing the reengineering initiative.

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CHAPTER 1

Introduction

Background

Today's healthcare environment is changing drastically. The concept of large numbers of admissions and maximized bed utilization is no longer viewed as economically acceptable to the leaders of managed healthcare organizations. With the arrival of managed care, the traditional healthcare paradigm characterized by price sensitivity, episodic care, and a physician-centered focus has been replaced. The new healthcare paradigm emphasizes cost containment, primary care, and a patient-focused approach to the delivery of healthcare. Additionally, hospital beds, traditionally viewed as revenue centers, are now being viewed as cost centers. Given this shift in the way healthcare is managed, specialty-care areas such as operating rooms (OR) will be viewed not as sources of income, but as cost centers (Jeon, 1995).

The Office of the Assistant Secretary of Defense for Health Affairs (OASD(HA)) has taken an aggressive position in the move towards managed care. In order to comply with the National Defense Authorization Act of 1993, OASD(HA) implemented a healthcare program that contains a health maintenance organization (HMO) model component as its centerpiece. This program is called TRICARE, and its objectives are to assure access to care, assure high quality care, control healthcare costs, and improve medical readiness (DoD Health Affairs, 1996). Improving efficiencies and lowering costs, while maintaining quality in all aspects of healthcare delivery, are key to meeting the goals established by TRICARE.

TRICARE offers beneficiaries a choice of three options for delivery of their healthcare; these options are TRICARE Prime, TRICARE Standard, and TRICARE Extra. TRICARE Prime is the HMO option, wherein enrollees have their care managed by an assigned Primary Care Manager. TRICARE Prime enrollees receive healthcare through an integrated network of military and contracted civilian providers. TRICARE Prime is the only option where the healthcare benefit may be provided by a combination of military and private sector providers. Under the remaining two options, the healthcare benefit is provided by the private sector alone. TRICARE Standard is the same fee-for-service program previously known as CHAMPUS (Civilian Health and Medical Program for the Uniformed Services) that existed prior to the implementation of the TRICARE program. While TRICARE Standard provides beneficiaries the greatest flexibility in choosing civilian healthcare providers, it also has the greatest beneficiary cost share¹. TRICARE Extra is a preferred provider option where beneficiaries receive a 5% discount on the TRICARE Standard cost of care when they choose a provider from the contractors' network (Carpenter, 1997). A summary of the benefits available under each of these options is listed in Appendix A.

The corporate structure created to manage the TRICARE program has several levels. The first level is the OASD(HA). Federal funds are distributed from OASD(HA) to the services (Army, Navy, and Air Force). Each of these services allocates funds to its respective facilities (GAO, 1995). Each military service has a Surgeon General who is responsible for the operation of its own military treatment facilities (MTFs).

There are three major components of the TRICARE program designed to ensure the TRICARE objectives are met. These components include the creation of 12

TRICARE Lead Agent Regions, the implementation of the TRICARE managed care support contract to provide the civilian health care services within each region, and capitation based financing.

Under TRICARE, the Military Health System (MHS) is divided into 12 joint-service regional areas located throughout the continental United States and Hawaii. Madigan Army Medical Center (MAMC) is located in Region 11, which consists of Washington, Oregon, and six northern counties of Idaho. A new administrative organization called the Lead Agent was created in each region to monitor and coordinate the delivery of healthcare. Region 11 is one of six Department of the Army sponsored lead agent activities with the MAMC Commander designated as the Lead Agent. The remaining six lead agent activities are sponsored by either the Department of the Navy or Department of the Air Force.

Lead agents have broad responsibilities for planning, coordinating, and monitoring the care delivered throughout the region by MTFs from all services as well as a regional civilian provider contractor who is responsible for the care provided to beneficiaries outside the MTF. The managed care support contract was awarded to Foundation Health Federal Services, Inc. in September, 1994. Foundation Health Federal Services, Inc. is headquartered in Rancho Cordova, California with a regional office in Tacoma, Washington. In order to effectively deliver the services required by the managed care support contract for Region 11, Foundation Health Federal Services has awarded 11 sub-contracts. Each lead agent works with a managed care support contractor and with the regional MTFs to integrate services and facilitate implementation of the TRICARE program within their region.

Capitation is the key financing feature of the TRICARE program. Under a capitation system, the commander of each MTF is given responsibility for the entire spectrum of healthcare for his or her population and is given a fixed amount of money per beneficiary per year to provide the necessary services. This method is similar to the per member per month method of budgeting used by civilian HMOs. The TRICARE capitation model was introduced in Fiscal Year 1994 as a method to allocate funds to the three military departments and to serve as the basis of budgeting for the MTFs. This was a modified capitation model based on the number of eligible beneficiaries residing within each commander's catchment area (area of responsibility). As the TRICARE program has evolved, so has the method of capitation. In Fiscal Year 1998, OASD(HA) began exploring enrollment based capitation. Beginning with Fiscal Year 1999, enrollment based capitation will become the resourcing vehicle for MTF budget development. As opposed to the modified capitation model where funds were allocated based on the eligible beneficiary population, enrollment based capitation allocates funds based on the number of beneficiaries enrolled in TRICARE Prime.

Within Region 11, the TRICARE program is managed by the TRICARE Executive Council (TEC) with the Lead Agent designated as the chairman. The TEC membership consists of the commanders of the five MTFs in the region, the Commanding Officer of the U.S. Coast Guard Support Center, Seattle, and the Regional Executive Director for Foundation Health Federal Services, Inc. The five MTFs in Region 11 are: MAMC, Fort Lewis; U.S. Naval Hospital, Oak Harbor; U.S. Naval Hospital, Bremerton; 62D Medical Group, McChord Air Force Base; and the 92D Medical Group, Fairchild Air Force Base. All are located within the state of Washington.

The Region 11 TRICARE program began on March 1, 1995. During the past two years, MAMC has had the opportunity to adapt to the ever changing political, economic, and social factors that influence healthcare delivery. These changes have forced the leadership of the MHS in general, and MAMC in particular, to look for new and more efficient methods of delivering healthcare.

Conditions Which Prompted the Study

Madigan Army Medical Center is a 1.2 million square foot, 414 bed, tertiary-care, teaching facility that provides over one million outpatient visits and 21,000 hospital admissions annually. Additionally, MAMC has an annual budget of \$170 million (including military labor) and provides training to physicians, nurses, and medical specialists (e.g., licensed practical nurses, laboratory technicians, operating room technicians). As the primary specialty referral center for Region 11, MAMC supports over 340,000 Department of Defense (DoD) beneficiaries throughout the region and, in addition, receives specialty referrals from Alaska and the Pacific (Chowen, 1996).

This large, geographically dispersed beneficiary population presents MAMC with many challenges not found in a typical managed care plan. In seeking more efficient methods of delivering healthcare, MAMC has produced a number of successful reengineering efforts (pharmacy services, closure of five nursing wards, creation of three observation units, expansion of same day surgery, and others). Following these efforts, the Command Group at MAMC decided to look at the OR complex as a candidate for a reengineering initiative. At MAMC two departments are key to the performance of a surgical procedure, the Department of Surgery and the Department of Anesthesia and Operative Services (DOAOS). Under the direction of the MAMC Commander, a multi-

disciplinary group composed of physicians, anesthesia providers, OR staff, and administrators was formed to look at reengineering the surgical process.

Description of the operating room complex. The MAMC OR complex consists of 14 ORs staffed by over 90 personnel from the DOAOS, plus surgeons from 12 surgical specialties. A floor plan of the OR complex is in Appendix B. Under the direction of the DOAOS, 12 ORs are staffed for surgery daily. This number is determined by the current OR complex full time equivalent (FTE) staffing levels shown below.

Table 1-1

OR FTE Staffing Levels

Position	Military	Civilian
Anesthesiologist	12	3
CRNA	14	10
OR Nurse	24	5.5
OR Tech	22	5
Total	72	23.5

Approximately 670 surgical procedures a month are performed in the MAMC OR complex. The only procedures not performed at MAMC are organ transplants and pediatric open heart surgery. The OR complex supply budget for Fiscal Year (FY) 1998 is \$4.9 million and is the second largest supply budget in the hospital, exceeded only by the pharmacy department with a supply budget of \$15.3 million. Separate from the supply budget is a large human resources expense required to compensate the surgical and OR staff. Surgeons and anesthesia providers are among the most highly paid personnel in the Army inventory.

In addition to the suite of operating rooms, the OR complex consists of a reception area, a patient/anesthesia preparation and holding area, and post-anesthesia care unit. The reception area is where a patient enters the OR process. Here, administrative information is obtained and verified, personal effects are inventoried and secured, and the patient's friends and family are shown where to wait during surgery. Once the patient leaves the reception area, he or she enters the patient/anesthesia preparation area where the patient receives a pre-operative exam and has an intravenous (IV) catheter inserted (usually in the arm or hand) through which medications are administered. The patient then enters the OR where surgery is performed. Following surgery, the patient is taken to the post anesthesia care unit. This is the recovery room where patients stay until they are stable enough to be transferred to a ward or released if the surgery was an ambulatory procedure. Figure 1 provides a patient flow diagram for the OR complex.

Surgical scheduling. The Surgical Information System (SIS) is a Disk Operating System (DOS) based computer program, developed at MAMC, and used by all surgical services to schedule surgeries. Development of SIS began in 1993 when MAMC leaders realized the need for a comprehensive, hospital-wide surgical information system that could schedule cases and quickly transform surgical data into information. In addition to providing a computerized information system to schedule surgical cases, the goal of SIS is to produce information that will improve processes surrounding surgery and

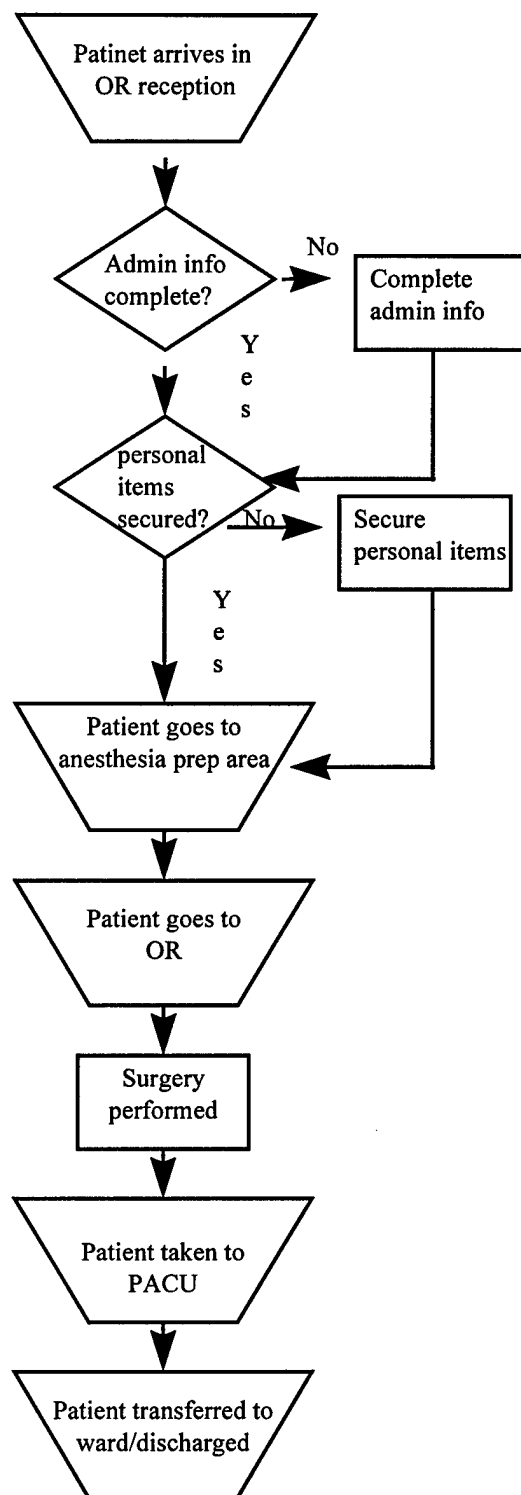


Figure 1. OR complex patient flow diagram.

OR utilization, support surgical case review, and provide input for residency review reporting (Westbrook, Dunn, & Wilcox-Riggs, 1995). A beneficial bi-product of SIS is that it also provides documentation necessary to meet Joint Commission for Accreditation of Healthcare Organization requirements. Because SIS is a DOS based system, its ease of use is not the same as Windows® based products; however, it does provide useful information to the surgical and OR staffs.

Using SIS, surgeries are scheduled when the requesting surgical service completes a surgical request and transmits it to DOAOS. This surgical request is commonly referred to as a buck slip. The buck slip identifies patient demographic data such as name, age, sex, requested date of surgery, and surgery specific information such as the type of surgery and special equipment required by the surgical team. Requesting clinics submit buck slips electronically or hand deliver them to the DOAOS SIS manager who arranges them by service (general surgery, orthopedics, etc.). Once sorted by service, the buck slips are sent to the OR nurse responsible for assigning cases to specific rooms. They are then forwarded to the anesthesiologist responsible for assigning an anesthesia provider to each case. The anesthesiologist in turn forwards a copy of the buck slip to the central materiel section so the proper equipment can be pulled for each case. The buck slip is then forwarded to the OR in order to verify the room set up and ensure the proper equipment is present when the patient arrives in the OR for surgery. The second page of the buck slip (Anesthesia Data Worksheet) is used to record times, procedures, medications, and other information during surgery. The buck slip travels with the patient into the post anesthesia care unit where any additional patient information is recorded.

Once the patient leaves the post anesthesia care unit, the buck slip is again sent to the SIS manager for data entry.

Objectives of Reengineering

The DoD decision to implement managed care has had a direct impact on the surgical process at MAMC. More surgical procedures are now being accomplished on an outpatient basis to reduce bed days since, as stated earlier, ORs are now viewed as cost centers (Jeon, 1995). The OR complex's large supply budget, and expensive personnel staff, when coupled with the complexity of surgical procedures performed demand more efficient scheduling, utilization of staff, and supply discipline in order for MAMC to remain cost effective. Given the significant resources consumed by the OR, the Command Group realized that the OR complex might benefit from reengineering. Among the potential benefits of reengineering would be a decrease in the number of surgical cases cancelled, a decrease in the number of surgical cases referred outside of MAMC, a streamlining of the methods to allocate OR time to surgical services, and a reduced surgical backlog. These benefits would result in an increase in the overall efficiency of the surgical process.

The goal of the reengineering initiative was to significantly reduce the variations that lead to OR inefficiency. By improving efficiency, more surgeries could be performed in the same number of rooms or the same number of surgeries could be performed in fewer rooms (i.e., maximizing throughput). The objectives of the reengineering effort, as stated by the Deputy Commander for Clinical Services (DCCS), were to reduce the number of surgical cases being referred to other facilities which MAMC has the ability to perform in-house, eliminate block scheduling as a method of

allocating OR time, and reduce surgical backlog to less than 2 weeks for any surgical service (D. E. C. Jones, personal communication, October 2, 1997). In addition, DOAOS wished to reduce the time it takes the surgeon to perform a procedure (surgeon time) and reduce room turn overtime to demonstrate improved efficiency (W. C. Petty, personal communication, October 1, 1997).

Surgical cancellations. Surgical case cancellations present a variety of problems to both the patient and the organization. First, most patients have some anxiety about an impending surgery. This can range from fear of not waking up from the anesthesia, to concern about the amount and type of pain following a procedure, to the possibility of an adverse outcome (Klafta & Roizen, 1996). Second, patients must mentally prepare for surgery. Third, surgery requires the patient to make certain arrangements at work and home. After such preparation, cancelling surgery for any reason places an additional burden on the patient and is in direct opposition to today's patient-centered focus on healthcare delivery.

From an organizational perspective, surgical cancellations epitomize inefficiency. Surgeons and staff prepare for a specific procedure, ORs are scheduled for a certain amount of time, and equipment and supplies are pulled according to the type of surgery scheduled. Each cancellation impacts on one or more of these activities and requires additional effort on each person involved to compensate for changes in the surgery schedule.

Surgical cases referred outside of MAMC. In addition to the ill will created by telling patients they must go elsewhere for surgery, there is a financial cost associated when referring cases to outside sources. Under the enrollment based capitation method of

budgeting, services provided outside the hospital will be paid for directly out of the hospital budget. It is, therefore, good practice to provide in-house all OR services for which MAMC has the performance capability.

Allocation of surgical time. There are many acceptable methods for allocating surgical time. One widely used method, and the method previously used at MAMC, is block scheduling². Many hospitals practice block scheduling because the extent to which surgery can be scheduled in advance varies by surgical specialty (Ozkarahan, 1995). Other scheduling methods include a first come, first served basis (also referred to as nonblocked scheduling), and a longest time first model in which those cases with the greatest variability in surgical duration are scheduled first (Hamilton & Breslawski, 1994). The DCCS at MAMC, who is an orthopedic surgeon, believed that block scheduling was an inefficient way to allocate surgical time for various reasons. First, surgeons are reluctant to release unused OR time. Second, if the scheduling cutoff time is too close to the date of surgery, the unfilled block of time is unused. Third, a blocked scheduling system may cause urgent surgery to be delayed until the patient's surgeon is scheduled to operate. As a result, the decision was made to change the method used to allocate OR time.

Surgical backlog. Increased surgical backlog is undesirable because it indicates a problem in meeting access standards and may adversely affect patient satisfaction. TRICARE Prime enrollees are guaranteed access to routine care, to include elective surgery, within 30 days. If the surgical backlog exceeds 30 days, patients may be referred out of the organization for their surgery. Surgical backlog can be reduced by increasing throughput capability and performing more surgeries. A successful reengineering

initiative in the OR complex should increase available OR time allowing for increased throughput. This should in turn lead to a decrease in the surgical backlog.

Matrix organization. One of the reasons MAMC has been successful in previous reengineering efforts is the culture of the organization. Madigan Army Medical Center adopted the Total Quality Management (TQM) philosophy in 1992. There are seven objectives of the TQM program at MAMC: (1) to develop a corporate TQM culture, (2) to be patient and customer centered, (3) to make data driven decisions, (4) to be process focused, (5) to use a multi-disciplinary approach, (6) to be horizontally integrated, and (7) to empower MAMC personnel.

As the TQM philosophy was implemented at MAMC, the culture began to change to reflect the new philosophy. One outcome of the TQM philosophy was the evolution of MAMC into a matrix organization. According to Ivancevich and Matteson (1996) a matrix organization seeks a balanced compromise between functional and product organizations. At MAMC, this balance is achieved by overlaying a horizontal structure of authority, influence, and communication on the vertical structure. A diagram of MAMC's matrix organization can be seen in Appendix C. Some of the more important advantages of a matrix organization include efficient use of resources, flexibility in conditions of change and uncertainty, technical excellence, improvement in motivation and commitment, and provision of opportunities for personal development. The Executive Board of Directors (EBOD) serves as the hospital executive committee with the purpose of collaborating, promoting quality, making decisions, providing implementation guidance, allocating resources, and making policy. The EBOD is composed of representatives from multi-disciplinary functional teams called Quality

Management Groups. The collaborative efforts of the Quality Management Groups have been instrumental in the success of previous reengineering efforts at MAMC.

Reengineering initiatives. The Surgical Support Services Quality Management Group was given the task of reengineering surgical processes in May of 1997 with the DCCS's stated objectives as their initial guidance. The proposal, titled Surgical Case Scheduling, was briefed to and approved by the EBOD in July of 1997, and those changes were implemented on September 2, 1997. The memorandum outlining the reengineering initiatives is included as Appendix D and summarized below:

- **Scheduling system:** Under Modified Block Scheduling, surgical requests, referred to as buck slips, must be submitted by a surgery service at least two normal working days prior to the scheduled date of surgery. If the buck slips are not received by DOAOS within the designated time, the scheduling window closes for that service and time not booked becomes open time for any service to utilize.
- **Surgical request accuracy:** Buck slip accuracy is the responsibility of the staff surgeon. Before scheduled surgery, all buck slips will be approved and checked for accuracy by the staff surgeon prior to electronic submission or hand delivery for scheduling. Following surgery, buck slips will be initialed at the top by the staff surgeon to validate accuracy prior to the patient being transferred from the OR to the post anesthesia care unit.
- **Staff surgeons** will be present at the beginning and end of each scheduled case. This will allow them to monitor progress and assist surgical residents in decreasing the amount of time they require to perform surgical procedures.

- Cases will be scheduled using the average case length by Current Procedural Terminology Code of the staff surgeon whose name appears on the buck slip. All historical data will be generated by SIS.
- Cancellation policy: Once a surgical schedule is published, all elective cases will be completed. Exceptions will be upon mutual agreement between the surgeon, anesthesia provider, operating room nurse, and patient.
- One room will be designated as a Time and Space Available (TSA) room Monday-Friday. Case priority designation will be based on an emergent and semi-emergent basis with priority to in-house patients. This will not be a scheduled room.
- One room will be designated a Deployable Medical Systems (DEPMEDS) Training Room for Anesthesia and Operative Services and will be designed for readiness training. Training emphasis will be on field anesthesia and field OR equipment. This is a fully equipped room and the type of surgery that can be performed in this room is unlimited.
- Everyday, two rooms will be scheduled as Ambulatory Surgery Rooms. Only cases that can be completed in under 1.5 hours should be scheduled.

An additional component of the reengineering initiative was the use of bar coding to electronically capture supplies and equipment used in the ORs. This mechanism was designed to assist with inventory management, provide a method of cost accounting for expendable supplies, and assist with the budgeting process. Due to manufacturer delays, the required software for the bar coding system is not yet available. The hardware was

ordered and delivered but the lack of software prevented the bar coding system from being implemented during this study period.

The initial briefing on the implementation of the initiative was presented to and approved by the EBOD in September 1997. In December, the Surgical Support Services Quality Management Group again briefed the EBOD on the initial results of the reengineering initiative with recommendations for future changes within the OR complex.

Results of the reengineering effort. Surgical cases continue to be scheduled using SIS; however, as a result of the reengineering effort, MAMC now uses a modified block scheduling system to schedule surgical cases. Surgical time is still allocated to surgical services by block times; however, under the modified block scheduling system, once the scheduling window is closed for a service, unscheduled time becomes open time for any surgical service to utilize. This differs from the standard block scheduling in that under block scheduling, open time is not made available for other services.

A new policy for cancelling surgical cases has been established. Once a surgical schedule is published, all elective cases appearing on that schedule will be completed. Cases will be cancelled only upon mutual agreement between the surgeon, anesthesia provider, operating room nurse, and patient. Prior to establishment of this policy, surgical cases could be cancelled by any member of the surgical team with no involvement of the patient.

The 12 ORs are now designated daily by the type of surgeries that will be performed in them. Everyday, two of these rooms are designated as ambulatory surgery rooms. Scheduling of these rooms is limited to those cases that are estimated to be

completed in under 1.5 hours. The goal of the ambulatory surgery rooms is to maximize output. Additionally, one room is designated as a time and space available room Monday-Friday. This is not a scheduled room. Priority for time and space available case designation is determined on an emergent/semi-emergent basis with priority to in-house patients. The other nine rooms are designated as long rooms, and by definition all cases with an estimated time greater than 1.5 hours are scheduled for these rooms.

Table 1-2

Daily Operating Room Designation

Room Designation	Number of Rooms	Scheduled Case Length
Ambulatory Surgery	2	< 1.5 hrs
TSA	1	Not Scheduled
Long Room	9	> 1.5 hrs

Statement of the Problem or Question

The staff members at Madigan Army Medical Center are responding to the challenge and requirement to operate in a managed care environment while working within a limited budget. Reengineering OR case scheduling is one of the initiatives taken to improve efficiency in order to meet that challenge. Operating room case scheduling has a significant impact on the overall efficiency, productivity, and utilization of the operating room complex and serves as the basis for this study. The research question for

this study was: Has the reengineering of OR case scheduling improved the overall efficiency of surgical services at Madigan Army Medical Center?

Literature Review

There are numerous references in the literature that address the efficiency of ORs. While the reviewed sources in this study cover a wide spectrum of issues, the primary focus of this review will be on those issues that directly relate to the reengineering initiatives implemented by the DOAOS and their impact on efficiency.

Reengineering. The concept of redesigning the traditional delivery system is not new, nor is the concept of multi-disciplinary groups. The Cleveland Metropolitan General Hospital developed clinical management teams consisting of a physician, nurse, and administrator over ten years ago (McGee & Hudak, 1995). Reengineering, originally a business systems process change, has been used successfully in a variety of healthcare settings. Projects have primarily been limited to specific functions, such as the use of information technology or bar coding to control costs. However, in one case an entire medical center was reengineered with multiple teams aimed at reorganizing virtually every department (Tunick et al., 1997).

A constant in reengineering is resistance to change within the organization. Resistance to change is universal and must be expected and planned for in advance. The culture created by the matrix organization has helped overcome such resistance at MAMC. Methods of countering resistance include obtaining commitment from the leadership and developing data demonstrating the need for change (Tunick, et al., 1997; McGee & Hudak, 1995). A system of promoting stakeholder input and involvement helps in dealing with resistance to reengineering initiatives (Tunick, et al., 1997; Pence,

1997). Designating key members of the process as stakeholders in the reengineering project is vital since these stakeholders will be responsible for carrying out the changes.

Patient-focused care has become the philosophical basis for the redesigning of healthcare delivery systems (Jones, 1997; Pence, 1997). Patient-focused care combines all the elements of redesign, reengineering, and restructuring. It places the patient at the center of the delivery of care and redirects activities so the right job is performed effectively and efficiently by the right person at the right time. Before healthcare providers can center their attention on the patient, they must first define their respective roles and how they will interact in the provision of patient care. This concept may be referred to as multi-disciplinary collaboration (Jones, 1997). A multi-disciplinary approach is vital to the success of any reengineering effort.

One of the key benefits of a multi-disciplinary approach is increased communication. The importance of communication between surgical and anesthesia teams in a teaching hospital was studied by Sexton, et al. (1997). In their study, they found that communication between anesthesia and surgical teams was classified as unacceptable or absent in approximately 20% of the observations. In over 70% of the observations, the quality of communication was found to lie in the lower half of their defined scale. While the significance of these findings is uncertain, similar research in aviation has shown that superior performing teams communicate more and better than less effective teams (Sexton, et al., 1997; Helmreich, Chidester, Foushee, Gregorich, & Wilhelm, 1989). A multi-disciplinary approach to reengineering enhances teamwork and communication.

Operating room delays. A problem facing personnel in the OR is delay (Robinson, 1993). In one hospital near Pittsburgh, Pennsylvania, patients typically spent more than one hour in the waiting room before surgery. In addition to the demonstrated inefficiency, patient satisfaction surveys predictably showed patients were not happy about the delay. Many factors contribute to delays, and thus inefficiencies in OR utilization (Andree, 1988).

In her study using quality improvement to reduce delayed surgical starting times, Morton (1995) conducted a systematic analysis of delays which revealed the following order of factors involved: (1) any anesthesia delay, (2) inadequate space or staff to meet needs, (3) incomplete workup or patient preparation, (4) scheduling changes due to incomplete scheduling information or room/equipment not immediately available, (5) physician not immediately available, (6) patient delays, and (7) emergency cases in progress.

Several of these factors require multi-disciplinary working groups in order to realize improvements. Additionally, multi-disciplinary working groups may allow several factors to be addressed simultaneously. This approach also enhances communication flow among all multi-disciplinary staff involved in each group. Demonstrable results in decreasing OR delays have been shown by many facilities adopting a multi-disciplinary collaborative approach (Greene, 1997; Morton, 1995; Robinson, 1993; Andree, 1988).

Another factor that contributes to delays, not only with first starts (the first surgery in a room on a given day) but with all surgical procedures, is the inaccurate estimation of surgical times. Accurate estimation of operating times is a prerequisite for

efficient scheduling of the OR in order to match OR complex workload to capacity (Wright, Kooperberg, Bonar, & Bashein, 1996; Dexter & Marcario, 1996). Additionally, improved OR scheduling could improve efficiency and reduce costs by reducing underutilization and/or by reducing unplanned extension of the workday (Dexter & Marcario, 1996). Surgical times may be estimated by (a) using the surgeon's estimate of how long it will take to perform the operation, (b) using scheduling software, or (c) using a combination of surgeon's estimates and scheduling software.

Wright and colleagues (1996) conducted a three phase clinical study to compare surgeons' time estimates with estimates made using computer scheduling software. In the first phase, surgeons estimated the time it would take to complete an operation. These times were then compared to estimates provided by using software scheduling programs. The results showed surgeons' estimates were more accurate than estimates provided by scheduling software. In this first phase, 26 of 43 surgeons provided significantly better results than did the scheduling system ($p < 0.01$). Of the remaining 17 surgeons' estimates, none were significantly different from the scheduling software estimate ($p = 0.05$). In the second and third phases, statistical models were used to incorporate surgeons' estimates, scheduling software estimates, and patient specific data in an attempt to improve the accuracy of predicted surgical times. Including patient data did not make the model more accurate than using only the surgeons' and scheduling software's estimates in the model. However, the study did demonstrate that the use of surgeons' estimates can increase the accuracy of the commercial software to predict the duration of surgery. In their study, the accuracy of the surgeons' estimates improved 18.2% when combined with scheduling software estimates (Wright et al., 1996). However, the

improvements achieved by statistical modeling versus either surgeons or scheduling software alone were not large, leading the authors to conclude the combination of the two methods provides the most accurate estimation of surgical duration. Although the study by Wright et al. (1996) was conducted at a teaching hospital, the study is limited in its application to MAMC in that it did not specifically address differences in estimated times between staff surgeons and surgical residents. Additionally, there was no mention of whether the scheduling software system used in this study adjusted estimated times to account for operations performed by residents.

One of the confounding factors in improving predictability of surgical duration noted by Wright et al. (1996) is that the scheduled operation may not be the same as the actual operation. For some procedures (e.g., a Whipple), scheduled operations often differ from performed procedures. A way to resolve this problem is for the OR staff to record, for each operation, the scheduled operation, the actual operation, and the actual case duration (Wright et al., 1996; Dexter, 1996). These data can then be compared to estimated data to improve predictions. As discussed earlier, SIS was developed at MAMC in 1993 to help with data collection and scheduling in the OR complex. Although developed before the studies of Wright et al. (1996) and Dexter (1996), SIS addresses many of the issues identified in these later studies.

The literature also addresses a perception that anesthesiologists can decrease OR costs and increase utilization by working more quickly. Dexter, Coffin, and Tinker (1995) examined whether eliminating time controlled by anesthesiologists would allow surgeons to do extra scheduled cases or see more scheduled clinic patients during an eight hour workday. Anesthesia controlled time is defined as the sum of the time starting when

the patient enters an OR, to when positioning or skin preparation can begin, plus the time from completion of the surgical dressing to when the patient leaves the OR (Dexter, Coffin, & Tinker 1995). They selected 11 surgical procedures to represent a wide range of surgical specialties, case lengths and complexity, and postoperative lengths of stay. Additionally, they accounted for differences between teaching and non-teaching hospitals. Their findings suggest that reasonably achievable decreases in anesthesia controlled time cannot decrease scheduled OR time sufficiently to permit scheduling even one additional 30 minute case each day. Although the Dexter, Coffin, and Tinker (1995) study is limited by the fact that data were collected from only one hospital, the implication has meaning for any hospital attempting to reduce costs and increase efficiency. Their study is not meant to suggest that inefficient anesthesia has no consequences. Clearly there are consequences involved with any type of inefficiency. What the study does suggest is that decreasing anesthesia controlled time alone is not enough to improve the overall efficiency in the OR. Each individual involved in the process must work as part of a team in order to improve efficiency. "Anesthesiologists, surgeons, and nurses must work collectively to achieve cost savings in the OR" (Dexter, Coffin, & Tinker, p. 1269).

Surgical scheduling methods. In surgical literature, scheduling refers to two distinct phases. The first phase is advance scheduling. Under this process, patients are scheduled for surgery on some future date. The second phase is referred to as allocation scheduling. In allocation scheduling, the sequence of surgical cases on a given day is determined assuming all patients are in the hospital and ready for surgery (Ozkarahan, 1995). Allocation scheduling determines which case goes in which room in what order.

There are two methods of advance scheduling that are based on the means of allocating OR time to surgeons. Some hospitals practice block scheduling. Other hospitals have advance scheduling systems that allocate surgical time on a first arrived, first served basis called nonblocked scheduling. Nonblocked advance scheduling often results in high cancellation rates because of overbooking of surgery, long waiting lines, and disparity between the OR utilization rates of surgical specialties. Additionally, under a nonblocked system, specialists scheduling elective cases that are less time sensitive can book their cases earlier, using up available surgical space. This decreases the availability of OR time for more urgent cases such as thoracic surgery or neurosurgery (Ozkarahan, 1995).

In determining the type of system to use in scheduling ORs, managers must determine priorities and then make decisions that support those priorities (Hamilton & Breslawski, 1994). One of the major goals of any scheduling system is the effective use of the OR complex. The literature reports several OR scheduling systems that may support this goal. In a survey conducted to determine which systems were currently being used, Hamilton and Breslawski (1994) contacted directors from 200 hospitals nationwide to solicit participation in a Delphi study. Seventy directors responded to the survey with the following results. Approximately 21% of the respondents used a first arrived first served scheduling system, 44% used a block scheduling system, and 35% used a combination of the two. This article did not differentiate as to the size or type of hospital or whether that had any influence on the type of system chosen.

Regardless of the scheduling system used, it is important to remember that there is a distinct difference between scheduling and access (Appleby, 1997). Scheduling is

simply arranging for the patient to have surgery while access, according to the standard previously described, is achieved when the patient actually receives healthcare. Effective scheduling is paramount to improving efficiency and meeting access requirements.

Purpose

The purpose of this study was to provide descriptive statistical information utilizing the variables of operating room turnover time, surgeon time, surgical cancellations, number of surgical cases referred outside of Madigan Army Medical Center, and surgical backlog to help determine whether the initiatives implemented by the Department of Anesthesia and Operative Services at Madigan Army Medical Center made a significant impact in improving the efficiency of the Operating Room complex. Data collected by the operating room staff over a 6 month period of time was analyzed. Historical information prior to and after the implementation of the reengineering initiatives is provided.

CHAPTER 2

Methods and Procedures

Data Collection

This study consisted of two data collection phases. The first phase was retrospective and consisted of a 3 month collection of data generated from the DOAOS prior to the reengineering initiative. This collection period was June 1, 1997 through August 31, 1997. This data served as the baseline against which a second set of data was compared. The second data collection phase was concurrent with the implementation of the reengineering initiative and was collected over a 3 month period as surgical cases were scheduled and performed. The time frame for this collection period was September 1, 1997 through November 30, 1997.

In order to measure the effectiveness of the reengineering initiative, a new database was created by the DOAOS. One reason for creating a separate data base was the difficulty in creating ad-hoc reports using SIS. By entering data in an Access® database, data fields can be manipulated to allow for greater flexibility in creating ad-hoc reports. Data were collected on the variables identified in the purpose statement (operating room turnover time, surgical time, surgical cancellations, number of surgical cases referred outside MAMC, and surgical backlog) and analyzed to determine the success of the reengineering process. Data on room turn over time and surgeon time were collected using the Anesthesia Data Worksheet (buck slip) designed by the Anesthesia Department (Appendix E). Cancellation data were collected from SIS generated surgery schedules (Appendix F), the number of cases referred outside of MAMC was provided by

Foundation Health Federal Services Inc., the Region 11 contracted civilian provider, and surgical backlog was determined by obtaining the SIS surgical backlog report at the end of the study period.

Operational Definitions

Room turnover time was defined as the time from when a patient leaves the operating room until the next scheduled case enters the operating room. Delays were accounted for and entered in SIS.

Surgeon time was defined as the time from when the patient is turned over to the surgeon until the surgeon has finished, to include casting and dressing.

For the purpose of this study, surgical backlog was defined as any elective surgery that could not be performed within 30 days of being scheduled in SIS. Under the TRICARE guidelines, any routine care that can not be provided in 30 days will be referred out of the organization. Elective surgery falls under the parameters of routine care and must be scheduled within 30 days in order to meet access standards.

For the purpose of this study, the number of surgical cases referred outside MAMC consisted of only those elective surgery cases which MAMC had the capability to perform, but for various reasons was unable to perform.

Data Analysis

Data collected during this study were analyzed and descriptive statistics calculated using the SPSS for Windows® statistical software program.

Means were compared using an independent-samples t-test ($\alpha = 0.01$) to determine significant differences in mean surgeon time, room turnover time, surgical

cases cancelled, and surgical cases referred outside MAMC before and after reengineering. There is no relationship between the patients and events that make up the variables tested before and after reengineering, therefore, the samples are independent. As a result, an independent samples test was determined to be the proper test for mean comparison (Norusis, 1994). Success for each variable is defined as any statistically significant reduction in the mean when compared prior to and after implementation of the reengineering initiative. Success for surgical backlog is achieved if at the end of the study the surgical backlog is less than the 2 week criteria established by the DCCS.

The content validity of a measuring instrument is the extent to which it provides adequate coverage of the topic under study (Cooper & Emory, 1995). One way to determine content validity is to use a panel to judge how well the instrument meets the standards (Cooper & Emory, 1995). The buck slip used for data collection was reviewed by a panel of surgeons, anesthesiologists, and nurses who all agreed it adequately covered the information needed for this study. Additionally, this form has been used at MAMC for over four years, and all anesthesia personnel are trained in its use.

The best method for determining reliability of the data in this study would have been for the patient to undergo the same procedure a second time and then do a correlation analysis to compare the strength of the relationships between the two sets of data collected. This option was neither practical, nor would it demonstrate good medical practice. Reliability has been assured by continually training and supervising anesthesia personnel in the proper use of the buck slip for data collection. Good definitions of the beginning and end of events requiring data collection and the large number of surgical cases performed on a monthly basis also provided reliability.

Patient confidentiality was maintained by using case numbers. All data collected for this study were identified by case number and categorized either by service or whether surgery occurred before or after the implementation of the reengineering initiative. There was no personal information collected during this study.

Assumptions

For the purpose of this study the following assumptions were made:

1. The surgical case load was defined as all patients who presented at MAMC and were referred for a surgical procedure. Madigan Army Medical Center did not actively seek to increase or decrease the number of surgical cases scheduled. All beneficiaries requiring elective surgery were scheduled for surgery.
2. The surgical case mixes for each phase of the study were similar.
3. The quality of care provided to patients undergoing surgery would not decrease if the number of surgical cases increase.
4. The surgical services staffing authorizations and fiscal budget were approximately equivalent for FY 1997 and FY 1998.
5. The procedures for scheduling patients in SIS were consistent among all surgical services.
6. There was no occurrence of the Hawthorne effect during this study.³ While the study considers only a 3 month period after implementation of the reengineering initiatives, the monthly volume of surgical cases is large enough to counteract the possibility of the Hawthorne effect.

CHAPTER 3

Results

During this study five separate variables were tested to determine the effects of a reengineering initiative in the MAMC OR complex. The study period consisted of 183 days during which 3,722 surgeries were scheduled and 4,044 were performed in MAMC operating rooms. Table 3-1 identifies the number of days, surgeries scheduled, and surgeries performed during each phase of the study. Results for each of the variables follow.

Table 3-1

Number of Days and Surgeries by Phase

Phase	Total days	Surgeries performed	Scheduled days	Surgeries scheduled
1	92	2,085	62	1,936
2	91	1,959	60	1,786
Total	183	4,044	122	3,722

Operating room turnover time

Table 3-2 provides descriptive statistics for operating room turnover time. There were 1,794 surgical cases that contained the necessary data on the buck slip to compute operating room turnover time. Of those 54% (N = 965) were scheduled prior to reengineering with a mean turn over time of 32.23 minutes. The remaining 46% (N = 829) were scheduled after implementation of the reengineering initiative with a mean turn

over time of 32.43 minutes. The independent-samples t test results are displayed at Table 3-3. Although the mean differences were not significant ($t = -.113$, $p = .910$) the smaller standard deviation indicated there was less variation in operating room turnover times after implementation of the reengineering initiative.

Table 3-2

Operating Room Turnover Time Descriptive Statistics

Pre/Post	N	Mean	Std Deviation
Pre	965	32.23	48.49
Post	829	32.43	19.28

Table 3-3

Operating Room Turnover Time Independent-Samples Test

t	df	Significance (2-tailed)	Mean Difference
-.113	1792	.910	-.20

Note. Equal variance assumed.

Surgeon Time

Surgeon time was measured for 12 surgical services. There were 4,044 surgical cases performed during the study period. Of those, 52% (N = 2,085) were performed prior to reengineering with a mean surgeon time of 107.86 minutes. The remaining 48% (N = 1,959) were performed after the implementation of the reengineering initiative with a mean surgeon time of 106.32 minutes. Table 3-4 provides descriptive statistics for overall surgeon time. The independent-samples t test results are displayed at Table 3-5. The mean differences were not significant ($t = .432$, $p = .666$); however, the smaller standard deviation indicated there was less variation in the combined surgeon times after the implementation of the reengineering initiative

Table 3-4

Surgeon Time Descriptive Statistics Pre and Post Reengineering

Pre/Post	N	Mean	Std Deviation
Pre	2085	107.86	104.67
Post	1959	106.32	94.58

Table 3-5

Surgeon Time Independent-Samples Test

t	df	Significance (2-tailed)	Mean difference
.489	4042	.625	1.54

Note. Equal variance assumed.

Figure 2 illustrates the differences in mean surgeon time for each of the 12 surgical services before and after the implementation of the reengineering initiative. The graph shows Cardio-Thoracic Surgery (CT) had the longest mean times pre and post reengineering while Ophthalmology (Eyes) had the shortest mean times. Statistical significance in mean surgeon times was only seen in the Urology Service. Following Figure 2, a statistical analysis of the differences in surgeon time for each service before and after the implementation of the reengineering is provided.

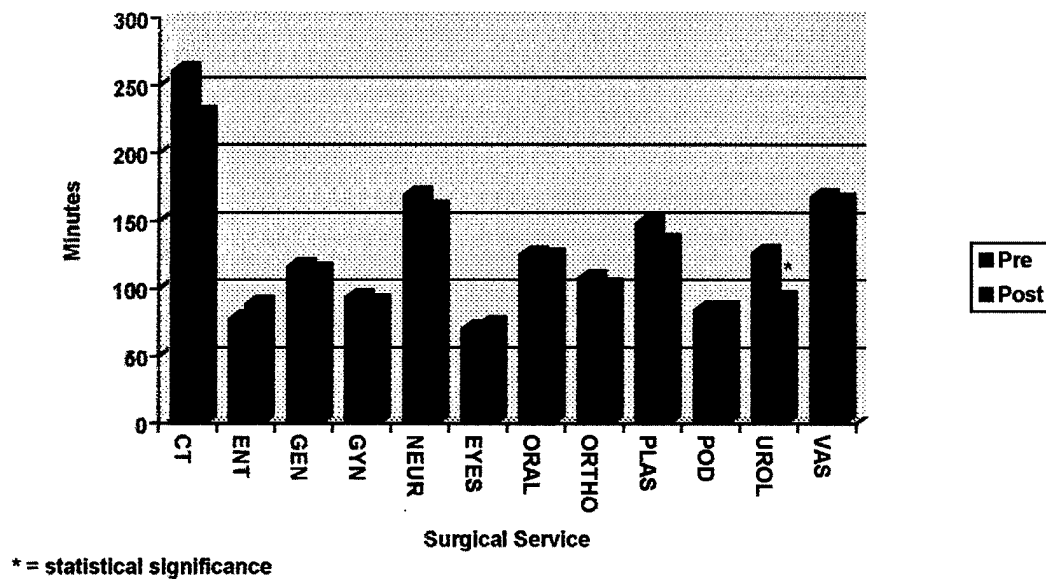


Figure 2. Comparison of mean surgeon times by service before and after reengineering.

Cardio-Thoracic Surgery Service. Table 3-6 provides descriptive statistics for the Cardio-Thoracic Surgery Service. There were 130 cardio-thoracic surgeries performed during the study period. Of those, 52% (N = 67) were performed prior to reengineering with a mean surgeon time of 260.72 minutes. The remaining 48% (N = 63) were performed after implementation of the reengineering initiative with a mean surgeon time of 228.27 minutes. The independent-samples t test results are displayed at Table 3-7. The mean differences were not significant ($t = -1.457$, $p = .148$).

Table 3-6Cardio-Thoracic Surgeon Time Descriptive Statistics

Pre/Post	N	Mean	Std Deviation
Pre	67	260.72	122.97
Post	63	228.27	130.94

Table 3-7Cardio-Thoracic Surgeon Time Independent-Samples Test

t	df	Significance (2-tailed)	Mean difference
-1.457	128	.148	-32.45

Note. Equal variance assumed.

Otolaryngology (ENT) Service. Table 3-8 provides descriptive statistics for the ENT Service. There were 614 ENT surgeries performed during the study period. Of those, 55% (N = 337) were performed prior to reengineering with a mean surgeon time of 77.35 minutes. The remaining 45% (N = 277) were performed after implementation of the reengineering initiative with a mean surgeon time of 88.10 minutes. The independent-samples t test results are displayed at Table 3-9. The mean differences were not significant ($t = 1.43$, $p = .152$).

Table 3-8

ENT Surgeon Time Descriptive Statistics

Pre/Post	N	Mean	Std Deviation
Pre	337	77.35	101.83
Post	277	88.10	79.46

Table 3-9

ENT Surgeon Time Independent-Samples Test

t	df	Significance (2-tailed)	Mean Difference
1.43	612	.152	10.75

Note. Equal variance assumed.

General Surgery Service. Table 3-10 provides descriptive statistics for the General Surgery Service. There were 792 surgeries performed by General Surgery during the study period. Of those 51% (N = 403) were performed prior to reengineering with a mean surgeon time of 115.92 minutes. The remaining 49% (N = 389) were performed after implementation of the reengineering initiative with a mean surgeon time of 112.75 minutes. The independent-samples t test results are displayed at Table 3-11. The mean differences were not significant ($t = -.457$, $p = .648$).

Table 3-10

General Surgery Surgeon Time Descriptive Statistics

Pre/Post	N	Mean	Std Deviation
Pre	403	115.92	100.07
Post	389	112.75	94.72

Table 3-11

General Surgery Surgeon Time Independent-Samples Test

t	df	Significance (2-tailed)	Mean Difference
-.457	790	.648	-3.16

Note. Equal variance assumed.

Gynecology Service. Table 3-12 provides descriptive statistics for the Gynecology Service (GYN). There were 449 GYN surgeries performed during the study period. Of those 49% (N = 219) were performed prior to reengineering with a mean surgeon time of 93.15 minutes. The remaining 51% (N = 230) were performed after implementation of the reengineering initiative with a mean surgeon time of 89.08 minutes. The independent-samples t test results are displayed at Table 3-13. The mean differences were not significant ($t = -.622$, $p = .534$).

Table 3-12

Gynecology Service Surgeon Time Descriptive Statistics

Pre/Post	N	Mean	Std Deviation
Pre	219	93.15	70.36
Post	230	89.08	68.12

Table 3-13

Gynecology Service Surgeon Time Independent-Samples Test

t	df	Significance (2-tailed)	Mean Difference
-.622	447	.534	-4.07

Note. Equal variance assumed.

Neurosurgery Service. Table 3-14 provides descriptive statistics for the Neurosurgery Service. There were 121 neurosurgeries performed during the study period. Of those 52% (N = 63) were performed prior to reengineering with a mean surgeon time of 168.97 minutes. The remaining 48% (N = 58) were performed after implementation of the reengineering initiative with a mean surgeon time of 158.52 minutes. The independent-samples t test results are displayed at Table 3-15. Although the mean differences were not significant ($t = -.350$, $p = .727$) the smaller standard deviation indicated less variation in surgeon time after implementation of the reengineering initiative.

Table 3-14

Neurosurgery Service Surgeon Time Descriptive Statistics

Pre/Post	N	Mean	Std Deviation
Pre	63	168.97	195.45
Post	58	158.52	120.64

Table 3-15

Neurosurgery Service Surgeon Time Independent-Samples Test

t	df	Significance (2-tailed)	Mean Difference
-.350	119	.727	-10.45

Note. Equal variance assumed.

Ophthalmology Service. Table 3-16 provides descriptive statistics for the Ophthalmology Service. There were 475 surgeries performed by the Ophthalmology service during the study period. Of those 53% of those cases (N = 254) were performed prior to reengineering with a mean surgeon time of 69.65 minutes. The remaining 47% (N = 221) were performed after the implementation of the reengineering initiative with a mean surgeon time of 72.96 minutes. The independent-samples t test results are displayed at Table 3-17. The mean differences were not significant ($t = .691$, $p = .490$).

Table 3-16

Ophthalmology Service Surgeon Time Descriptive Statistics

Pre/Post	N	Mean	Std Deviation
Pre	254	69.65	51.62
Post	221	72.96	52.67

Table 3-17

Ophthalmology Service Surgeon Time Independent-Samples Test

t	df	Significance (2-tailed)	Mean Difference
.691	473	.490	3.31

Note. Equal variance assumed.

Oral Surgery Service. Table 3-18 provides descriptive statistics for the Oral Surgery Service. There were 116 oral surgeries performed during the study period. Of those 49% (N = 57) were prior to reengineering with a mean surgeon time of 124.65 minutes. The remaining 51% (N = 59) were performed after implementation of the reengineering initiative with a mean surgeon time of 123.17 minutes. The independent-samples t test results are displayed at Table 3-19. The mean differences were not significant ($t = -.088$, $p = .930$).

Table 3-18

Oral Surgery Service Surgeon Time Descriptive Statistics

Pre/Post	N	Mean	Std Deviation
Pre	57	124.65	87.24
Post	59	123.17	94.42

Table 3-19

Oral Surgery Service Surgeon Time Independent-Samples Test

t	df	Significance (2-tailed)	Mean Difference
-.088	114	.930	-1.48

Note. Equal variance assumed

Orthopedic Service. Table 3-20 provides descriptive statistics for the Orthopedic Service. There were 815 orthopedic surgeries performed during the study period. Of those 52% (N = 426) were performed prior to reengineering with a mean surgeon time of 107.15 minutes. The remaining 48% (N = 389) were performed after the implementation of the reengineering initiative with a mean surgeon time of 101.03 minutes. The independent-samples t test results are displayed at Table 3-21. The mean differences were not significant ($t = -1.00$, $p = .316$).

Table 3-20

Orthopedic Service Surgeon Time Descriptive Statistics

Pre/Post	N	Mean	Std Deviation
Pre	426	107.15	95.04
Post	389	101.03	77.08

Table 3-21

Orthopedic Service Surgeon Time Independent-Samples Test

t	df	Significance (2-tailed)	Mean Difference
-1.00	813	.316	-6.11

Note. Equal variance assumed.

Plastic Surgery Service. Table 3-22 provides descriptive statistics for the Plastic Surgery Service. There were 84 plastic surgeries performed during the study period. Of those 50% (N = 42) were performed prior to reengineering with a mean surgeon time of 147.93 minutes. The remaining 50% (N = 42) were performed after the implementation of the reengineering initiative with a mean surgeon time of 134.14 minutes. The independent-samples t test results are displayed at Table 3-23. The mean differences were not significant ($t = .713$, $p = .478$).

Table 3-22

Plastic Surgery Service Surgeon Time Descriptive Statistics

Pre/Post	N	Mean	Std Deviation
Pre	42	147.93	97.07
Post	42	134.14	79.21

Table 3-23

Plastic Surgery Service Surgeon Time Independent-Samples Test

t	df	Significance (2-tailed)	Mean Difference
.713	82	.478	13.79

Note. Equal variance assumed.

Podiatry Service. Table 3-24 provides descriptive statistics for the Podiatry Service. There were 136 surgeries performed by the Podiatry Service during the study period. Of those 42% (N = 58) were performed prior to reengineering with a mean surgeon time of 83.95 minutes. The remaining 58% (N = 78) were performed after the implementation of the reengineering initiative with a mean surgeon time of 84.53 minutes. The independent-samples t test results are displayed at Table 3-25. The mean differences were not significant ($t = .089$, $p = .929$).

Table 3-24

Podiatry Service Surgeon Time Descriptive Statistics

Pre/Post	N	Mean	Std Deviation
Pre	58	83.95	31.63
Post	78	84.53	40.93

Table 3-25

Podiatry Service Surgeon Time Independent-Samples Test

t	df	Significance (2-tailed)	Mean Difference
.089	134	.929	.58

Note. Equal variance assumed.

Urology Service. Table 3-26 provides descriptive statistics for the Urology Service. There were 223 urology surgeries performed during the study period. Of those 49% (N = 110) were performed prior to reengineering with a mean surgeon time of 126.09 minutes. The remaining 51% (N = 113) were performed after the implementation of the reengineering initiative with a mean surgeon time of 92.16 minutes. The independent-samples t test results are displayed at Table 3-27. The mean differences were significant ($t = 2.496$, $p = .004$) and the smaller standard deviation indicated there was less variation in surgeon time after implementation of the reengineering initiative.

Table 3-26

Urology Service Surgeon Time Descriptive Statistics

Pre/Post	N	Mean	Std Deviation
Pre	110	126.09	124.54
Post	113	92.16	70.37

Table 3-27

Urology Service Surgeon Time Independent-Samples Test

t	df	Significance (2-tailed)	Mean Difference
2.496	171.18	.004	33.93

Note. Equal variance not assumed.

Vascular Surgery Service. Table 3-28 provides descriptive statistics for the Vascular Surgery Service. There were 108 vascular surgeries performed during the study period. Of those 45% (N = 49) were performed prior to reengineering with a mean surgeon time of 167.27 minutes. The remaining 55% (N = 59) were performed after the implementation of the reengineering initiative with a mean surgeon time of 164.15 minutes. The independent-samples t test results are displayed at Table 3-29. The mean differences were not significant ($t = -.128$, $p = .899$).

Table 3-28

Vascular Surgery Service Surgeon Time Descriptive Statistics

Pre/Post	N	Mean	Std Deviation
Pre	49	167.27	138.28
Post	59	164.15	114.97

Table 3-29

Vascular Surgery Service Surgeon Time Independent-Samples Test

t	df	Significance (2-tailed)	Mean Difference
-.128	106	.899	-3.11

Note. Equal variance assumed.

Surgeon time overview. Table 3-30 provides an overview of the changes in the dependent variable, surgeon time, for each of the 12 surgical services after the implementation of the reengineering initiative and reflects increases or decreases in number of surgeries performed, mean surgeon time, and standard deviation for each surgical service. The table shows that decreases in the standard deviation were demonstrated for 8 of the 12 surgical services after the reengineering initiative was implemented. Of the eight services whose standard deviation decreased, three (Gynecology, Urology, and Vascular) had an increase in the number of cases performed and a decrease in the mean surgeon time during the post reengineering phase.

Table 3-30

Changes in Surgeon Time After Reengineering

Service	Number of surgeries	Mean surgeon time	Standard deviation
Cardio-Thoracic	decrease	decrease	increase
ENT	decrease	increase	decrease
General	decrease	decrease	decrease
Gynecology	increase	decrease	decrease
Neurosurgery	decrease	decrease	decrease
Ophthalmology	decrease	increase	increase
Oral	increase	decrease	increase
Orthopedic	decrease	decrease	decrease
Plastic	no change	decrease	decrease
Podiatry	increase	increase	increase
Urology	increase	decrease	decrease
Vascular	increase	decrease	decrease

Surgical Cancellations

Table 3-31 provides descriptive statistics for the surgical cancellations. There were 3,722 surgical cases scheduled in the operating rooms during the study period. Of those, 52% (N=1,936) were scheduled prior to the implementation of the reengineering initiative and 48% (N=1,786) were scheduled after the implementation of the reengineering initiative. Surgical case cancellations were converted to a daily cancellation rate per 100 cases scheduled with a mean rate of 8.3 prior to reengineering and 7.9 after reengineering. The independent-samples t test results are displayed at Table 3-32. The mean differences were not significant ($t = .360$, $p = .720$).

Table 3-31

Surgical Cancellation Rate Descriptive Statistics

Pre/Post	N	Mean	Std Deviation
	(days)		
Pre	63	8.3E-02	5.20E-02
Post	59	7.9E-02	4.87E-02

Table 3-32

Surgical Cancellation Rate Independent-Samples Test

t	df	Significance (2-tailed)	Mean Difference
.360	120	.720	3.28E-03

Note. Equal variance assumed.

Surgical Referrals

Table 3-33 provides descriptive statistics for the surgical cases referred during the study period. There were 40 cases referred during the study period. Of those, 13 were referred prior to the reengineering initiative and 27 were referred after implementation of the reengineering initiative. The referrals were converted to a daily referral rate per 100 cases performed at MAMC. The resulting mean rates were 0.478 prior to reengineering and 1.339 after reengineering. The results of an independent-samples t test are displayed at Table 3-34. The mean differences were not significant ($t = -.246$, $p = .015$).

Table 3-33

Surgical Referrals Descriptive Statistics

Pre/Post	N	Mean	Std Deviation
	(days)		
Pre	92	.478	1.60
Post	91	1.339	2.92

Note. Data provided by Foundation Health Federal Services, Inc.

Table 3-34

Surgical Referrals Independent-Samples Test

t	df	Significance (2-tailed)	Mean Difference
-2.46	139.54	.015	-.861

Note. Equal variance not assumed. Data provided by Foundation Health Federal Services, Inc.

Surgical Backlog

At the conclusion of the study period there were 209 cases on the backlog list with a waiting time greater than 2 weeks. Approximately 33% (N = 68) were originally scheduled prior to implementation of the reengineering initiatives. The remaining 67% (N = 141) were scheduled for surgery after the implementation of the reengineering initiative. Of the 12 surgical specialties at MAMC, 7 had a surgical backlog greater than 2 weeks. The backlog by surgical specialty before and after the implementation of the reengineering initiative is illustrated in Figure 3. Table 3-35 lists the number of backlog cases by surgical service.

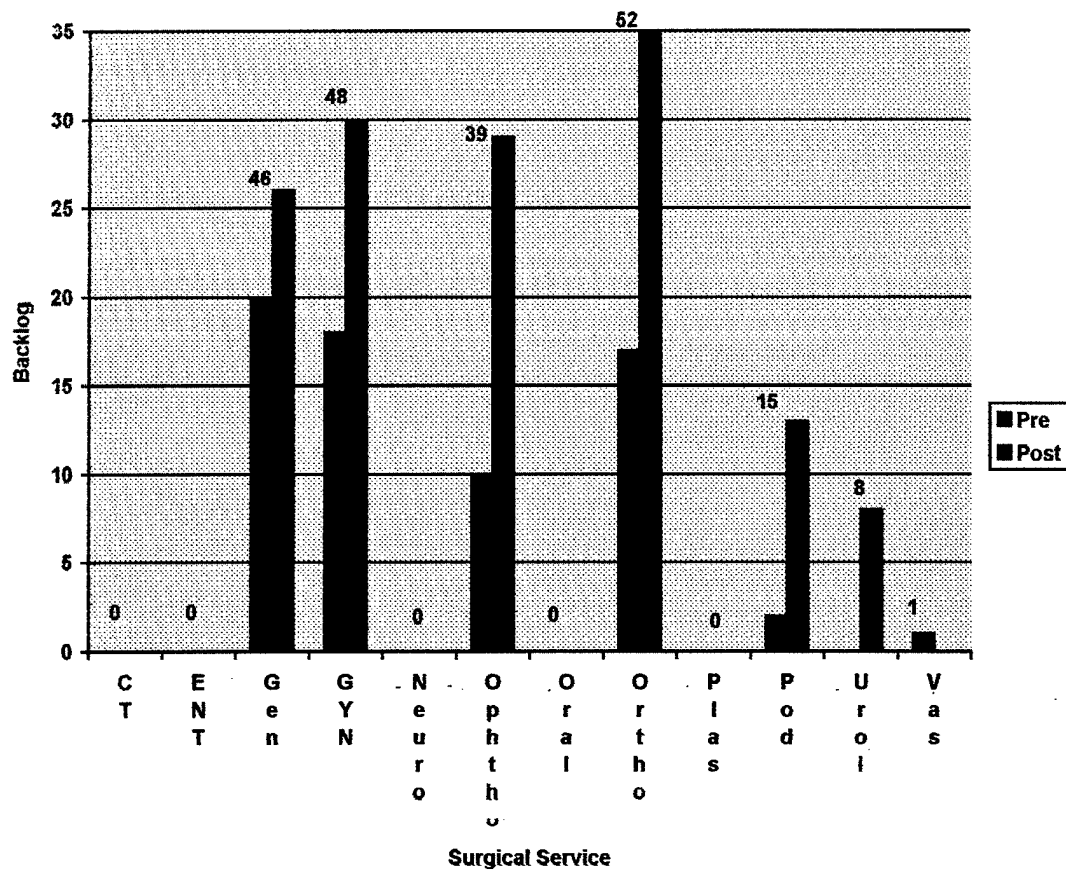


Figure 3. Surgical backlog by service.

Table 3-35Surgical Backlog

Surgical Service	Pre	Post	Total
Cardio-Thoracic	0	0	0
ENT	0	0	0
Gen Surg	20	26	46
GYN	18	30	48
Neuro	0	0	0
Ophtho	10	29	39
Oral Surg	0	0	0
Ortho	17	35	52
Plastics	0	0	0
Podiatry	2	13	15
Urology	0	8	8
Vascular	1	0	1
Total	68	141	209

Chapter 4

Discussion

Table 4-1 summarizes the results for the five variables tested during this study.

No variable showed a significant difference in the means before and after implementation of the reengineering initiative. However, it was necessary to look beyond statistical significance and evaluate each variable in relation to the goal of the reengineering initiative. The goal was to reduce the variations leading to inefficiency, thereby improving the processes and allowing for increased throughput in the OR complex. Total Quality Management philosophy stresses reduction of variations as key to process improvement. Results of this study indicated variation was reduced in three of the five variables analyzed: room turnover time, surgeon time, and cancellation rate. Variation was expressed by the standard deviation that is based on the distance between the individual data points and the mean. A larger standard deviation indicates more variation and a smaller standard deviation indicates less variation. Reduced variations did have a positive impact on the efficiency for the associated variable though the results were not statistically significant. Each variable will be discussed separately in this chapter.

Table 4-1Summary of Results

Variable	Statistically Significant	Decreased Variation
OR turn over time	No	Yes
Surgeon time	No	Yes
Surgical cancellations	No	Yes
Surgical referrals	No	No
Surgical backlog	N/A	No

Note. Statistical significance in mean surgeon time was achieved in 1 of the 12 surgical services.

Operating room turnover time

Operating room turnover time had a mean time of approximately 32 minutes both prior to and after implementing the reengineering initiative. While statistical significance was not demonstrated between the pre and post reengineering phases, MAMC's room turnover time did show a decrease in variation and can be favorably measured against the operating room turnover time of another teaching hospital. This study documented the time required to prepare a MAMC OR for the next surgery over a six month period and determined the mean time was 32 minutes. This time is considerably less than the 36 minute average reported by Mazzei (1994) when he looked at operating room start times and turnover times in a university hospital. Additionally, the standard deviation of the mean operating room turnover time decreased by 60% following the implementation of the reengineering initiative. Increased consistency through reduced variation leads to increased efficiency.

Surgeon Time

Overall surgeon time was measured before and after the implementation of the reengineering initiative. Additionally, surgeon time was measured for each of the 12 surgical services at MAMC. The results of analysis showed no significant difference in the combined mean surgeon times or the mean surgeon times for individual services except for the Urology Service. What the data did show was decreased variation in the standard deviations of the mean times for 8 of the 12 surgical services.

A discussion by the author with the Chief of the Urology Service was not able to identify specific factors leading to the reduction in surgeon time. Two issues were raised by the Urology Service Chief, the length of the study period and case mix (J. C. Norbeck, personal communication, February 26, 1998).

The first issue, length of the study, may be a factor in that only 223 surgeries were performed during the investigation period. The percentage of surgeries performed were 49% before and 51% after reengineering. The fact that approximately 110 surgeries were performed during each phase of the study may be a contributing factor. However, there were six other surgical services with less than 100 surgeries performed during each phase of the study, none of which demonstrated a statistically significant reduction in mean time.

The second issue raised was case mix. Case mix adjustments were not made for this study. One of the assumptions listed in the Methods chapter (pg. 27) was that case mixes prior to and after implementation of the reengineering initiative were similar. After the initial discussion with the Urology Service Chief, a case mix comparison was performed comparing the number of procedures, by type, before and after the

implementation of the reengineering initiative. This comparison (Appendix G) was shown to the Urology Service Chief who determined case mix was not a factor in the reduced mean surgeon time.

In attempting to further investigate the case mix issue, case comparisons were also performed for the Cardio-Thoracic Surgery Service and Neurosurgery Service (Appendix G). The Chief of the Cardio-Thoracic Surgery Service also agreed case mix was not a factor. The Chief of Neurosurgery cautioned against making too specific conclusions based on surgeon times of mixed cases. He suggested future studies look at one or two procedures within a service. He also suggested the study period be 6 months for each phase to ensure an adequate number of cases to determine statistical significance.

Surgical Cancellations

Although the mean differences for surgical cancellations were not statistically significant, there was a decline in both the surgical cancellation rate and the variation after implementation of the reengineering initiative. The MAMC goal is to have the surgical cancellation rate below 7% (J. Messing, personal communication, March 24, 1998). This study demonstrated that MAMC was progressing in its efforts towards reaching that goal. Two factors contributed to this decline. First was the emphasis placed on reducing the cancellation rate given by the DCCS prior to the reengineering effort. Emphasis from senior leadership, with clearly stated standards, normally results in increased emphasis and effort from those directly involved in the process, in this case the physicians and anesthesiology staff.

The second and more influential factor was the teamwork created as a result of the reengineering initiative. Prior to reengineering, the decision to cancel a surgery could be

made unilaterally by the patient, the surgeon, or the anesthesia provider. The reengineering initiative required all three parties be involved in any non patient directed decision to cancel a surgery. Involving the patient, surgeon, and anesthesia provider in the decision to cancel uses a systems approach and results in a decision based on need, not merely convenience. However, it should be stressed that a patient can always decide not to have a procedure performed even if consent to the surgery was previously given.

Surgical Referrals

Statistical significance was not demonstrated in the mean number of surgical procedures referred out of MAMC. Surgical referrals are an indirect indication of work being performed in the OR complex. The premise was that increased efficiency in the OR would result in increased throughput leading to a decreased backlog and a decreased number of surgical procedures being referred out of MAMC.

One of the reasons for the increased number of surgical case referrals may have been an increase in the number of external taskings for physicians during this time period. During the second phase of this study, MAMC was tasked to provide surgeons to the 47th Combat Support Hospital and the 250th Forward Surgical Team to support major field training exercises. Additionally, a surgeon was tasked to provide support to the hospital at Ft. Irwin, California. Although these taskings are part of a military physician's job, any time a surgeon is externally tasked, he or she is unavailable to perform surgery in the MAMC OR and on MAMC patients.

Of the 40 surgical cases referred out of MAMC during the study period, 27 occurred after implementation of the reengineering initiative. Orthopedics, Podiatry, and General Surgery, accounted for 18 of the 27 surgical cases referred. LTC (Dr.)

Johnstone, Chief, of the Orthopedic and Podiatry Services identified factors contributing to the increased referral rate. The first factor identified was the external taskings. During the post reengineering phase, two orthopedic surgeons were tasked to provide support for field training exercises. During the same time period, the General Surgery Service also provided surgeons in support of the same exercises.

Doctor Johnstone further identified three orthopedic cases that he considered emergency cases. Of the three patients, none was enrolled in TRICARE Prime. This does not mean they are ineligible to receive care at MAMC, it means they chose to use one of the other TRICARE options earlier identified for their healthcare. The TRICARE contract requires that even for emergency services the patient must still go through the process of being referred from MAMC for services elsewhere. This requirement does not prevent a beneficiary from receiving emergency services. It is used as a utilization management tool to help keep the MAMC Commander informed of the health of his population and to show where services are being delivered.

The final factor identified is the location of the patient's residence in relation to MAMC. As previously mentioned, Region 11 includes Washington, Oregon, and six northern counties of Idaho. Beneficiaries who live a long distance from MAMC may request to be referred to a surgeon closer to home. Authorizing these referrals is not only more convenient geographically for the patient, but patients can often be scheduled for surgery sooner than they would at MAMC.

Surgical Backlog

Success was said to be achieved if, at the end of the data collection period (December 1, 1997), no surgical service had a surgical backlog greater than 2 weeks. A query of SIS revealed that 5 of 12 services had a backlog of less than 2 weeks. The total backlog of 209 patient was a substantial reduction from the 447 patient backlog prior to reengineering.

The Department of Surgery has made a great effort to ensure surgical backlog lists were accurate and valid. It is not uncommon for patients who are scheduled for elective surgery to be reassigned to another duty station without informing the service that has them scheduled for surgery and having their names removed from the list. Additionally, though less frequently, a patient who is scheduled for an elective surgery may need to have a different surgery on a more emergent basis, and during that surgery the original procedure is also performed.

Another reason for the differences in the surgical backlog is that, while the procedure for scheduling patients for surgery was the same for all services, those procedures were not uniformly followed by each service. Some services intentionally did not schedule patients into SIS, but instead maintained "hip-pocket" lists. These were usually patients with less critical and less time sensitive surgical needs. In some cases, these were patients who informed their physician they could come in for surgery with very little notice. If a scheduled patient cancelled surgery, the physician would call one of these patients and try to re-book the OR time. Because these patients were not scheduled for surgery through SIS, they did not appear as surgical backlog.

At the end of the study period, Orthopedics had the largest backlog with 52 patients scheduled for surgery. A conversation with LTC (Dr.) Johnstone, Chief, Orthopedic Surgery Service, revealed this is a vast reduction in the surgical backlog for Orthopedics. Prior to reengineering, Orthopedics had a backlog well over 100. Doctor Johnstone indicated that having ORs designated as long rooms and having a TSA room contributed to the reduction in backlog for Orthopedics. The reengineering room designations combined with the Department of Surgery efforts to manage the backlog list resulted in a substantial decrease in the surgical backlog.

Nursing Shortage

Since the beginning of this study period, MAMC has experienced a severe shortage of OR nurses and technicians. Staffing levels have been reduced 24% for OR nurses and 10% for OR technicians. Additionally, MAMC has been unable, as of yet, to hire civilian personnel to fill these shortages. The result is the MAMC OR complex has reduced the number of ORs staffed on a daily basis from 12 to 8.

There were a number of factors contributing to the reduction in staff. Most notable was an increase in the number of Army nurses who were not selected for retention. The other major contributing factor has been the employment opportunities in the local civilian market. Civilian employment opportunities are plentiful in the local economy. Due to its current personnel wage schedule, MAMC has difficulty competing with wages being offered by civilian healthcare organizations. Civilian nurses and technicians are leaving MAMC to accept jobs on the local economy, and, because of the wage disparity, MAMC has been unable to hire replacements.

However, steps have been taken by MAMC leadership to alleviate this problem. Job descriptions have been reevaluated and, where appropriate, rewritten to accurately reflect levels of responsibility and technical skills needed by OR nurses. These new job descriptions justify higher salaries. Also, recruiting and retention bonuses are being offered to qualified candidates. The civilian personnel office has a number of hiring actions for OR nurses, but they have not been filled because the new measures are not yet in effect. It will take time to fill the positions and bring the OR complex back up to 12 rooms daily.

Documentation

During the data collection period, several issues involving documentation were identified. These issues fall into the categories of surgical requests and the reengineering process.

Surgical requests. First, the requesting surgical service (e.g., General Surgery, Vascular Surgery, etc.) was not listed on the buck slip. As part of their residency training, surgical residents routinely rotate through different surgical services. Additionally, there are a number of procedures performed by more than one surgical service. When these conditions were present, there was increased potential for a surgical procedure to be assigned to the wrong service.

Second, there was a section on the buck slip listing the surgical procedure being performed. Currently, there appears to be no standard for listing each procedure. Some procedures are listed generically, while others are listed specifically. For the purposes of workload collection, there was increased potential for error.

Third, there appeared to be a substantial reduction in room turnover time and an increase in the number of buck slips actually documenting a “prior-patient-out-of-room time” when surgical procedures are batched. Batching refers to scheduling multiple patients with the same procedures (e.g., tonsillectomies) one after the other in the same room, where the same type of equipment is being used, and the staff is performing the same procedure. The prior-patient-out-of-room time is necessary to compute the room turnover time and was the data element missing in those surgical cases where turn over time could not be calculated.

The three procedures most often batched were myringotomies (PE Tubes), phacoemulsification with intraocular lens (PHACO with IOL), and tonsillectomies. These three procedures had a 86% completion rate for prior-patient-out-of-room as compared to a 65% completion rate for the entire study period. The room turn over time for these procedures was 18.83 minutes compared to 32 minutes for the entire study period.

The ability to batch procedures is limited by the length of the procedure and the number of procedures scheduled on a given day. Coronary bypass surgeries are lengthy procedures with only one or two scheduled per day. Surgeries such as these are not good candidates for batching. However, those procedures scheduled for ambulatory surgery rooms (by definition procedures that can be completed in less than 1.5 hours) are candidates for batching.

Reengineering process. There appeared to be a lack of documentation with regard to the planning conducted for the reengineering initiative. The memorandum of agreement dated September 2, 1997 (Appendix D) was the only documentation found

concerning the reengineering initiative. That memorandum was a final product, which did not detail the processes involved or the reasoning and data used to make decisions. When the OR nursing shortage is rectified and the OR complex increases the number of rooms staffed each day, many of these issues will have to be looked at again. This study provides data about the surgical procedures performed but does not provide insight as to why processes happened as they did. Documentation of the reengineering process would prove invaluable in reassessing the OR complex situation.

Limitations

The major limitation of this study was the length of the study period. Although over 4,000 surgeries were performed during this study, there were significant differences in the number of surgeries performed by each service. The Chief of Urology raises a valid point when he said 113 surgeries performed after reengineering may not have been sufficient to accurately assess the effect of the reengineering. One way to compensate for the length of the study period would have been to do a case mix adjustment. While case mix adjustment was beyond the scope of this study, it is an excellent suggestion for any future studies.

Another limitation deals with the method of allocating surgical procedures to surgical services. The buck slips used to schedule surgeries do not list the requesting service. They do list the requesting surgeon. Since residents rotated through different surgical services and some surgical procedures were performed by more than one service, there was a potential to allocate some surgical procedures to the wrong surgical service. When it was unclear which service should be credited for performing the surgery, data was not entered into the database until the issue was resolved. However, steps taken to

properly credit procedures to the correct service could not guarantee data entry errors were not made. A solution to this problem is to include the requesting surgical service on the buck slip.

Chapter 5

Conclusion and Recommendations

Conclusions

The purpose of this study was to determine whether the reengineering initiatives implemented by the DOAOS improved the efficiency in the OR complex. Statistical analysis conducted from the data collected during this study tends to support the conclusion that the reengineering initiative implemented by the DOAOS at MAMC did not result in marked increased efficiency in the OR complex. However, it is important to remember that process improvement is incremental and continual. Although not statistically significant, improvements were seen in 4 of the 5 variables tested. Room turnover times were more consistently near the 32 minute mean time. Surgeon time showed decreased variation around the mean time and, surgical cancellations and backlog were reduced.

This study demonstrated improvements in the MAMC OR complex and provides base line data for a 6 month period that can be used in future studies. As the OR personnel shortages are filled, decisions must be made concerning how many rooms to staff and whether they should be long, ambulatory, or time and space available rooms. The data and information obtained during this study can provide the baseline information needed to make these decisions.

This information can also be used as an internal benchmark against which future process improvements can be measured. Benchmarks serve as the standard against which additional improvements are measured. Internally established benchmarks can be as valuable to the organization as externally established standards.

Recommendations

Future studies in the OR should attempt to improve upon the metrics used to determine increased efficiency. Two specific areas should be included in future studies: the effect of the DEPMEDS room on readiness and the use of bar codes to capture supply costs in the OR.

Another area that should be studied is surgical referrals. This study did not explore the costs associated with surgical referrals. Nor did it ask questions about what other services were referred out of MAMC along with the actual surgery. Future studies should examine the use of ancillary services to include radiographic studies and laboratory procedures and address the potential costs of ancillary services associated with surgical referrals. The potential savings gained by recapturing surgical referrals may justifies a separate study.

The Surgical Support Services Quality Management Group should continue to look at ways to improve efficiencies in the OR complex. Emphasis needs to be placed on documenting the processes and reasons leading to any future decisions. The OR nursing shortage will eventually be corrected and the number of ORs staffed each day will increase. The DOAOS must be prepared to make decisions that ensure continued quality services and improved efficiencies.

The buck slip used to schedule surgical procedures should be modified to include the requesting surgical service. While this may seem a minor point, it did prove to be an important issue during data collection. Also, standards need to be developed for listing scheduled procedures on the buck slip. Current Procedural Terminology (CPT) codes can provide a standard that ensures proper workload is captured.

In conclusion, this study documented workload for a 6 month period in the MAMC OR complex and demonstrated improvements were realized after implementing the reengineering initiative. This study also provided valuable information that can be used in future studies involving the OR complex. Additionally, this study provided a mechanism to objectively evaluate the impact of the reengineering initiative. Finally, this study can support future decisions regarding case scheduling in the OR complex.

Footnotes

¹Beneficiaries are required to pay a deductible based on the rank of the military sponsor. Once the deductible has been paid, the government will reimburse a percentage of the cost for healthcare. Charges exceeding the reimbursement become the beneficiaries' responsibility (i.e., beneficiary cost share).

²Block scheduling entails reserving blocks of time for individual surgical specialties. For example, orthopedics may have two rooms blocked for their use on Tuesdays and Thursdays. The length of each block is determined by the medical staff based on past use, and the block of time is reserved for the owner's exclusive use.

³The Hawthorne effect is a condition that occurs among groups being studied and observed. According to the Hawthorne effect, workers feel important because they are being observed at work, and, therefore, they produce more (Ivancevich & Matteson, 1996).

Appendix A

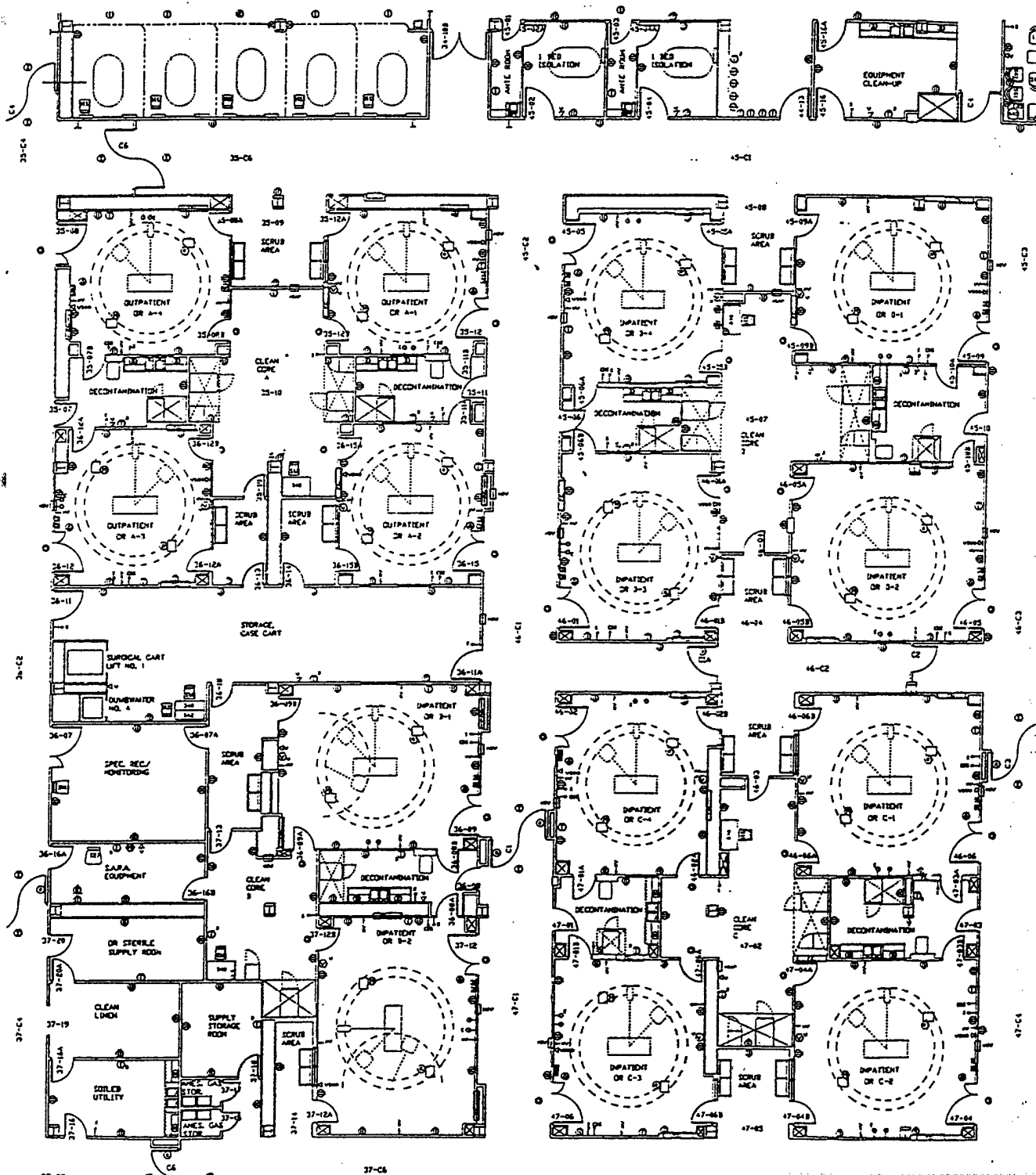
TRICARE Options

TRICARE Options

	Standard	Extra	Prime
Deductibles	Yes; same as TRICARE Extra	Yes; same as TRICARE Standard	None if care is received at an MTF or civilian network
Cost shares or co-payments	Yes; highest of all options	Yes; 5% lower than TRICARE Standard	None for care in MTF; nominal for civilian network care
Enrollment fees	None	None	None for active duty families; yes for retirees and their families
Out-of-pocket costs	Highest of all options	Lower than TRICARE Standard	None for care in MTF; nominal for civilian network care
Access to civilian doctors and hospitals	Greatest flexibility to choose a doctor and medical facility	Choice limited to network of civilian doctors	All care provided through assigned Primary Care Manager. Needed care not available at MTF referred to civilian network
Preventive tests/exams	With applicable deductibles and co-pays	With applicable deductibles and co-pays	Recommended as part of primary care and included free of charge
Primary care managers	No	No	Yes; key feature of this option

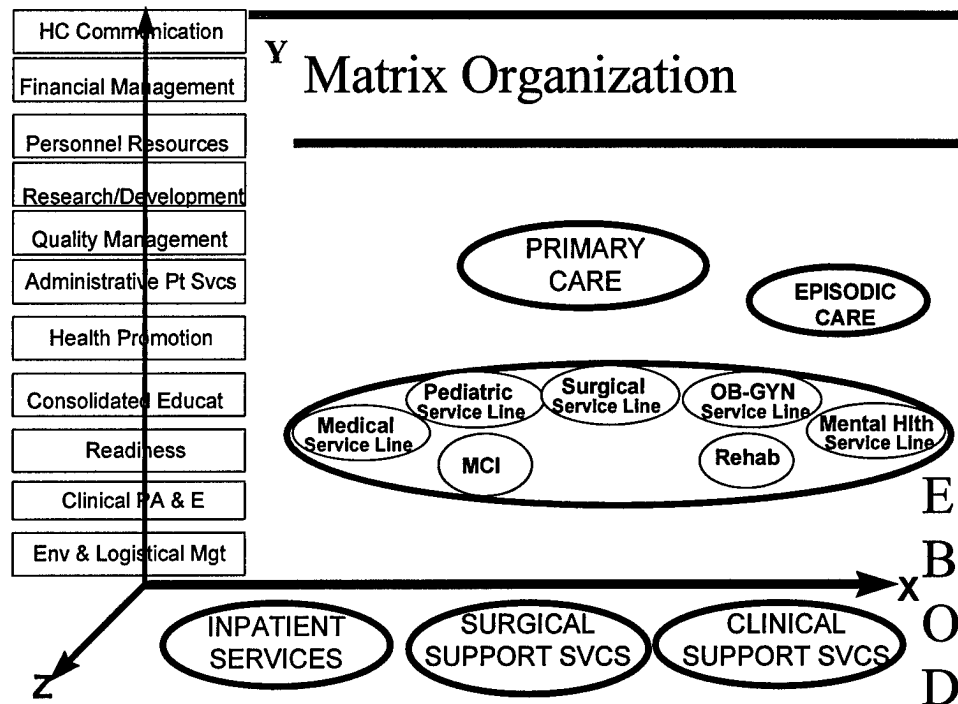
Note: From DoD Health Affairs TRICARE Marketing Office, 1996

Appendix B
Operating Room Complex Floor Plan



Appendix C

Madigan Army Medical Center Matrix Organization



X axis = Functional or key processes at MAMC

Y axis = MAMC infrastructure coordinating activities (support functions)

Z axis = Traditional military wiring diagram

EBOD = 1 representative from each Quality Management Group; Coordinating Activity; Service Line; and the positions of Deputy Commander for Clinical Support; Deputy Commander for Administration; Chief Nurse; Director, Western Regional Command; Chief of Graduate Medical Education; and the Command Sergeant Major

APPENDIX D

MCHJ-DOAOS

2 September 1997

MEMORANDUM OF AGREEMENT between DOAOS, DOS, and DOBG

SUBJECT: **Re-Engineering Operating Room Surgical Case Scheduling.**

1. The Following bullets were presented in a combined follow-up meeting held 7 July 1997 in the DOAOS Classroom from 1500-1615 and in Surgical Services QMG 2 Sept 1997 at 0630.

Those in attendance included on 7 July were: 2 Sept Attendance= *

CAPT Petty*	LTC Potter
COL Anderson	LTC Johnstone
COL Eggebrotten*	MAJ Neill
COL Allison	MAJ Hartman*
COL Tollefson	CPT Richardson
LTC Messing*	LTC Chapman*

Schedule of Rooms

<u>Hours</u>	<u>Monday</u>	<u>Tuesday</u>	<u>Wednesday</u>	<u>Thursday*</u>	<u>Friday</u>
0730-1530 10		10	10	10	10
0730-1730 0		2	2	2	2

*= Rooms start at 0800 on Thursday

Additional:

a. **Scheduling System --- Modified Block Scheduling**

Surgical Requests (buck slips - SIS scheduling) must be in 2 normal (48 hours by 0730) working days prior to scheduled date of surgery. We need them as early as possible for planning. If the buck slip requests are not in within the designated time, the **Scheduling Window Reservation has closed for that service**, the time not booked becomes "OPEN" time for any service to utilize. Any Surgical Service can book the un-

utilized time, however strict coordination must be made with the Anesthesia and Operative Services Utilization Manager prior to committing cases to "Open" time.

b. Per Memo (25 July 1994) **Subject Surgical Information System**, Buck Slip accuracy is the responsibility of the **Staff** surgeon. All elective Buck Slips will be approved, checked for accuracy (by the Staff surgeon) prior to electronic submission or hand delivery for scheduling. Buck slips will be initialed at the top to validate accuracy prior to departing from the OR suite to the post anesthesia care unit.

c. **Staff Surgeons will be present at the beginning and end of each scheduled case** to monitor progress. Residents will help position, prep and check surgical equipment to assure accuracy of requested information and to help reduce wasting of unnecessary items.

d. Cases scheduled will use the average case length by CPT Code history of the **Staff surgeon whose name appears on the buck slip**. All historical data will be generated by SIS Historical data.

e. All scheduled cases will be IN their assigned rooms, no later than 0730 except 0800 on Thursdays.

f. **Scheduling impasses** will be mediated through the Assistant Chief of Surgery, Operating Room Head Nurse and Anesthesia Utilization Manager.

g. **Cancellation Policy**: Once a surgical schedule is published, all elective cases will be completed. Exceptions will be upon **Mutual** agreement between Surgeon, Anesthesia, Operating Room Nursing and the Patient.

h. ONE Room will be designated as a **TSA room**, Monday-Friday. TSA case priority designation will be based on emergent and semi-emergent basis with priority to in-house patients. This will **not** be a scheduled room. Arbitration of priority will be made by the requesting surgeons with the Assistant Chief of Surgery as the mediator working directly with the DOAOS UM manager.

i. ONE Room will be designated **DEPMEDS Training Room** for Anesthesia and Operative Services. Training emphasis will be on Field Anesthesia and Field OR equipment.

j. TWO Rooms everyday will be scheduled as **Ambulatory Surgery Rooms**, only cases that can be completed in under 1.5 hours (In Room-Out Room time) should be scheduled. Main effort is to maximize throughput.

k. The following definitions will become universally understood by all parties as **"THE DEFINITIONS"** which refer to any statistical reports produced by SIS:

- 1) **SIS times** are in hours and tenths of an hour
example (1.6 = 1 hour and 36 minutes)
 - 2) **Room Turnover Time** = Starts when the first scheduled patient of the day leaves the room until the next scheduled case enters their room. Delays will be accounted for and noted on the buck slips. TSA and emergency cases which void the planned scheduled case will be treated as first cases and will not have a Turnover time assigned to the start of that case.
 - 3) **In the Room Time** = when the patient enters the room until the patient leaves the room. This is the number which will be used as a planning factor for scheduling cases and averaging on the buck slips. This includes anesthesia time, prep time, and surgical time.
 - 4) **Surgeon Time** = from Turn over to Surgeon till surgeon finished (includes casting / dressing). This information will be made available upon request but is not used for planning purposes and UM.
 - 5) **Surgeon Turnover Time** = From Surgeon finished to Turn Over to Surgeon on the next scheduled case. This information will be made available upon request but is not used for planning purposes and UM.
 - 6) **Anesthesia Time** = From initial holding area contact till patient report ended in post anesthesia care unit. This information will be made available upon request but is not used for planning purposes and UM.
 - 7) **Nursing Time** = From initial preparation of room till room available to receive next patient. This information will be made available upon request but is not used for planning purposes and UM.
2. Implementation date: 2 September 1997.
 3. POC this memo is LTC Messing- 968-2402.

/S/
WILLIAM C. PETTY
CAPT, MC (USN)
CHAIRMAN, DOAOS

Appendix E

Anesthesia Data Worksheet

ANESTHESIA DATA WORKSHEET														
DELT: DA-1 (ANESTHESIA)		US-1 (EQUIPMENT)		JN-1 (NURSING)		DP-1 (PATIENT)		DS-1 (SURGEON)						
Patient Name	Age	Sex	FHP/SSN	Register No.	Surg Date	OR/Case	ASA	1	2	3	4	5	E	Est surg
Res/Student Anesthesia	Staff Anesthesia	Surgeon	Asst Surgeon	EBL	Prior pt out of OR	TOTS								
						Start anesthesia	Surg start							
FLUIDS														
(1) NS _____ ml	(5) PRBC _____ u	(9) albumin _____ ml												
(2) LR _____ ml	(6) cellsaver _____ ml	(10) colloid, non-alb												
(3) D5LR _____ ml	(7) FFP _____ u													
(4) dex/combo _____ ml	(8) platelets _____ u	() other _____												
MONITORING/SPECIAL TECHNIQUES														
Surgery Region/Type	Anesthesia Technique	Non-Invasive Monitor	Special Techniques	Invasive Monitor										
(1) intra abdominal	(1) general	(1) agent analyzer	(1) hypotension	(1) arterial line										
(2) intra thoracic	(2) regional	(2) ETCO2	(2) hypothermia	(2) CVP: int. jug										
(3) neuro	(3) combined	(3) Doppler	(3) cardiopul bypass	(3) CVP: subclavian										
(4) outpatient	(4) MAC/sedation	(4) Neurotrack	(4) fiberoptic intubation	(4) CVP: long arm										
(5) vaginal delivery		(5) evoked potentials	(5) sitting position	(5) PA catheter										
(6) Cesaerean sect		(6) others	(6) others	(6) ICP										
(7) all others				(7) transesophageal echo										
GENERAL ANESTHESIA/SEDATION														
Induction Technique		Airway												
(1) IV	(4) IM	(1) mask	(4) nasotracheal	(6) double lumen tube										
(2) inhalation	(5) other _____	(2) LMA	(5) tracheostomy	(7) jet ventilator										
(3) rectal		(3) orotracheal												
Induction Agent		Primary Anesthetic	Secondary Anesthetic	Neuromuscular Blockade										
(1) thiopental	(1) isoflurane	(1) isoflurane	(1) succinyl											
(2) fentanyl	(2) enflurane	(2) enflurane	(2) vecuronium											
(3) etomidate	(3) halothane	(3) halothane	(3) atracurium											
(4) methohexital	(4) desflurane	(4) desflurane	(4) mivacurium											
(5) propofol	(5) N2O	(5) N2O	(5) pancuronium											
(6) sufentanil	(6) propofol	(6) propofol	(6) pipecuronium											
(7) ketamine	(7) fentanyl	(7) fentanyl	(7) curare											
(8) midazolam	(8) sufentanil	(8) sufentanil	(8) metocurine											
(9) alfentanil	(9) alfentanil	(9) alfentanil	(9) induction only											
(10) halothane/N2O	(10) ketamine	(10) ketamine												
(11) other _____	(11) other _____	(11) other _____												
REGIONAL ANESTHESIA														
Block Technique	(6) supraclavicular	(12) sciatic												
(1) subarachnoid	(7) interscalene	(13) lumbar-plexus (1 shot)												
(2) lumbar epidural	(8) sciatic-femoral	(14) lumbar-plexus (continuous)												
(3) thoracic epidural	(9) caudal (continuous)	(15) other												
(4) axillary	(10) caudal (1 shot)													
(5) field block (surg)	(11) bier (IV regional)													
			Local Anesthetic											
			(1) bupivacaine	(5) with fentanyl										
			(2) lidocaine	(6) with morphine										
			(3) tetracaine	(7) other _____										
			(4) chloroprocaine											

DIAGNOSIS:

PROCEDURE(S)/COMMENTS

LATERALITY

Appendix F

SIS Surgical Schedule

OB: KENDRICK/HOOVER
0830-1700: BORG
1030-1900: DULAVERIS
SSC: PERAGINE/SOETH

Madigan Army Medical Center
Operating Room Schedule
23-Feb-1998
Page: 1

Call: HARTMAN #3109
2nd Call: BLACKMON
CRNA Call: BOGGESS
CRNA OB Call: DAMPIER

Room Case	Patient Name FP/SSN	Age	Unit From To	Surgeon(s)	Anesthetist	Nursing	Anesthetic Blood	Est Surg Time
A01 01 23Feb			OR AS	CUPERO SILVA	BUTLER, MAJ KULA, JOHN, DR.	DEPRECKER, SGT BERTOCCHINI, 1LT	GENERAL 0 unit(s)	90 min
Proposed procedure(s): 1. TYMPANOPLASTY WITHOUT MASTOIDECTOMY 2.								
						Laterality: L		
A01 02 23Feb			OR AS	CUPERO SILVA	BUTLER, MAJ KULA, JOHN, DR.	DEPRECKER, SGT BERTOCCHINI, 1LT	GENERAL 0 unit(s)	60 min
Proposed procedure(s): 1. EXCISION - MALIGNANT LESIONS; LESION DIAMETER 1.1 TO 2.0 CM 2.								
						Laterality:		
A01 03 23Feb			OR AS	CUPERO SILVA	BUTLER, MAJ KULA, JOHN, DR.	DEPRECKER, SGT BERTOCCHINI, 1LT	GENERAL 0 unit(s)	90 min
Proposed procedure(s): 1. TONSILLECTOMY, PRIMARY OR SECONDARY, AGE 12 OR OVER 2. SEPTOPLASTY								
						Laterality:		
A03 01 23Feb			OR AS	DAINTY SHROUT	LANDRY, CPT HACHEY, MAJ ARMFIELD, RICHARD MA	FAVRE, SPC GUSTAVSON, MS.	CHOICE 0 unit(s)	90 min
Proposed procedure(s): 1. LAPAROSCOPY, (PERITONEOSCOPY) DIAGNOSTIC (SEPARATE PROCEDURE) 2. CORPUS UTERI; CHROMOTUBATION OF OVIDUCT, INCLUDING MATERIALS								
						Laterality:		
A03 02 23Feb			OR AS	DAINTY SHROUT	LANDRY, CPT HACHEY, MAJ ARMFIELD, RICHARD MA	FAVRE, SPC GUSTAVSON, MS.	CHOICE 0 unit(s)	30 min
Proposed procedure(s): 1. LAPAROSCOPY, (PERITONEOSCOPY) DIAGNOSTIC (SEPARATE PROCEDURE) 2. CORPUS UTERI; CHROMOTUBATION OF OVIDUCT, INCLUDING MATERIALS								
						Laterality:		
A03 03 23Feb			OR AS	DAINTY SHROUT	LANDRY, CPT HACHEY, MAJ ARMFIELD, RICHARD MA	FAVRE, SPC GUSTAVSON, MS.	CHOICE 0 unit(s)	60 min
Proposed procedure(s): 1. LAPAROSCOPY, (PERITONEOSCOPY) DIAGNOSTIC (SEPARATE PROCEDURE) 2. CORPUS UTERI; CHROMOTUBATION OF OVIDUCT, INCLUDING MATERIALS								
						Laterality:		

Appendix G

Urology Service Case Comparison

Procedure	Pre	Post	Delta
Circumcision	31	34	3
Cystectomy	0	2	2
Epididymectomy	0	2	2
Excision of Varicocele	1	1	0
Hydrocelectomy	11	3	-8
Hypospadias Rpr	0	2	2
Inguinal Hernia Rpr	3	0	-3
Lesion Excision	2	1	-1
Lymphadenectomy	3	4	1
Nephrectomy	2	2	0
Orchiectomy	1	3	2
Orchiopexy	8	8	0
Penile Prosthesis	5	5	0
Penile Repair	4	1	-3
Pereyra Procedure	0	1	1
Prostatectomy	3	6	3
Pyeloplasty	3	2	-1
Scrotoplasty	3	1	-2
Sling Op for Incont.	5	7	2
Suture Removal	0	1	1
Testis Bx	0	1	1
TURBT	2	0	-2
Ureter/Pelvis Bx	1	0	-1
Ureteral Fistula Rpr	1	0	-1
Ureteral Stent Plcmnt	1	1	0
Ureterneocystostomy	2	1	-1
Ureteroscopy	0	1	1
Urethromeatoplasty	1	0	-1
Urethroplasty	5	8	3
Vasectomy	0	1	1
Vasovasostomy	12	14	2

Appendix H

Acronyms

DCCS	Deputy Commander for Clinical Services
DEPMEDS	Deployable Medical Systems
DOAOS	Department of Anesthesia and Operative Services
DOS	Disk Operating System
EBOD	Executive Board of Directors
FY	Fiscal Year
HMO	Health Maintenance Organization
MAMC	Madigan Army Medical Center
MEDCOM	U.S. Army Medical Command
MHS	Military Health System
OR	Operating Room
OASD(HA)	Office of the Assistant Secretary of Defense for Health Affairs
SIS	Surgical Information System
TEC	TRICARE Executive Council
TQM	Total Quality Management
TSA	Time and Space Available Room

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