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Case Study: Review of Operating Room Utilization at Naval Hospital Jacksonville

A Graduate Management Project Submitted to the Program Director in Candidacy for the Degree of Master of Health Administration

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The purpose of the study was to determine if the operating suite at Naval Hospital Jacksonville (NHJAX) is being under utilized. The operating suite consists of six operating rooms (OR) that provide service for seven surgical services. The variables OR capacity, OR capacity utilized, allocated block time per service, allocated block time used per service, and the number of surgical cases referred outside NHJAX were analyzed. Data were collected over fiscal year 2002. Analysis showed that the OR suite is only utilizing 69.25% of available minutes for the year. Out of the seven surgical services only Ear, Nose, and Throat (ENT) consumes greater than 75% of allocated minutes. The result of this study showed that the OR is being under utilized and that the antiquated data collection system (which requires a great deal of manual data collection) employed n the OR suite needs to be replaced with a user-friendly modern system. Thereby, allowing for improved utilization of resources, including equipment, rooms, and staff.

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Abstract

The purpose of the study was to determine if the operating suite at Naval Hospital Jacksonville (NHJAX) is being under utilized. The operating suite consists of six operating rooms that provide service for seven surgical services. The variables operating room (OR) capacity, OR capacity utilized, allocated block-time per service, allocated block-time used per service, and the number of surgical cases referred outside NHJAX were analyzed. Data were collected over fiscal year 2002. Analysis showed that the OR suite is only utilizing 69.25% of available minutes for the year. Out of the seven surgical services only Ear, Nose, and Throat (ENT) consumes greater than 75% of its allocated minutes. The result of this study showed that the OR is being under utilized and that the antiquated data collection system (which requires a great deal of manual data collection) employed in the OR suite needs to be replaced with a user-friendly modern system. Implementation of a modern system will allow for improved utilization of resources, including equipment, rooms, and staff.

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Introduction

Overview of Naval Hospital Jacksonville

Naval Hospital Jacksonville (NHJAX) is located in sunny Jacksonville, Florida on the Naval Air Station. It is a medium size medical treatment facility (MTF), with seven outlying branch medical clinics (BMCs) from Athens, Georgia to Key West, Florida. The hospital is staffed with approximately 1,489 military, civilian, and contract personnel, with another 640 personnel at the BMCs.

The hospital has a 60-bed inpatient capacity that is expandable to 178-beds. In fiscal year (FY) 2002, NHJAX had a total of 405,814 outpatient visits (inclusion of BMCs resulted in a total of 704,261 outpatient visits), 5,255 admissions, and 13,264 occupied bed days. In FY 2001, NHJAX had 372,585 outpatient visits (inclusion of BMCs resulted in a total of 659,300 outpatient visits), 5,509 admissions, and 13,933 occupied bed days.

As a general medical and surgical facility and with a Level II emergency medicine department, the hospital provides a wide range of general and specialty care. It also supports a family practice graduate medical residency program, a Navy Nurse Corps anesthesia program, a perioperative Navy Nurse Corps training program, and a residency for U.S. Army-Baylor University Graduate Program in Healthcare Administration. While

maintaining services for its beneficiary population, the hospital provides personnel for various operational platforms including the fleet hospital.

Operational Definitions

For the purpose of this study, the following operational definitions apply.

Block-time per service – the minutes allocated daily for each surgical service during which only that service can schedule a surgery for the assigned operating room (OR).

Inpatient surgery – a surgical procedure performed when a surgical patient is admitted to the hospital for 24 hours or more.

Minutes allocated - the available minutes set aside (blocked) each month for a specific surgical service.

Minutes used - the actual minutes used to perform a case(s) by a specific surgical service.

Network – a group of civilian healthcare professionals in the community that has contracted with TRICARE to supplement care provided to military beneficiaries.

Outliers - any minutes that do not cluster around the average minutes per case or average turnover times.

Same day surgery – a surgery performed on an outpatient basis at the hospital when the patient stay is less than 24 hours.

Surgical time – the period from surgical incision to placement of dressing.

TRICARE – the Department of Defense (DoD) managed care program for healthcare, which encompasses a health maintenance organization model (TRICARE Prime) as its centerpiece, a preferred provider option (TRICARE Extra), and a fee-for-service option (TRICARE Standard).

Turnover time - the time between one patient leaving the operating room and the next patient entering it.

Usage – the surgical demand demonstrated by the amount of time the OR suite is used.

Utilization - the total amount of time used compared with the total amount of time budgeted for in the operating suites.

Conditions Which Prompted the Study

The evolution of TRICARE, the increasing number of options available to military beneficiaries, and the increasing cost of healthcare, dictate that MTFs bring beneficiaries back into the facility while efficiently employing available resources. To help facilitate this, the commanding officer challenged each

department to implement a family centered care (FCC) approach throughout the organization (Lockhart, 2002).

Family centered care focuses on shifting from episodic care to preventive care through implementation of population health initiatives; thereby, offering increased response to customers. Customers include not only the beneficiary population, but the hospital staff and BMC staff as well. Family centered care will affect every area of the organization. With this concept the surgical suite staff must market the services provided to customers. Marketing will ensure widest dissemination of services offered and possibly recapture beneficiaries once they are aware of the variety of surgical procedures performed in the facility.

The surgical suite consists of six general ORs and two obstetric ORs, the latter being located on the labor and delivery floor. The surgical suite is staffed by 12 perioperative nurses, 32 OR technicians, and 13 anesthesia providers (6 physicians and 7 certified registered nurse anesthetists), who provide services to approximately 33 surgeons from 7 surgical areas. The seven areas allocated time in the surgical suite are general surgery; orthopedics; gynecology; urology; ophthalmology; oral maxillofacial; and ear, nose, and throat (ENT).

Elective procedures are scheduled in 480-minute blocks of time Monday through Friday, except Thursday when 450-minute blocks are used due to staff meetings and training. One of the five ORs remains open for emergency cases only. The operating suite has minimal staffing after normal working hours and can be used for emergency surgeries 24 hours a day, 7 days a week. A total of 945 inpatient and 2,529 same day surgery cases were performed in FY 02.

Complete data for minutes allocated and used were unavailable for all of FY 01, as collection did not begin until July 2001. The 3 months of data that were collected showed 111,842 minutes allocated and 84,471 minutes used. A total of 516,140 minutes were allocated to all services for FY 02 with only 357,421 minutes being consumed, a utilization average of 69.25%. Several services did not fully use allocated, blocked time while others exceeded scheduled time.

Statement of the Problem

The implementation of family centered care requires all departments in the organization to assess their current business practices. To meet this challenge, the staff of the surgical suite must determine if the operating suite is being utilized efficiently. To determine if increasing the OR caseload at NHJAX is feasible; several data elements must be analyzed.

First, what is the genuine capacity of the surgical suite? Second, are areas that interact with the operating room (i.e., same day surgery unit [SDS], intensive care unit [ICU], post anesthesia care unit [PACU]) capable of adequately providing support without straining the system? Third, is a redistribution of current allocated block-time needed? Finally, the number and type of elective procedures that are referred to the network should be evaluated to determine the overall impact of recapture.

Literature Review

Prior to the implementation of managed care, hospitals did not have to focus on OR scheduling efficiency because "collections for OR care often exceeded five times hospital costs" (Mazzei, 1999, p. 1). As managed care and reimbursements continually tighten, organizations look for methods to decrease cost and improve efficiency and utilization while providing quality care. Efficiency of key cost centers is imperative during any re-alignment. Size of the organization is not a major consideration. Utilization management is one method to increase efficiency. Several areas that impact utilization in the operating suite include the method of scheduling, sequencing of cases, and turnover times.

What is a realistic target for operating room utilization? Many managers hear the figures of "80% to 85%" (Patterson, 1997). Ed Parkhurst, of PRISM Healthcare Consulting, suggests these figures date back to the early 1970s when hospitals needed to justify new hospital construction or renovations due to the certificate-of-need procedures required by federal legislation. As time passed these figures became a goal for operating room staff.

Many experts believe the maximum utilization rate is 80% to 85% before flexibility starts to decline. When flexibility begins to decline then the organization should start looking at how all available space is used. The American Hospital Association developed a space-planning software program for OR utilization. According to Patterson (1997) its guidelines included:

- Standard ORs - 75%
- Neurosurgical and cardiac rooms - 65%
- Cystoscopy rooms - 50%

An article written by Govern (2001) asserts that 85% is considered optimum utilization and anything higher tends to generate bottlenecks.

A multi-hospital study on utilization in the operating room published in 1974 by the Chicago Hospital Council, is the most often referenced work in this area. The study examined 12

hospitals in the Chicago area. Some findings (see discussion in Patterson, 1997) included:

- Utilization ranging from 75% to 80% with an average of 53% (although a rate of 75% to 80% was considered obtainable, none of the 12 hospitals were able to achieve the goal).
- Utilization ranging from 40% to 83% with an average of 62% was seen in general-purpose operating rooms (these rooms performed a large variety of surgeries without compromising patient safety).
- Utilization ranging from 17% to 36% with an average usage of 23% was seen in special purpose rooms.
- The potential for 75% to 80% was well above the actual average utilization.

In 1996, OR Benchmarks completed a benchmarking study on operating room efficiency. Results were similar to those of the Chicago Hospital Council's study. The 157 facilities that participated in the study had an average overall utilization of 57% with a range of 35% to 83% (Patterson, 1997).

Mary Shetler (1972) reports that inadequate utilization in the operating suite is due primarily to scheduling of cases. The operating hours most often requested by surgeons are from 7:30 to 10:00 in the morning, with the second choice being in the afternoon from 12:00 to 2:00. Hours available outside of

these times, although scheduled, are not a first choice or second choice for surgeons performing elective cases.

The healthcare system is continually transforming how medical care is provided. As the practice of nontraditional medicine increases, providers and other hospital staff cannot lose sight of the reason why hospitals exists. Hospitals are not in business for the convenience of the providers or just to provide employment for other staff members; rather, they are in business for the patients.

Generally, one of two methods is used to allocate OR time; block-scheduling or open-booking. Each method has its own drawbacks. A master schedule defining the number and type of operating rooms available, the hours available, and the services that are allowed to book during the available hours is utilized for block-scheduling. Although this method of scheduling "has been observed to be potentially more efficient, this is dependent on whether the scheduled block accurately reflects the actual patterns of usage and whether mechanisms are in place to release unreserved blocks in a timely manner" (Kontak-Forsyth & Grant, 1995, Summary section, para. 3).

An open schedule operates on the premise that the first surgeon requesting a time will be booked (first come, first served). This type of scheduling, although easily implemented and widely used, has several disadvantages. These disadvantages

include excessive overtime, friction between surgeons/services, increased levels of cancellations, and low resource utilization.

Prior to deciding on the most efficient scheduling method for a particular facility, the organization needs to clarify its mission and goals. Dexter (2000a, 2000b) discusses the following four strategies for operating room scheduling. First, incurring the least cost possible, provide care to all patients, while allowing the surgeon to choose day of surgery. This strategy places no limits on number of hours a surgeon can schedule elective cases. All cases are performed without time or staff restraints. This method is commonly used by private-practice-surgeons in medium and large operating suites. Second, maximize medical outcomes of a population, subject to the constraint of a blocked-time schedule, for elective cases. If this is the goal, then ORs should not strive for an ideal utilization rate since ideal block-time utilization is irrelevant. Third, minimize cost while caring for all patients within an institutionally defined reasonable period of time. Use of this strategy requires collaboration among anesthesia, surgical groups, and integrated case scheduling management. Elective cases performed after normal operating hours will occur only if they are due to limited OR time (during normal hours) or an extensive waiting period will occur. Lastly, maximize revenues subject to the constraints of a fixed schedule for all

elective surgery. This strategy requires limiting cases performed to regularly scheduled hours.

Dexter (2000c) states there are two reasons why OR time is under utilized. First, although surgeons plan surgery and the suite is available, patients opt out. Second, patients seek surgical treatment and an operating room is vacant, but a surgeon is not available; thereby, creating a situation that causes under utilization in an integrated scheduling system.

Cases should be scheduled to reduce the impact of equipment and personnel. This will require that case times be predicated accurately. Algorithms are a useful way of doing that (Dexter, et al, 1999).

Mazzei (1999) states the variable with the greatest effect on OR utilization is the length of time patients wait before undergoing surgery. A computer simulation conducted by Dexter, Macario, Traub, Hopwood, and Lubarsky (1999) showed that operating room utilization could increase 6% to 29% (13% average) with a waiting time of only 1 to 2 weeks. A 2 to 3 week delay results in an improvement of 0% to 12% (5% average).

Turnover time is another important factor to consider when assessing OR efficiency. In 1991, the search for that magical number was labeled "a sacred cow" (Patterson, 1999, p. 7) by *OR Manager*. This means that patient outcomes are not necessarily improved, but that the ritual of the search itself has been

blessed by time. At present "there is no national standard for turnover time" (Patterson, 1999, p. 9).

As with any industry, healthcare organizations cannot be fit into a standardized template. Turnover times will vary according to the type of procedures and other organizationally specific factors, making it nearly impossible to apply a national standard for turnover time across the spectrum of healthcare. In one organization alone, surgeons, anesthesia personnel, and nurses can each differently define turnover time.

When looking at turnover times it is important to remember that numbers alone will not disclose factors underlying turnover. Internal processes will have a major impact. Therefore, healthcare administrators must look at both the numbers and the processes. Factors influencing turnover time include:

- Patient (readiness, arrival time)
- Performance and ability of anesthesia providers
- In-room staff
- Surgeons and assistants
- Support personnel
- Equipment and supplies
- Procedures and protocols
- Patient flow

Cheryl Barratt of Concepts in Healthcare, a Becton and Dickinson consulting unit, believes that instead of comparing turnover times with other organizations it "may be more useful to compare turnover times by surgeon for key procedures within the same OR" (Patterson, 1999, p. 9).

Statement of Purpose

It was the purpose of this study to determine if the OR at NHJAX is being utilized efficiently. The variables examined were: OR capacity, utilized OR capacity, allocated block-time per service, allocated block-time used per service, and number of surgical cases referred outside NHJAX.

Methods and Procedures

This was a retrospective study involving no patient specific information. Fiscal year 2002 data, (October 1, 2001 through September 31, 2002) was collected. These data can serve as a baseline for future studies on OR utilization at NHJAX. Using SPSS for Windows®, descriptive statistics were compiled and analysis done on data collected on variables identified in the statement of purpose. Descriptive statistics were used to determine the means and standard deviation of cases or minutes around the mean.

The number of surgical referrals outside NHJAX for FY 02 was obtained from the consultation control department in the

hospital. Minutes allocated and minutes used were determined for each of the services to establish the percentage consumed for each month. This was done by dividing the minutes used by minutes allocated and multiplying by 100 to get a percentage of OR utilization for each service for a specific month or a yearly percentage.

An analysis of percentages of allocated minutes was performed to determine which services were over utilizing and which services were under utilizing. Over utilization was defined as any use of greater than 85% of allocated minutes by each surgical service. Under utilization was defined as any use of less than 75% of allocated minutes by each surgical service. According to the literature, 80% to 85% OR utilization has become the goal for operating room staff and experts agree that this is the "maximum utilization an OR can be expected to reach" (Patterson, 1997). Determination of the overall utilization rate in the OR suite relied on the above criteria of greater than 85% for over utilization and less than 75% for under utilization.

Reliability and Validity

All data obtained from within the OR are considered to have come from an instrument with content validity. Cooper and Schindler (2001) contend the content validity of a measuring

instrument is the extent to which adequate coverage of the information under study is provided. The valid instrument used to collect required data for this study was the OR's time log. Operating room staff personnel have used this log for a several years and are familiar with its purpose. Construct validity is supported by the literature review. It is evident from the literature review that measurement of the utilization of an operating room is an appropriate measure of its efficiency.

The best method for determining reliability would be for all patients undergoing surgery during a particular period, e.g., fiscal year 2002, to have the same procedure a second time; thus, permitting one to compare the strength of relationship between the two data sets using correlation analysis. This is not realistic. Using all cases performed during the fiscal year by each surgical service provides reliability.

Assumptions

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

- Staffing remains stable and operating six ORs will not place a strain on staffing in the OR suite or other areas of the hospital. Possible deployments of the casualty receiving and treatment ship-8 (an aircraft/helicopter

carrier used primarily by the Marine Corps for transportation which later becomes a combat warship medical facility when the Marines leave the ship), fleet hospital (a transportable medical and surgical unit [up to 500-beds] designed to be up and running anywhere in the world within 10 days of a call to service), and 2nd force service support group (a medical battalion that supports Marines in the field, the primary source of medical support [level 2] above the aid station level) platforms staffed by NHJAX were not factored into this study.

- There is enough equipment in operational order to perform all required procedures while maintaining the current OR standards for use of equipment. Standards require that equipment is not flash-sterilized between cases.
- An increase of surgical cases will not affect the high quality of care surgical patients currently receive.
- Support areas (SDS, ICU, and PACU) will not be unduly affected by an increase of surgical cases.
- NHJAX is a teaching hospital, and this is not expected to change in the future.

Results

When assessing the utilization of the surgery suite, the first area of concern was the number of procedures the surgery suite was capable of supporting each day, when all six ORs were operating. Although the surgery suite is available and can support emergency surgeries 24 hours a day, 7 days a week, only normal working hours (Monday – Friday, 0730 – 1530) were used to determine the number of cases per day necessary for OR utilization to reach 80%. Each room is available for 480 minutes, 4 days a week and 450 minutes on Thursday. If weekends and federal holidays are not counted, the OR suite is operational 8.975 months (35.9 weeks) per year. The formula used was:

Minutes/Day = Avg. Cases/Day/Rm) x #Rms/Day = Total Cases/Day) x Avg. Mins/Case

Days/Wk = Cases/Wk) x 4 Wks/Mo = Cases/Mo) x 8.975 Mo/Yr = Cases/Yr

In order to employ all six ORs at an 80% efficiency rate the following caseload is needed: 20.6 to 21.9 cases per day, 108.3 cases per week, 433.4 cases per month, and 3,889.5 cases per year.

Minutes Allocated per Surgical Service

Table 1 presents the total minutes of surgical time for inpatient and outpatient procedures that each service was allocated in FY 02. As noted orthopedics and general surgery

were allocated the most minutes during the fiscal year, constituting more than 55% of available OR minutes.

Table 1

Allocated Minutes FY 02

Surgical Service	Mins Allocated	% of Total Mins
General Surgery	125,791	24.37
Orthopedics	161,460	31.28
Gynecology	74,960	14.52
Urology	39,480	7.65
Ear, Nose, Throat	50,010	9.70
Ophthalmology	41,399	8.02
Oral Maxillofacial	23,040	4.46
Total Minutes FY02	516,140	100.00

Average Surgical Minutes per Case

To determine the average minutes per case, the total number of cases performed for a surgical service divided by the total surgical minutes utilized in FY 02 for each surgical service was used. Outliers were not accounted for. Table 2 indicates the average minutes per case for each of the seven surgical services.

Table 2

Average Minutes Per Case FY 02

Surgical Service	Cases	Mins Used	Avg. Mins/Case
General Surgery	969	96,160	99
Orthopedics	1,045	120,326	115
Gynecology	390	43,303	111
Urology	264	28,739	109
Ear, Nose, Throat	514	43,596	85
Ophthalmology	219	19,355	88
Oral Maxillofacial	103	15,567	151
Totals	3,504	367,046	105

Note: Outliers are not accounted for when calculating average minutes per case.

Cases per Surgical Service

Table 3 presents descriptive statistics for the number of cases per surgical services for FY 02, while n represents the number of months data was collected. The mean is the average number of procedures per month. The orthopedic service averaged the most cases (87.08) monthly, while dental averaged the least (8.58). The minimum and maximum number of monthly procedures per surgical service for the 12-month period are also depicted.

Table 3

Descriptive Statistics on Cases per Surgical Service

Surgical Service	n	Mean	SD	Minimum	Maximum
General Surgery	12	80.75	15.00	53	105
Orthopedics	12	87.08	14.64	62	109
Gynecology	12	32.50	6.56	19	41
Urology	12	22.00	6.71	11	33
Ear, Nose, Throat	12	42.83	10.60	24	59
Ophthalmology	12	18.25	2.56	15	23
Oral Maxillofacial	12	8.58	3.23	4	14

Minutes Used per Surgical Service

Table 4 presents descriptive statistics for the number of inpatient and outpatient minutes used per surgical services for FY 02, while n represents the number of months of data collected. The mean is the average number of minutes per month for each surgical service.

Turnover Time per Surgical Service

Table 5 presents descriptive statistics for turnover times (in minutes) for the surgical services for FY 02, while n represents the number of procedures that had documented turnover times. The mean is the average turnover time for each surgical service.

Table 4

Descriptive Statistics on Inpatient/Outpatient Minutes Used

		Inpatient		Outpatient	
Surgical Service	n	Mean	SD	Mean	SD
General Surgery	12	3729.42	979.07	4143.67	980.94
Orthopedics	12	2126.08	1885.32	7740.33	2537.11
Gynecology	12	1722.75	516.08	1552.08	698.15
Urology	12	1031.00	426.51	1196.67	529.36
Ear, Nose, Throat	12	1408.67	408.20	2262.33	914.91
Ophthalmology	12	15.08	35.28	1575.83	400.96
Oral Maxillofacial	12	261.25	286.26	1018.92	447.76

Table 5

Descriptive Statistics on Average Turnover Times

Surgical Service	n	Mean	SD
General Surgery	490	22.07	14.59
Orthopedics	553	20.29	11.01
Gynecology	183	23.56	11.85
Urology	137	20.98	10.77
Ear, Nose, Throat	325	15.83	11.84
Ophthalmology	139	15.58	11.18
Oral Maxillofacial	42	19.55	10.70

Note: Outliers were not accounted for.

Referrals from Each Surgical Service

During FY 2002, there were 1,415 referrals outside NHJAX. Five hundred sixty-six referrals were for orthopedic services. Other referrals included: 236 for general surgery, 127 for

gynecology, 236 for ENT, 125 for ophthalmology, 115 for urology, and 10 for dental. It is not known if any or all of these referrals resulted in surgeries in the network.

Surgical Cancellations/Delays

Cancellations of elective surgery in FY 02 totaled 212 cases across all seven surgical services. Either the surgeon or the patient can cancel elective surgery; and cancellation can be due to other operational commitments, the surgeon requesting additional evaluations, or the surgeon not showing up on day of surgery. Cancellation by a patient results from the patient reporting for surgery with a minor illness that requires the procedure to be cancelled or the patient not showing up due to fear of surgery or for other personal reasons.

In FY 02, 1,096 of the 3,504 surgical case (31.28%) performed were delayed. Table 5 indicates the number of cases and minutes of delay for the surgical services during the last 6 months (April to September) of FY 02. Causes for delays included:

- Anesthesia
- Preparation and positioning
- Surgeons (late)
- Equipment (not available)
- Patients (arriving late to the same day surgery unit)

During the last 6 months of the fiscal year, the orthopedic service experienced a greater number of delays caused by anesthesia (938 minutes among 86 cases) and preparation and positioning (1,965 minutes among 165 cases) than did the other services. Of the seven surgical services, ENT had the largest delay due to a surgeon being late (629 minutes among 19 cases). During this same time, equipment (319 minutes among 14 cases) and miscellaneous (480 minutes among 11 cases) delays resulted for all surgical services.

Table 6

Percentage of Total Time Delay by Surgical Services April – September 2002

Surgical Service	n	Number of Delays	Total Delay Time	% of Total Delay Time	Mean	SD
General Surgery	509	124	1,779	19.86	59.30	60.52
Orthopedics	562	263	3,187	35.57	106.23	139.70
Gynecology	200	57	713	7.96	23.77	27.67
Urology	125	41	752	8.39	25.07	31.61
Ear, Nose, Throat	298	96	1,721	19.21	57.37	74.39
Ophthalmology	113	38	522	5.83	17.40	33.55
Oral Maxillofacial	66	22	285	3.18	9.50	19.41
Totals:	1,873	641	8,959	100.00	N/A	N/A

N= Number of cases performed during six-month period of April-September 2002.

Cases Required per Surgical Service

In order for each surgical service to operate at 80% utilization, a minimum number of cases must be performed. Table

7 indicates the number of cases each surgical service should perform in order to reach an 80% utilization rate. This takes into account the number of days each week and number of rooms each day that a particular service is allocated time in the OR suite.

Table 7

Cases Required for 80% Utilization by Surgical Services

Surgical Service	Cases/Day (M,T,W,F/Th)	Cases/ Week	Cases/ Month	Cases/ Year
General Surgery	3.9/3.6	19.2	76.6	687.5
Orthopedics	6.7/6.3	32.9	131.8	1,182.6
Gynecology	3.5/3.2	17.1	68.3	613.1
Urology	3.5/-	7.1	28.2	253.3
Ear, Nose, Throat	4.5/4.2	8.8	35.1	314.6
Ophthalmology	4.3/-	8.7	34.8	312.0
Oral Maxillofacial	2.5/-	2.5	10.2	91.2

Note: On Monday, Tuesday, Wednesday and Friday each available OR is allocated 480 minutes. On Thursday each available OR is allocated 450 minutes due to a 30-minute delay in start time.

Discussion

Minutes Allocated per Surgical Service

The minutes allocated to each surgical service fluctuate monthly, due to the number of working days in the month. Historical data are not used in estimating how many minutes to allocate to each service monthly.

The minutes allocated to each surgical service are reviewed quarterly and adjusted as needed. Block-times are not split; therefore, a whole day is taken from the service that is under utilizing its allocated time. When a surgical service continually uses 40% or less of its allocated minutes, the minutes for that surgical service are reexamined and then probably redistributed to another service that is utilizing 80% or more of its allocated time. During FY 02, ENT's allocation went from two rooms per week to three rooms per week, due to its high usage of assigned minutes.

Average Surgical Minutes per Case

The average minutes per case ranged from 85 to 151 minutes. Oral maxillofacial cases required the most time to perform, while ENT cases required the least time to perform. This could be due to either case complexity and/or type of procedure performed.

Orthopedic providers performed 1,045 cases (120,326 minutes) while general surgery providers completed 969 cases (96,160 minutes) resulting in the most cases and minutes used of the seven surgical services during FY 02. The average case length during the fiscal year for orthopedics was 115 minutes while general surgery averaged 99 minutes a case.

Fiscal year 2003 minutes per case are subject to change according to how many minutes each surgical service is allocated for the month or year and how many minutes are actually consumed. Minutes per specific procedure were not used to determine average minutes per case since the OR suite's information system is unable to supply this type of data.

Cases per Surgical Service

As noted, during one month, personnel of the oral maxillofacial service performed only four surgical procedures. This was the fewest number of surgical procedures performed by any surgical service during any month in the fiscal year and is explained by the fact that the oral maxillofacial service only requires OR time when general anesthesia is necessary. Orthopedics and general surgery both had months where they exceeded more than 100 cases; orthopedics had as many as 109 and general surgery as many as 105. None of the other services reached such capacity. In fact, the closest, ENT, lagged by more than 50 cases. The mean number of cases performed per month ranged from 8.58 cases for oral maxillofacial, with a standard deviation of 3.23, to 87.08 cases in orthopedics, with a standard deviation of 14.64.

Minutes Used per Surgical Service

Among the various surgical services the average mean of inpatient minutes used for FY 02 ranged from a low of 15.08 minutes for ophthalmology to a high of 3,729.42 minutes for general surgery. The average mean of outpatient minutes utilized ranged from a low of 1,018.92 minutes for oral maxillofacial to a high of 7,740.33 minutes for orthopedics. The surgical service averaging the greatest number of allocated minutes used for inpatient surgery was general surgery. Orthopedics, followed by general surgery, used the most minutes in outpatient surgery.

Table 1 shows that the orthopedic service was allocated the most minutes in the OR, which would be expected since, as Table 4 shows, it consumed the most minutes overall. Appendix A shows the percentage of minutes used in FY 02 for each surgical service, broken down for inpatient and outpatient. Figures 1 through 7 in Appendix B are graphical representations of total minutes utilized during FY 02 compared to minutes allocated for each surgical service.

Turnover Times per Surgical Service

Although there is "no national standard for turnover time" (Patterson, 1999, p. 7), most studies "assume that a surgical suite already has a mean turnover time of less than 30 minutes"

(Dexter, 2000d, p. 25). The various surgical services had room turnover times ranging from 15.58 to 23.56 minutes. The surgical services with the shortest turnover times were ophthalmology, ENT, and oral maxillofacial. Their times ranged from 15.58 to 19.55 minutes, accounting for 27% of the sample (506 cases). The longest mean turnover times were in gynecology (23.56 minutes) and general surgery (22.07 minutes), which together accounted for 56% of the 1,043 sample cases. Outliers (longest and shortest cases) were not removed; the information system used by the OR did not have this capability.

As noted earlier, facilities should "[n]ever look at utilization as the only indicator of OR performance" (Patterson, 1997). Facilities should compare turnover times among surgeons for key procedures within the same facility. Comparing turnover time for key procedures instead of specialties would provide a better indicator of efficiency in utilization of the OR suite. For this study turnover times could not be compared among surgeons for key procedures since the current information system in the OR suite does not have this capability. Utilization can be artificially increased with long cases or excessive turnover times.

Referrals

It is unknown whether network referrals result from constraints of capacity or capability. Capacity is the number

of patients that can be seen at current staffing levels without affecting the quality of care provided. Capability refers to the hospital having equipment and supplies necessary to perform a particular procedure. If the hospital does not have required equipment or supplies, or if the hospital cannot meet the current standard of care, then capability does not exist. The referral management department of the hospital does not collect this information by capacity or capability.

Surgical Cancellation/Delays

Surgical cancellations accounted for 6.0% of cases in FY 02. Although this is not a large percentage of surgical cases, it is costly and results in the inefficient use of OR staff. When cancellations occur managers must then devote excessive time to rearranging the remaining scheduled cases to ensure personnel are used effectively and that cases that can be performed earlier are rescheduled.

Delays accounted for 14,046 minutes (3.93%) of the total 357,421 minutes of OR time used during FY 02. A significant contributing factor to delays in the OR is late arrival of surgeons (Robinson, 1993) and anesthesiologists (Grudich, 1991).

Data regarding delays were collected over a 6-month period, April to September 2002. Orthopedic service lost the most time (3,187 minutes) due to delays. Appendix C shows each of the

surgical service's delays broken down by the number of cases and actual minutes of delay. Although literature shows that late surgeons are the number one reason for delays, this is not the case at NHJAX. Late surgeons only accounted for 11.20% of delays while the preparation and positioning of patients accounted for 55.01% (4,928 minutes). Orthopedic service accounted for 21.93% (1,965 minutes) of delay due to preparation and positioning. All other surgical services accounted for less than 10% each.

Cases Required to Obtain 80% Utilization

Each month the surgical services are allotted a specific number of minutes, distributed in block-time format, in the surgical suite. Some services have one to two rooms per week while others have one room available 5 days a week.

Total minutes of OR time used by the surgical service divided by the number of cases a particular surgical service performed during FY 02 resulted in the average minutes per case. The average minutes per case is subject to change during FY 03 depending upon case complexity, length of case, and number of cases performed for each surgical service.

Using the previously discussed formula, the average minutes per case was employed to help determine the number of cases to be performed to acquire an 80% utilization rate for that

service. To reach 80% utilization, as indicated in table 6, orthopedics must perform more cases daily (6.7/6.3), weekly (32.9), monthly (131.8), and annually (1,182.6) than the other surgical services. The oral maxillofacial service must perform the fewest cases daily (2.5), weekly (2.5), monthly (10.2), and annually (91.2).

Conclusion and Recommendations

The purpose of this study was to determine if the OR suite was being utilized efficiently. Data collected and analyzed indicate that the OR suite is not being operated at its maximum potential. When all seven surgical services are considered, the data show that the OR is being under utilized. Currently the utilization rate is 69.25%.

When comparing each surgical service's utilization of its OR time, only ENT used more than 85% of the time allotted. All other surgical services expended 75% or less of allocated time, with ophthalmology using the least at 46%. Patterson (1997) states that when one surgical service's utilization is greater than 80% to 85%, other surgical services will usually have lower usage to compensate. This fits that pattern.

The acquisition of a surgical information system is needed to help manage the surgical suite and capture patient data throughout the surgical continuum. The system currently used by the OR suite was developed for another facility and tailored for

NHJAX. It has been used since November 2000, is not user friendly, and is unable to respond to basic queries for general information such as, but not limited to, turnover times, surgical outlier times, and case lengths.

Currently, staff members manually collect data from hand written logs to generate reports. This is not only time consuming, but it also leaves room for increased error. Moreover, the current system cannot compare the performance of providers.

Implementation of an advanced surgical information system will allow personnel in the surgical suite to maximize the quality of patient care, develop business strategies, optimize processes, and increase return on investment. Productivity can be increased by eliminating non-clinical tasks, such as manually preparing reports and manually completing OR time sheets for each room, that are presently performed by clinical staff.

A good surgical information system can provide credible data to help staff members make changes in the way they perform. Credible data allow for providers to identify bottlenecks caused by their unique way of performing procedures, thereby, allowing for the development and improvement of clinical pathways. High-quality data not only allow for improved efficiency in the OR suite but also can produce cost savings. Analysis of data will

enable personnel to reduce duplication of activities, identify and reduce delays, and increase compliance of providers.

There are several ways to help improve OR utilization. Some of these include reducing the number of ORs available and implementing an integrated surgical information system. Reducing the number of available ORs would increase utilization since utilization is only measured for the rooms remaining open and staffed. If rooms that are not being utilized efficiently are closed, staff redistribution can occur. This can increase the available time in the more efficient ORs, which will thereby increase efficiency and utilization of the OR suite.

It is the opinion of the researcher that the OR suite personnel can improve utilization. Replacement of the existing information system with a more user friendly system that better captures, manages, and interprets data should be the initial step. Implementation of a modern system will improve utilization of resources including equipment, rooms, and staff.

Appendix A

Percentage of Minutes Utilized

	Inpatient		Outpatient		Total	
Surgical Service	Utilized	%	Utilized	%	Allocated	%
General Surgery	44,763	36	49,724	40	125,791	75
Orthopedics	25,513	16	92,884	58	161,460	73
Gynecology	20,673	28	18,625	25	74,960	52
Urology	12,372	31	14,360	36	39,480	68
Ear, Nose, Throat	16,904	34	27,148	54	50,010	88
Ophthalmology	181	0	18,910	46	41,399	46
Oral Maxillofacial	3,135	14	12,227	53	23,040	67

Appendix B

Figure B1

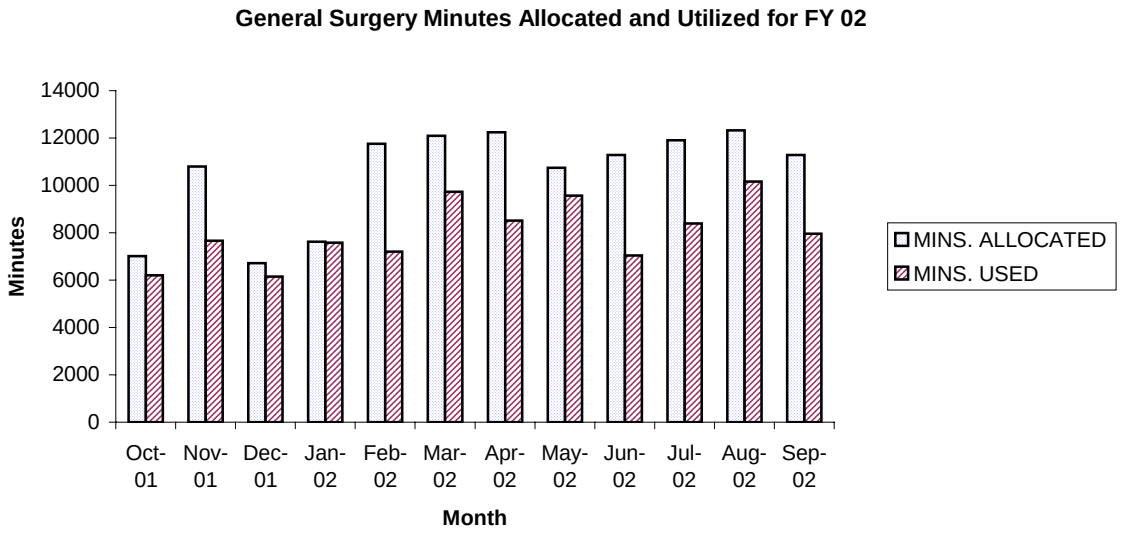
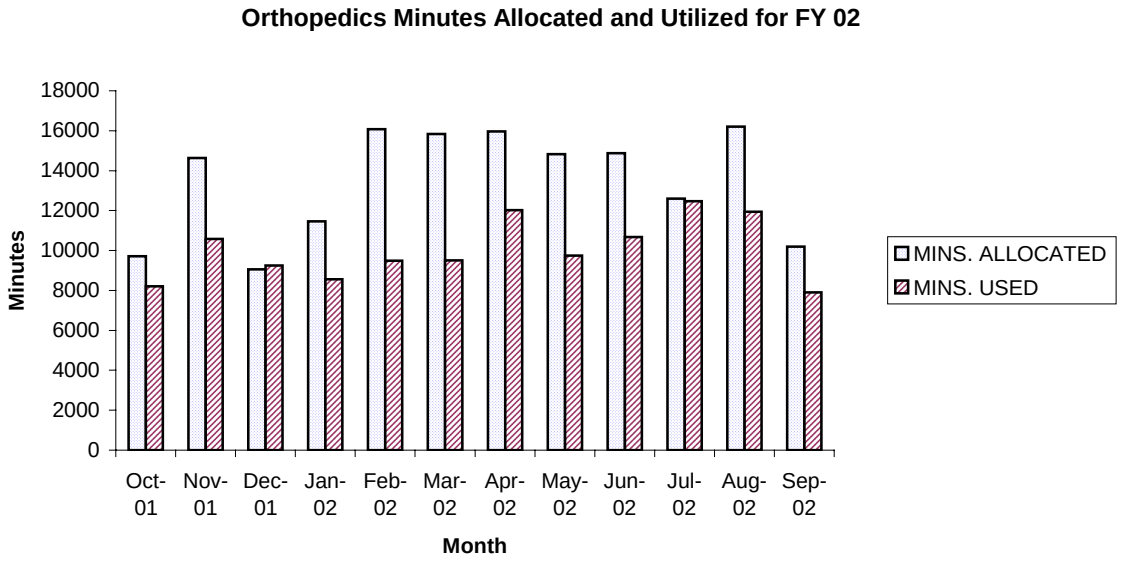


Figure B2



Appendix B

Figure B3

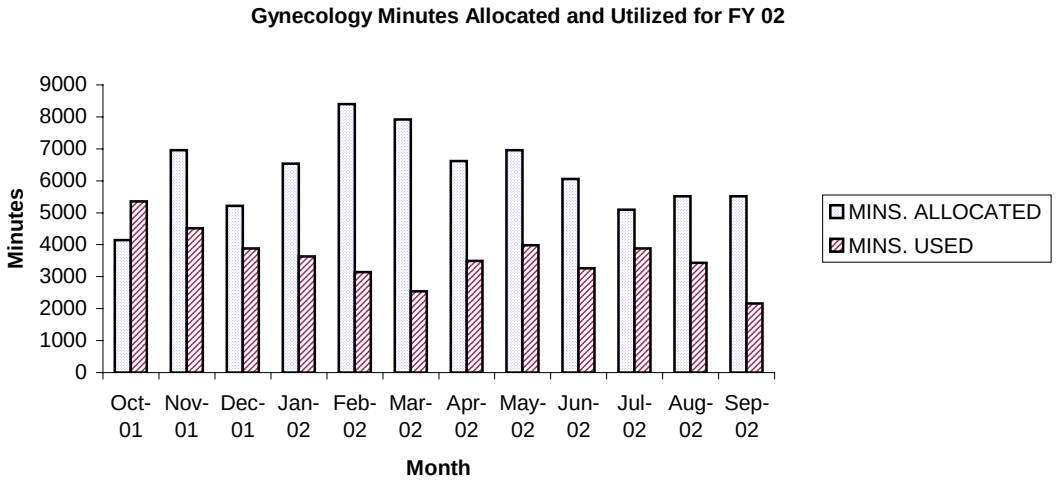
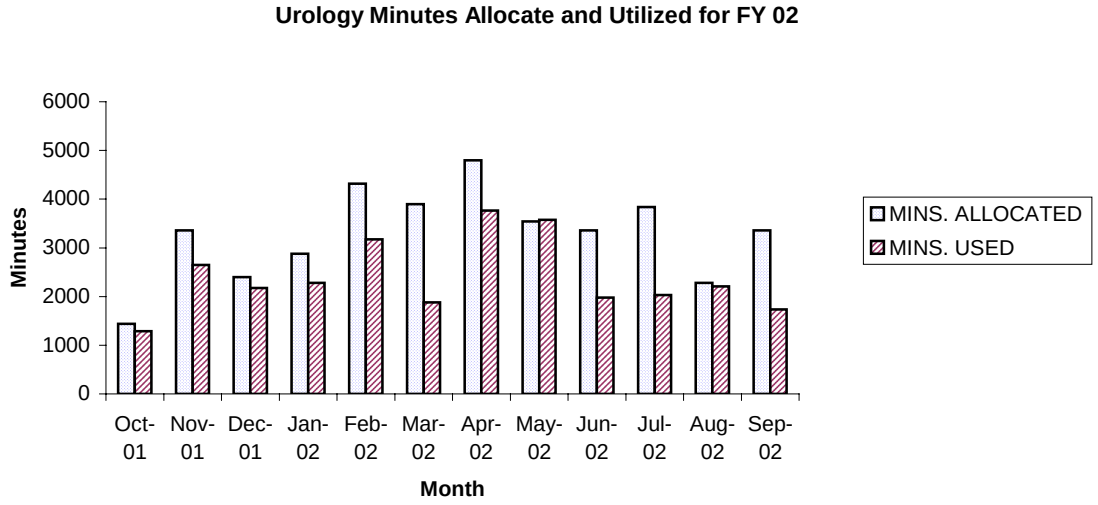


Figure B4



Appendix B

Figure B5

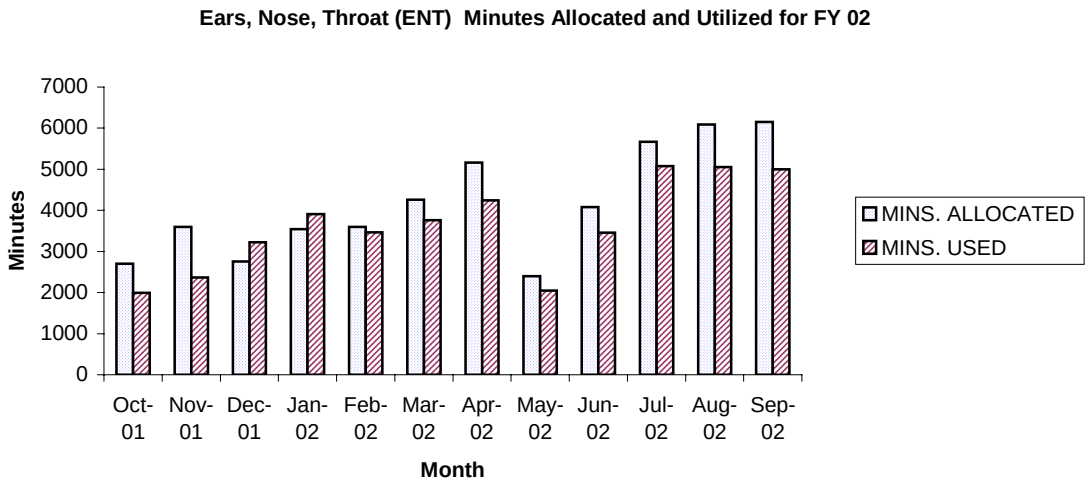
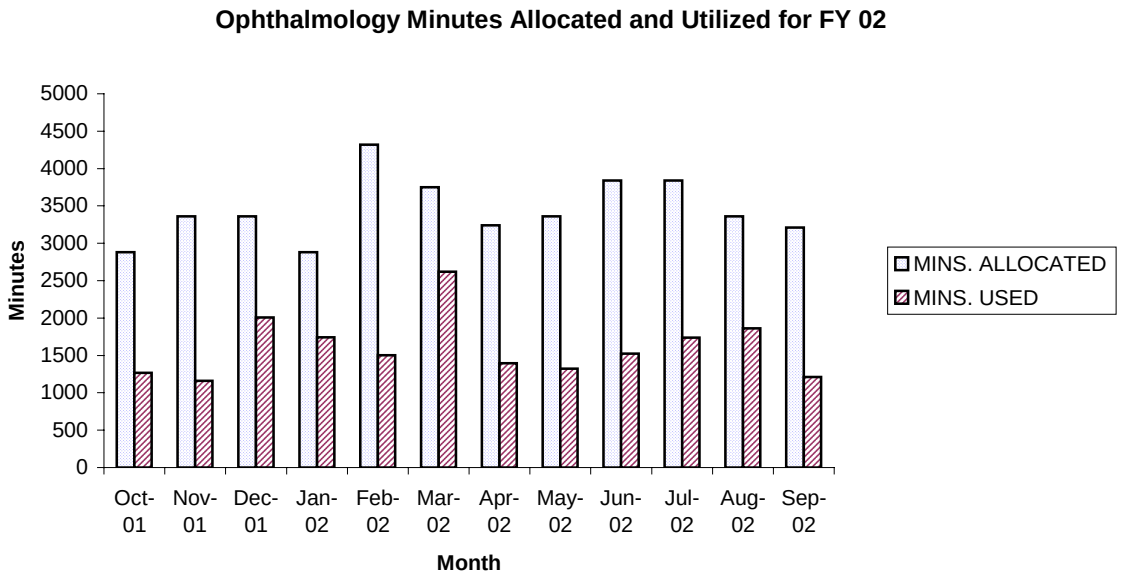
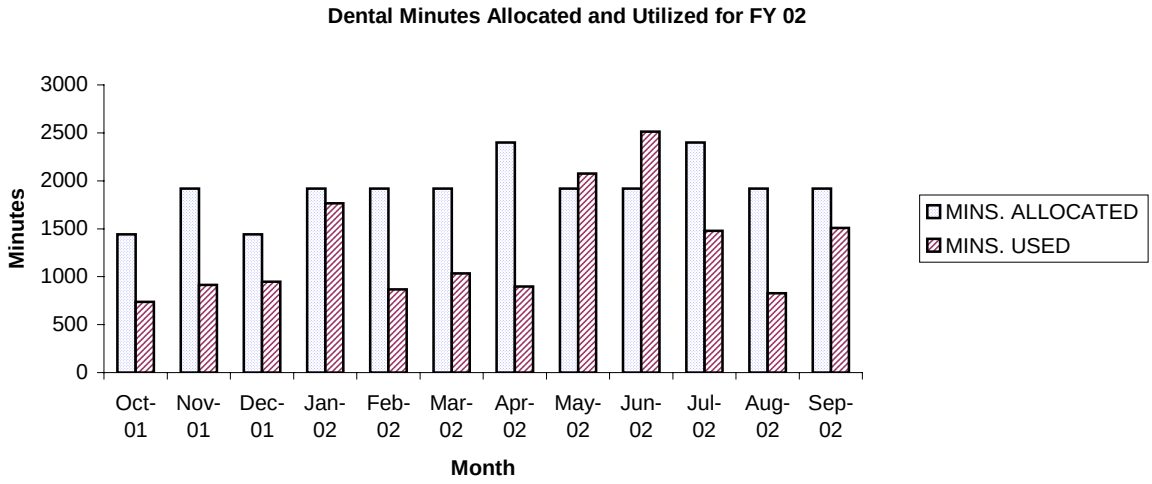


Figure B6



Appendix B

Figure B7



Appendix C
Number Cases/Minutes Delays

	Overbooked		Anesthesia		Prep & Positioning		Surgeon Late		Equip		Misc.	
	Cases	Minutes	Cases	Minutes	Cases	Minutes	Cases	Minutes	Cases	Minutes	Cases	Minutes
ORTHO	11	251	18	178	30	344						
	27	768	15	133	26	274						
	13	446	13	157	35	516	2	40			2	60
	20	986	9	59	26	291	2	25	1	25		
	17	747	5	66	20	244			2	35		
	25	1,310	26	345	28	296	1	27	1	12	1	60
Totals:	**113**	**4,508**	**86**	**938**	**165**	**1,965**	**5**	**92**	**4**	**72**	**3**	**120**
GEN SURG	13	396	12	118	14	179	1	60	2	55		
	25	1,361	7	70	13	133						
	10	480	3	53	10	147					1	20
	10	175	8	97	13	156						
	10	447	9	137	9	92	1	20	1	30	1	120
	11	603	8	102	9	155	1	20	1	15		
Totals:	**79**	**3,462**	**47**	**577**	**68**	**862**	**3**	**100**	**4**	**100**	**2**	**140**
ENT	5	92	10	80	10	137	5	234				
	8	341	4	93	14	211	3	45				
	4	108			11	176	1	20				
	6	105	3	21	8	146	2	45				
	4	301			6	107	1	75	1	15		
	4	168	2	22	8	84	7	210				
Totals:	**31**	**1,115**	**19**	**216**	**57**	**861**	**19**	**629**	**1**	**15**		
EYE	2	205	1	5	5	39			1	10		
	3	102			13	163	1	45				
					3	33					1	20
	4	51										
	3	66	1	15	5	46	1	15	1	10		
	2	71			4	61	1	60				
Totals:	**14**	**495**	**2**	**20**	**30**	**342**	**3**	**120**	**2**	**20**	**1**	**20**

Appendix C
Number Cases/Minutes Delays

	Overbooked		Anesthesia		Prep & Positioning		Surgeon Late		Equip		Misc.	
	Cases	Minutes	Cases	Minutes	Cases	Minutes	Cases	Minutes	Cases	Minutes	Cases	Minutes
DENTAL			2	22								
			1	32	3	15						
	3	99			1	40						
	4	126	2	10	7	91						
	2	98	1	8	2	29						
			1	7	2	31						
Totals:	**9**	**323**	**7**	**79**	**15**	**206**						
GYN	1	39	2	13	6	48						
	7	279	1	20	11	75						
	6	306			4	30					2	75
	4	108	4	37	8	91					1	35
	6	479	3	43	4	64					1	50
			1	16	6	42	2	32	1	42		
Totals:	**24**	**1,211**	**11**	**129**	**39**	**350**	**2**	**32**	**1**	**42**	**4**	**160**
UROLOGY	2	18	3	40	1	10						
	3	208	3	55	6	109						
	1	9	4	52	4	85			1	40	1	40
	4	189	2	75	2	46						
	1	38	1	5	3	81						
	3	95	5	43	2	11	2	30	1	30		
Totals:	**14**	**557**	**18**	**270**	**18**	**342**	**2**	**30**	**2**	**70**	**1**	**40**

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