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The Obstetrics and Gynecology (OB-GYN) clinic at Reynolds Army Community Hospital, Fort Sill, Oklahoma, provides a wide range of specialty services for complicated obstetrical (OB) cases and many gynecological (GYN) cases to an estimated beneficiary population of more than 25,000 females. At present, the professional staff cannot handle the current demand for services. Because of this staffing constraint, many patients are referred to the Preferred Provider Network of OB-GYN physicians for necessary treatment under the Catchment Area Management Project (CAM). Under CAM, the hospital commander finances care provided both at Reynolds Army Community Hospital (RACH) and on CHAMPUS. The goal of the CAM demonstration project is to provide quality patient care at a demonstrated cost savings by managing treatment location. For treatment at RACH, the OB-GYN clinic Chief establishes a patient appointment schedule on the basis of experience with, and knowledge of, patient demographic data. This study outlines one method of determining which type of patient appointments should be seen at the OB-GYN clinic by using simultaneous mathematical models in the scheduling process. The objective is to provide the clinic Chief with a useful tool in templating a cost effective schedule.

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FOR Residency Committee. U.S. Army-Baylor University Program in Health Care Administration (HSUA-IHC), Academy of Health Sciences, U.S. Army, Fort Sam Houston, TX 78234-6100

I am very pleased to forward CPT Hanf's Graduate Management Project (GMP) to the residency committee. As you read his project, it will become evident to you that he has the ability to apply his academic training to real-world problems not only at Reynolds Army Community Hospital, but wherever his career might take him in the AMEDD. I highly encourage you to consider CPT Hanf's GMP for the Boone Powell Award. CPT Hanf's GMP is indicative of his continual quest for knowledge concerning the complex realities in health care management. He is an exceptional officer as well as an excellent student.

DENNIS H. JOHNSON
COL, MS
Deputy Commander for
Administration

Scheduling Outpatient Services: A Linear Programming Approach

A Graduate Management Project

Submitted to the Faculty of

Baylor University

In Partial Fulfillment of the

Requirements for the Degree

of

Master of Health Administration

by

Captain Darrell J. Hanf, MS

28 July 1990

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A project of this magnitude could not possibly be accomplished without a tremendous amount of support and assistance from many people. Although the total list of people who have helped me throughout the year is lengthy, I would like to mention several people who deserve special recognition for their efforts during the course of this study. I would like to thank Janet Meghia and Art Kromer for helping me retrieve and search through hundreds of inpatient and outpatient records in hopes of developing the 'episodes of care' necessary for the linear model. I would also like to thank Mary Nahrgang and Major Kathyrn Parks for their knowledge and advice on the operation of the OB-GYN clinic. I would like to make special mention of Major Jose Galarza, one of my faculty advisors, for his time and patience in formulating the linear programming model. His insight into the formulation of linear models, and timely assistance in the methodology for this study were invaluable. A further acknowledgment goes to Colonel Dennis Johnson, residency preceptor, for allowing me the latitude and flexibility to complete this study. His guidance, support, and encouragement were vital throughout the year. Finally, I would be remiss if I didn't express my deepest appreciation to Annette, my wife, and my three children: Nichole, Nathaniel and Colleen. Their love and support kept me going throughout the year.

Abstract

The Obstetrics and Gynecology (OB-GYN) clinic at Reynolds Army Community Hospital, Fort Sill, Oklahoma, provides a wide range of specialty services for complicated obstetrical (OB) cases and many gynecological (GYN) cases to an estimated beneficiary population of more than 25,000 females (Fact Sheet, 1989). At present, the professional staff cannot handle the current demand for services. Because of this staffing constraint, many patients are referred to the Preferred Provider Network of OB-GYN physicians for necessary treatment under the Catchment Area Management Project (CAM). Under CAM, the hospital commander finances care provided both at Reynolds Army Community Hospital (RACH) and on CHAMPUS. The goal of the CAM demonstration project is to provide quality patient care at a demonstrated cost savings by managing treatment location. For treatment at the RACH, the OB-GYN clinic Chief establishes a patient appointment schedule on the basis of experience with, and knowledge of, patient demographic data. This study outlines one method of determining which type of patient appointments should be seen at the OB-GYN clinic by using simultaneous mathematical models in the scheduling process. The objective is to provide the clinic Chief with a useful tool in templating a cost effective appointment schedule.

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Introduction

For several years, officials in the Department of Defense (DoD) realized the need to control the upwardly spiraling costs of the Civilian Health and Medical Program of the Uniformed Services (CHAMPUS) component of the Military Health Services System (MHSS). Originally, the DoD developed CHAMPUS as a supplemental cost-sharing insurance plan because of the inability of the direct care system to handle the increasing dependent and retiree population (Phelps et al., 1984). It soon became apparent, however, that the rate of growth of CHAMPUS was much more rapid than that of the direct care system. Because DoD funded this costly CHAMPUS program, it initiated several cost control initiatives in an attempt to contain costs. Many of these initiatives involved using existing resources (e.g., personnel, facilities) more effectively.

This section will sketch an overview of the financial impact that CHAMPUS has had on the Military Health Services System, and present several reasons for the rapid CHAMPUS growth rate. Then, a DoD cost control initiative of the CHAMPUS program currently being tested at Fort Sill will be presented. The following section will discuss the goals of the CAM demonstration project at Fort Sill,

and focus on one aspect of the CHAMPUS problem at Reynolds Army Community Hospital (RACH).

Overview

An examination of DOD medical cost figures over the past 10 years shows the impact of the CHAMPUS program. Outlays for DoD medical costs have grown from $4.1 billion in fiscal year (FY) 1979 to $12.5 billion in FY 1988, while the CHAMPUS costs soared from $485 million to $2.4 billion during the same period (Gisin & Sewell, 1989; Congressional Budget Office, 1988). These dollar figures represent a CHAMPUS rate of growth of 494 percent, significantly higher than the entire DoD medical expenditure growth rate of 271 percent. Due to this rapid growth in CHAMPUS costs, DoD was confronted with annual budget shortfalls averaging more than $300 million. To cover CHAMPUS obligations, each year DoD was forced to shift millions of dollars from supplemental funds (Gisin & Sewell, 1989, p. 88).

Arguably, CHAMPUS's difficulties, in fact those of the entire military health care system, are symptomatic of two problems: (a) the increasing size of the eligible beneficiary population, and (b) the lack of provider and consumer incentives to contain costs. In the United States alone, over 8 million beneficiaries are entitled to care at approximately 129 hospitals and 350 outpatient (freestanding) clinics in the direct health care component of the

Military Health Services System (Congressional Budget Office, 1988). The demand for services by this vast number of eligible beneficiaries (9.2 million worldwide) far exceeds the capabilities of the military health care system; thus, many eligible beneficiaries are referred to the more expensive CHAMPUS component for care.

The first apparent cause of CHAMPUS's difficulties is the increasing size of the beneficiary population. Gisin and Sewell (1989) reported that the 20-year military retirement and the general increase in life expectancy rates for Americans are factors which account for the beneficiary population increase. Compounding these two factors is the heavier use of military health services in comparison to civilian counterparts. "While the average rate of outpatient visits in the civilian population is about five a year, active-duty dependents average seven outpatient visits a year--a difference of 40 percent" (Congressional Budget Office, 1988, p. 16).

The lack of appropriate incentives to control utilization in the military direct care system appears to be the second cause of CHAMPUS's difficulties. The military budgeting process allocates funds by workload not by productivity, utilization or health status. The more workload generated by providers in the direct care system the more reimbursement facilities receive, even though

the health status of their beneficiaries may not have improved. As a result, there is no incentive for the military provider to 'curb per capita use of medical services' (Congressional Budget Office, 1988, p. 20). Nor does the consumer have an incentive to curtail current demand levels, because outpatient services provided in the direct health care system are free. There is no copayment, no usage fee, no provider fee, no deductible, and no charge for pharmaceuticals--even hospital stays in the direct care system cost beneficiaries only $8 a day (Gisin & Sewell, 1989).

A further difficulty for CHAMPUS is that the budget process does not penalize managers for allowing patients to use CHAMPUS as a more expensive supplement to the existing military facilities. Although dependents and retirees pay higher out-of-pocket costs under CHAMPUS, many hospital commanders have 'overtly encouraged' patients to use CHAMPUS as a means of reducing the long queues at military facilities (Gisin & Sewell, 1989, p. 88). This action certainly helps the direct health care system, but creates a problem for DoD since there is no control on utilization of services after a beneficiary is receiving care through CHAMPUS.

In an attempt to control the escalating costs of health care, DOD has sponsored several programs such as PROJECT RESTORE and the Military-Civilian Health Services Partnership Program to 'bring medical workload into military hospitals and clinics.' These

programs had only limited impact on cost containment (Executive Summary, 1988, p. 2). An outgrowth of these early initiatives has been a concept termed catchment area management (CAM) which is currently being tested at Fort Sill.

Catchment Area Management is a managed care program which provides the hospital commander with the authority and flexibility to manage his resources and patients within his area of responsibility. The DoD defines that area of responsibility to be "the region roughly 40 miles around each military hospital" and is termed a catchment area (Congressional Budget Office, 1988, p. 11). Under CAM, the hospital commander has exclusive responsibility for all care to enrolled beneficiaries. "Instead of two health plans in a given catchment area--one run by a private carrier [CHAMPUS], the other by the local military medical commander--there . . . [is] a single military-based plan" (Congressional Budget Office, 1988, p. 69). Under CAM, the hospital not only receives its direct care funding appropriations, but also receives CHAMPUS dollars of an amount approximately equal to the previous year's expenditures (Gisin & Sewell, 1989, p. 88). For FY 1989, RACH received an additional $12.6 million for its CAM project.

In order to develop the most cost effective combination of services, the commander must decide which services will be provided in-house under direct care, and which will be referred to the local

community. These decisions must be made 'ensuring that all beneficiary needs are met, while [simultaneously] operating within given resource constraints' (Gisin & Sewell, 1989, p. 88).

Conditions which prompted the study

The presence of the CAM demonstration project at Fort Sill provides an opportunity to study cost effective management techniques under resource constraints. As originally designed by DoD Health Affairs in February 1988, the major goals of CAM are (a) containing costs, (b) improving access to health care, (c) improving beneficiary and provider satisfaction, and (d) maintaining quality care. Recently, the hospital commander added two other goals: (a) a positive impact of CAM on the hospital staff, and (b) improved community awareness. According to Gisin and Sewell (1989) any successful strategy for implementing CAM must include channeling more costly CHAMPUS workload back into the medical treatment facility (MTF).

One indicator of the amount of workload channeled to CHAMPUS is the issuance of a Certificates of Non-Availability (Statements of Non-Availability). Currently, the hospital commander must approve a statement of non-availability before any inpatient procedure may be reimbursed under CHAMPUS. For RACH, the Obstetrics and Gynecology (OB-GYN) service demonstrated the highest increase in the number of non-availability statements issued from FY 1988 to FY

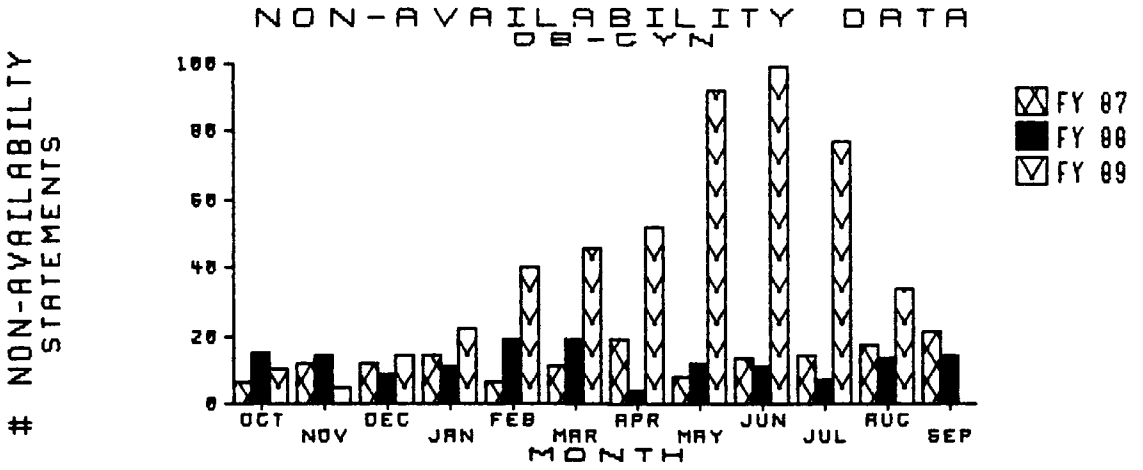

Figure 1. Non-availability statement data for the OB-GYN clinic. (Source: Command Performance Summary, July 1989, p. 13)

1989 as shown in figure 1. These figures represented a 466 percent increase in just two years. According to the 3rd Quarter Review and Analysis for FY 1989, this increase in the number of OB-GYN non-availability statements was preceded by a shortage of OB-GYN physicians at RACH.

A comparison of the issuance of non-availability statements across several specialty areas clearly demonstrates the amount of obstetrics (OB) workload that was seen under CHAMPUS in FY 1989 (Figure 2). During the same time that more non-availability statements were given out for OB-GYN hospital care, a definite shift in emphasis from inpatient to outpatient health care was being observed throughout the command (CHAMPUS Division, 1988, p.

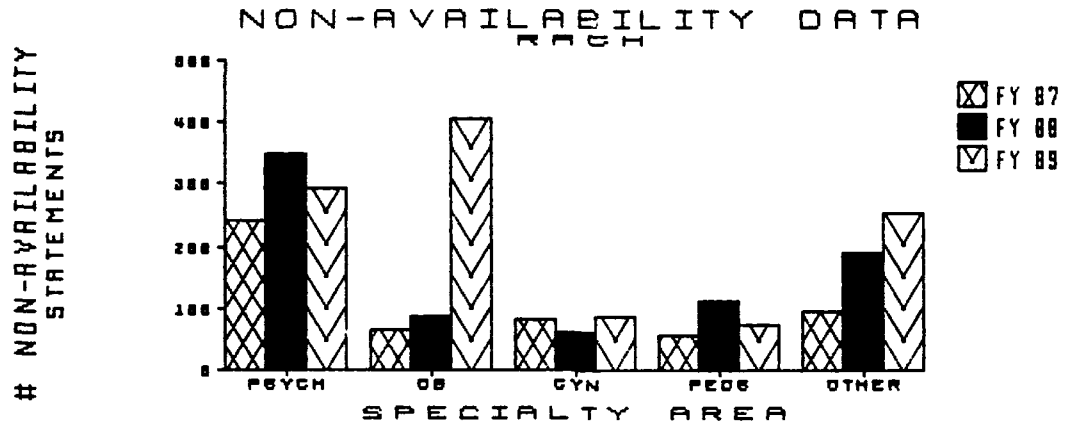

Figure 2. Non-availability statement data for RACH, FY 87 - FY 89. (Source: Command Performance Summary, July 1989, p. 13)

31). An evaluation of the OB-GYN quarterly workload data suggests that from the beginning of FY 1989, gynecology (GYN) visits increased 7.6 percent (+129), while OB visits plummeted 20 percent (-312). If the issuance of non-availability statements were due to physician shortages, then both OB and GYN in-house visits should have decreased. As depicted in figure 3, only the OB visits decreased. This was also shown in figure 2 over a three year period since the majority of the patients channeled to CHAMPUS required OB care, while the number of GYN non-availability statements remained about the same.

Many in administration argue that an OB visit represents more workload, and thus more reimbursement to RACH, than a GYN visit--due to the heavy weighting toward inpatient care. An

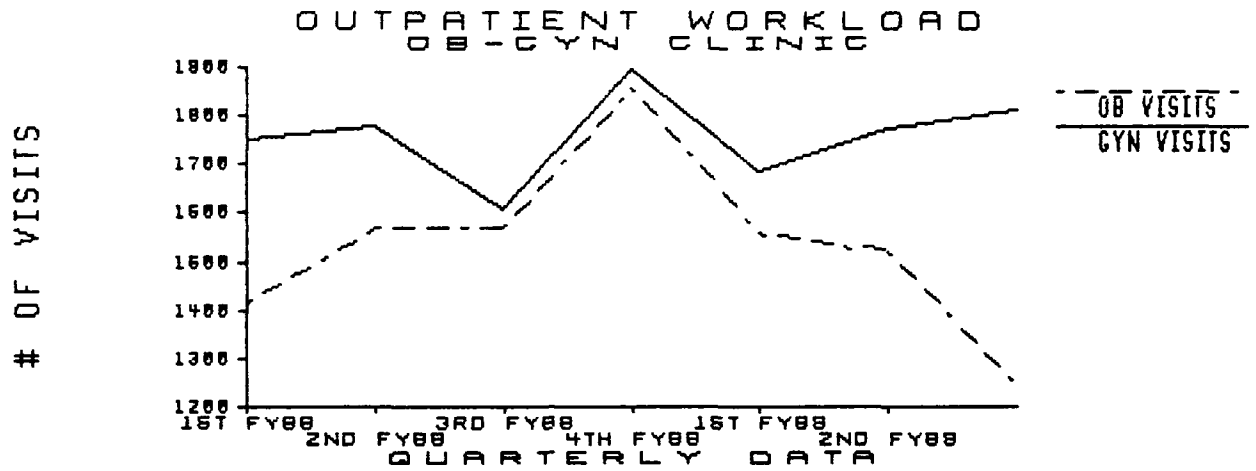

Figure 3. OB-GYN outpatient workload data for FY 88 and FY 89. (Source: Medical Summary Report (MED 302), RACH)

example of this argument could be seen if one were to schedule and value OB-GYN visits as part of a patient's entire care process (euphemistically termed "bundling"), instead of as independent outpatient visits. Under the current scheduling method, an OB visit receives the same reimbursement as a routine GYN visit because outpatient visits are scheduled as discrete procedures; however, bundling an OB visit to its entire care process (e.g., OB delivery) represents more reimbursement to RACH than many GYN visits (e.g., infertility). At the same time, the entire OB process absorbs more resources. In following this argument, OB visits become more valuable to RACH than other visits. As

presented later, this study uses the basis of this 'bundling' argument to place a value on the different patient visits.

Whether through a workload weighting process (i.e., Medical Care Composite Unit) or some other valuation scheme (i.e., Ambulatory Visit Groups), these patient visits represent workload and reimbursement to RACH. Under the CAM project, workload channeled away from the more expensive CHAMPUS program means more than reimbursement to RACH, it also means cost savings. As a result, there is a concern about what level and mix of in-house appointments should be scheduled at the OB-GYN clinic to manage the tremendous demand for services under the CAM demonstration project more efficiently.

The OB-GYN clinic classifies all outpatients in one of sixteen descriptive, mutually exclusive categories of care (Table 1). Patients are placed in these categories based on the type of care required (i.e., routine gynecology, colposcopy), rather than by case-mix as in most classification schemes. The primary disadvantage to this classification scheme is that it does not address health care resource requirements as a function of case-mix intensity. This disadvantage presents a problem when trying to place a value on the different patient categories in determining the appropriate level and mix of patients to be scheduled in-house.

Essentially, the current methodology of scheduling patients in the OB-GYN clinic is through the Appointment and Scheduling Module (ASM) of the Automated Quality of Care Evaluation Support System (AQCESS). The ASM automates the scheduling process by creating templates of the number and types of visits normally seen in the clinic (National Data Corporation, 1988). For the most part, the clinic chief develops these templates through experience with, and knowledge of, patient demographics (see Appendix B). The Clinical Support Division staff does look at the total clinic workload, but uses no quantitative data to augment the appointment template developed by the OB-GYN clinic chief.

In summary, the upwardly spiraling costs of CHAMPUS is symptomatic of the overall problems associated with program. Because of this tremendous cost, DoD began a catchment area management (CAM) demonstration project at Fort Sill as a cost control initiative. At RACH, one of the most costly services in terms of dollars spent on CHAMPUS is OB-GYN. Because the demand for OB-GYN care far exceeds the capability at RACH, many beneficiaries seek care downtown (on CAM). In order to satisfy the cost containment goal of CAM, the hospital commander must ensure that the OB-GYN clinic schedules those appointments which minimize the cost of referrals on CHAMPUS. Minimizing CHAMPUS costs can be

accomplished by scheduling the costly appointments at the less costly military facility.

Statement of the Management Problem

The problem for this study was to develop a cost effective model of scheduling OB-GYN outpatient services to a defined beneficiary population at Reynolds Army Community Hospital.

Review of the Literature

> The public today demands maximally beneficial care that is also cost-effective. . . . There are few . . . guidelines to help health professionals (euphemistically called 'providers') to make cost-benefit decisions in the clinical setting. These same professionals are also expected to make decisions involving the allocation of scarce resources and are blamed for failure to do so. (Horwitz, 1989, p. 17)

As a means of tying together the literature review with the OB-GYN service at Fort Sill, this section will briefly address the OB-GYN clinic at RACH. Unlike most military OB-GYN clinics, this clinic operates in a large family practice health care setting. The existence of the family practice department at RACH not only affects OB-GYN workload, but also patient referral patterns. This section is intended to provide an understanding of the OB-GYN operation in a family practice model. The OB-GYN clinic provides services for complicated OB cases and many GYN cases to a

beneficiary population of more than 25,000 females (Fact Sheet, 1989). According to MAJ Kathryn Parks, Chief of the OB-GYN Service, the demand for services at the OB-GYN clinic has been "twice the amount of work capable of being performed by the current military physician staff" (K. Parks, personal communication, May 18, 1989). At the present time, the OB-GYN clinic staff consists of three military OB-GYN physicians and one nurse practitioner, two fewer OB-GYN physicians than authorized on the current Table of Distribution and Allowances (TDA) for RACH. As a result, many of the routine OB-GYN procedures, to include OB delivery and follow-up visits, are the responsibility of the family practice physicians at Fort Sill.

Fort Sill has the largest Department of Family Practice in the United States Army (CHAMPUS Division, 1988, p. 31). Currently, there are five family practice clinics located throughout the post. The 36 physicians and 7 physician assistants assigned to these clinics provide primary health care to eligible family members from designated units, and routinely follow these family members throughout the course of treatment. For nonemergent OB-GYN care, active duty and dependent female members enter the health care system through their unit's designated family practice clinic. More complex OB-GYN cases are referred to the OB-GYN clinic for care which the family practitioner is not credentialed to perform.

Realistically, the OB-GYN functions as a sub-specialty consultation service, rather than a primary care clinic. [Some would argue that OB-GYN care is primary care (see Kongstvedt, 1989, p. 27)]. As shown in figure 4, much of the clinic's workload is generated by family practice on a referral basis; however, many of the routine OB-GYN patients are distributed back to the family practice clinics for appropriate treatment. For example, under current policy, each family practice physician must follow five routine OB patients monthly. The OB-GYN clinic establishes the initial OB record, to include a history and physical, then distributes the routine patients to our appropriate family practice

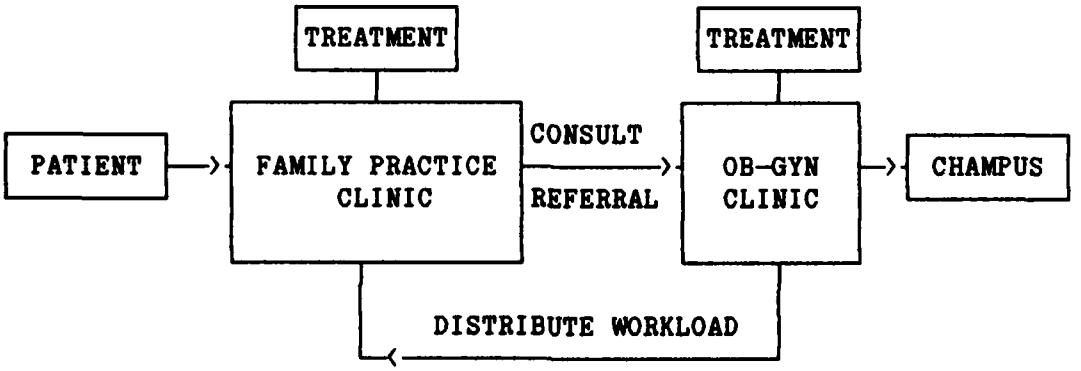

Figure 4. Family practice model for OB-GYN workload.

clinic for care and delivery (K. Parks, personal communication, Sep 28, 1989). Of course if complications develop, the OB-GYN physicians are available for consultation.

Even with a family practice department, the demand for OB-GYN services far exceeds the capability of the hospital's OB-GYN resources. As a result, the overflow is referred to the more expensive CHAMPUS. According to our hospital commander, "Once we send out OB-GYN, we'll never recapture the workload. [Under CAM], we are in the business of recovery as much as possible" (W. Gonzalez, Morning Report, Sep 6, 1989).

The following sections will present an overview of CAM as a managed care program, and discuss several alternative programs which help the hospital commander deliver less costly health care services. These sections will be followed by a discussion on two features which were incorporated into the CAM demonstration project.

Managed Care

According to Kongstvedt (1989), the term "managed health care" refers to any system in which a third party intervenes in the delivery of health care in such a way that costs are controlled (p. xiii). Since the inception of the Western clinic, a fee-for-service partnership in Tacoma, Washington, scores of managed care programs have been implemented (Flinn, McMahon, &

Collins, 1987, p. 256). In the past, most of these managed care programs have focused on hospital costs; however, today many firms are introducing similar programs for the increasing costs of outpatient medical care (Kendel, 1989, p. 28).

One of the most popular marketable entities being used to control costs is the Preferred Provider Organization (PPO). By definition, PPOs are formal organizations which purchase health care services for covered beneficiaries from a selected group of participating providers (Kongstvedt, 1989, p. 12). Typically, the preferred provider physician network agrees to abide by the credentialing, utilization, and reimbursement processes of the PPO in return for high patient volume. According to Borland (1987), first generation PPOs are provider based and discount oriented, and use the 'prudent purchasing' control mechanism to contain costs. Prudent purchasing refers to the process of negotiating with providers for a discounted fee based on a particular volume of patients (Aaron & Breindel, 1988, p. 63).

The CAM project can be classified as a first generation PPO. However, since the CAM project describes a less formal relationship than would be described by a PPO, the CAM project fits more closely with Kongstvedt's definition of a preferred provider arrangement (PPA) (see Kongstvedt, 1989, p. 12). Certainly, the mechanism of controlling costs in the CAM project is through 'prudent

purchasing" to a defined (enrolled) beneficiary population. No matter how CAM is classified, it is a program that requires the local hospital commander to determine the most cost effective methods of providing medical services.

Health Care Programs

Several programs are available to the local hospital commander which provide him the flexibility of delivering less costly health care services within his catchment area. Some of these programs include the Military-Civilian Health Services Partnership Program (Partnership Program), the Direct Health Care Provider Program, and the Catchment Area Management Program. These programs are geared to control costs, enhance benefits, and improve military-civilian coordination.

Partnership program.

The Military-Civilian Health Services Partnership Program is a Department of Defense initiative which authorizes MTF commanders to bring civilian providers into their facilities to provide health services to CHAMPUS beneficiaries (Fact Sheet, 1987, p. 2). This program, which replaced the Joint Health Benefits Delivery Program, requires that all providers meet CHAMPUS requirements for certification; and that the costs of supplies, equipment, and ancillary personnel not available in the MTF be included in the providers negotiated price (Memorandum, 1988, p. 1). This program

is designed to make health care services in MTFs more accessible, to maximize utilization, and to reduce costs by combining the resources of the civilian and military health care system.

Partnership agreements may be either internal or external. The internal partnership agreement outlined in the DoD instruction allows for civilian providers to practice within the MTF (Fact Sheet, 1987). Beneficiaries receiving care under Internal Partnership Agreements are not required to meet a deductible or pay the usual CHAMPUS copayment (Memorandum, 1988, p. 1). This internal agreement is expected to save the government money by using less expensive military facilities, eliminating civilian hospital charges, and reducing the CHAMPUS overhead costs (Fact Sheet, 1987, p. 2). The external partnership agreement allows military providers to treat CHAMPUS eligible beneficiaries in civilian medical facilities (HSC Memorandum, 1988, p. 1). This type of agreement saves the patient his apportioned cost of civilian provider fees.

Direct health care provider program.

Another program available to the hospital commander is the Direct Health Care Provider Program (DHCP). This program permits the hospital commander to contract with providers to deliver medical services within the military hospital. Like the partnership program, the DHCP program offers potential savings by

using the ancillary services of the MTF, while at the same time eliminating the expensive civilian hospital charges (Spurlock, 1988).

Catchment area management.

A program that has been receiving a great deal of attention in recent years is the CAM project. As mentioned earlier, the CAM project was designed to allow the hospital commander to develop an integrated health care program for the efficient delivery of health services both within and outside the MTF. According to the CAM concept paper, the hospital commander has full use of the direct care provider program and the partnership program as a means of bringing workload back into the direct care system (Spurlock, 1988, p. 2). Two features separate the CAM from the other two programs: an enrollment plan, and a health care finder feature.

In its study of the military health care system, the Rand Corporation reported that the lack of an enrollment system made it difficult to evaluate a hospital's performance. Rand noted that most hospital commanders were evaluated on workload produced, rather than patients cured, because of a poorly defined beneficiary population. Three areas, in particular, caused problems in defining a catchment area population: people who 'cross over'

between the direct care system and civilian systems, lack of continuity of care, and duplication of effort (Phelps, et al., 1984, p. 6).

The proposed remedy for the inadequate system of evaluating MTFs was an enrollment system. Under Rand's enrollment concept, the hospital commander would be responsible for providing care to a set number of people choosing to enroll, until the MTF enrollment target was reached. With this system, an evaluation could be based on how effective the commander was at arranging and providing care, rather than on the amount of workload produced. As a means of measuring the efficacy of the CAM project, an enrollment plan was incorporated as a necessary feature.

The population eligible for CAM enrollment, and the subject of this study, are those DoD beneficiaries under the age of 65 years. Catchment Area Management enrollees and those people seeking care at the MTF are a defined population that can be managed by the hospital commander. Under CAM, the hospital commander can direct and control health care utilization and referral patterns so as to deliver cost effective care. Those patients choosing to use regular CHAMPUS cannot be controlled, and are, therefore, not part of this study.

The second feature of the CAM project was the use of a health care finder. The early success of the Air Force's Health Care

CATCHMENT AREA MANAGEMENT

PATIENT ACCESS

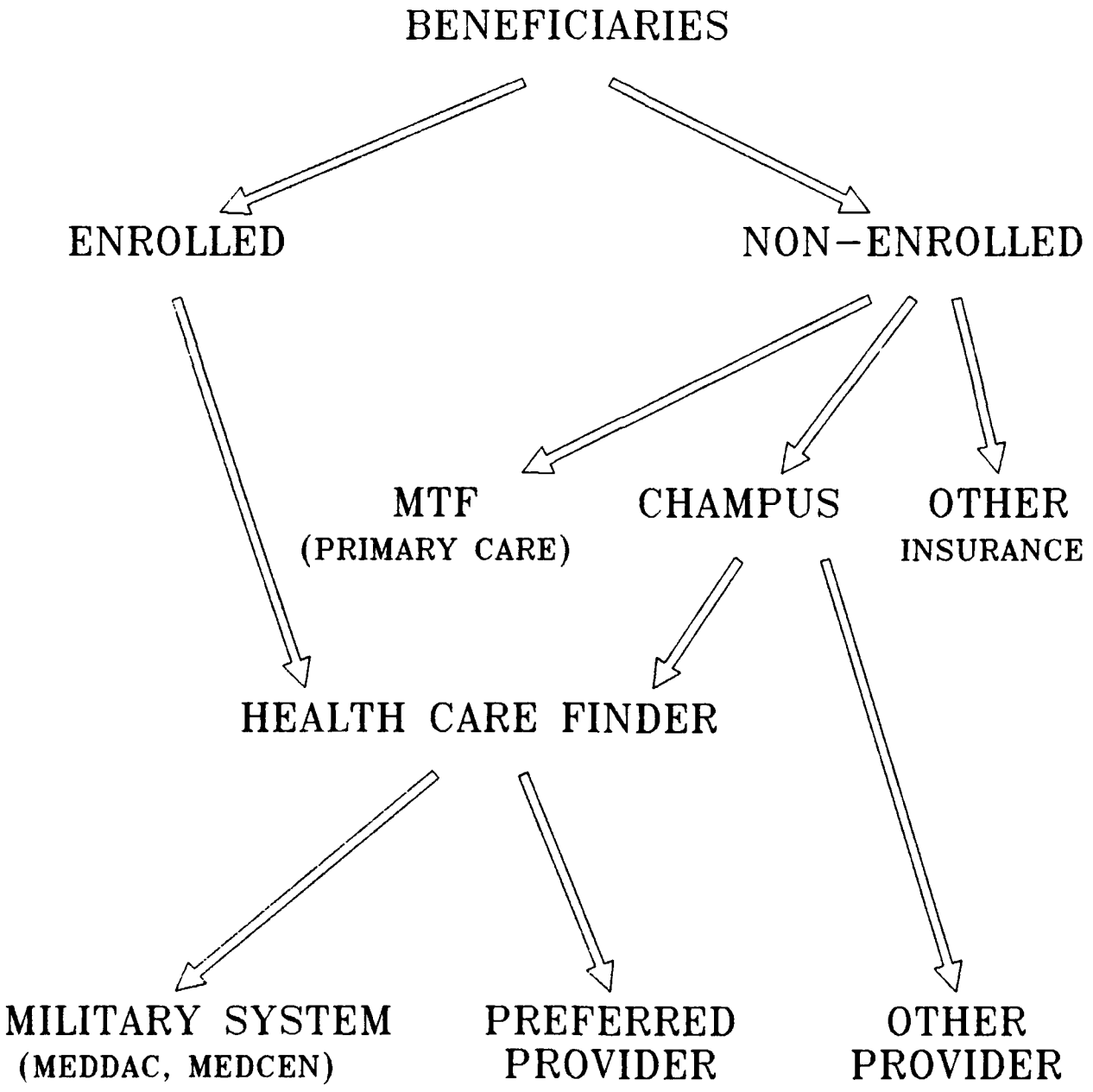

FIGURE 5. Patient access
(SOURCE: CAMPO, 1989, p. 6)

Finder Program in acquiring provider networks and linking civilian and military medical facilities encouraged Health Services Command (HSC) to adopt a similar feature for CAM (Congressional Budget Office, 1988, p. 70). Under CAM, the health care finder (HCF) facilitates referrals of patients to military and civilian health care services (Information Paper, 1989).

As shown in figure 5, the HCF has two options for making speciality care appointments for other than same day referrals: the direct care system (MTF) or the preferred provider network of civilian physicians (CAMPO, 1989). In this role, the HCF is the key to managing care as effectively as possible. Because services at RACH are less costly than similar services provided by civilian facilities, the OB-GYN HCF always seeks available appointments within the MTF prior to arranging outside referrals; however, due to the tremendous demand for appointments, many beneficiaries cannot be scheduled at the MTF.

To take full advantage of the opportunity to effectively manage all resources within RACH, the commander must schedule the number and types of appointments that will maximize the hospital's capabilities as well as maximize cost savings. As defined by Grimaldi (1988), cost savings (or cost avoidance) is the amount of money a hospital does not spend because managed care is introduced. There are several techniques available which can be used to

evaluate cost savings potential among various alternatives: benefit-cost analysis, cost effectiveness analysis, and linear programming.

All three of these cost-effectiveness techniques begin with the assumption that resources are limited and, therefore, that it is not possible to satisfy all the demand for care (Weinstein, 1986, p. 194). This assumption appears to be valid for the OB-GYN services at RACH. Additionally, these techniques yield the best alternative, among many, in precise quantitative terms such as costs and benefits. According to Neumann (1983), cost-effectiveness analysis (CEA) and benefit-cost analysis (BCA) are subsets of applied economics that try to discern whether the dollar and nondollar benefits of an alternative outweigh its total dollar and nondollar costs. Both CEA and BCA use the ratio of net cost to benefit as a measure of each alternative's effectiveness in the analysis. Of course, the effective alternative would be expected to break even or realize a profit.

Warner and Holloway (1978), believe that linear programming can best be used in decisions which require a 'best or optimal' solution among several alternatives (p. 188). Unlike CEA or BCA, linear programming allows implicit evaluation of all alternatives simultaneously. This method of evaluating the alternatives clearly demonstrates the 'opportunity cost' of resources. Joglekar (1984)

defines the opportunity cost of resources as the value of resources forgone by not being able to use the resources required by another alternative. Because all the alternatives are simultaneously competing for limited resources in linear programming, the opportunity cost of resources is optimized when the final objective (maximize cost savings) is achieved.

Linear programming offers a further advantage over the other two techniques in that it determines the range over which the analysis is still valid. This range is defined as the sensitivity analysis of the solution and cannot be assessed using CEA or BCA without explicit assumptions (Joglekar, 1984, p. 288). Because of the advantages that linear programming offers over the other two cost-effectiveness techniques, it was selected as the optimizing technique in this study.

Linear Programming

Linear programming is a cost effective analysis technique that uses simultaneous mathematical formulas to optimize the use of scarce resources (Levin, Rubin & Stinson, 1986). According to Hollis (1986), modeling techniques, such as linear programming, have been widely used by business and industry to save time, money, and potential risks associated with the planning process. For the past decade, linear programming has been widely used in long-range planning and production scheduling (Schrage, 1986); however, due to

the high cost of collecting the necessary input data, linear programming was mainly restricted to the petroleum industry during this period. Schrage (1986) suggests that the continuing development of database systems has allowed other 'facets of business' to exploit the power of linear programming (p. 2).

According to Schrage (1986), programming in linear programming means to plan, and as such, a linear programming model is a prescriptive planning tool. Most often, management uses linear programming as an adjunctive tool in making decisions about allocating and using scarce resources (Levin et al., 1986).

Linear programming involves allocating scarce resources on the basis of some criterion of achieving an organization's goals (Schrage, 1986). The criterion for success usually entails maximizing savings, minimizing costs or maximizing output. In all linear programming problems, there are two classes of objects: (a) resources, such as physician time or nursing time, and (b) activities, such as 'schedule OB patients' or 'schedule GYN patients.' Each activity either consumes resources or adds additional resources (e.g., scheduling a GYN appointment takes several minutes of physician time). 'The problem is to determine the best combination of activity levels which does not use more resources than are actually available' (Schrage, 1986, p. 2).

One of the classic applications of linear programming techniques involve product mix problems. Product mix problems feature a collection of products (such as type of visit) which compete for a finite set of resources. The objective is to determine the kinds and quantities of products to be produced. Associated with each product is a product value, and associated with each resource is an availability (Schrage, 1986, p. 52). As presented later, the product value in this study is defined as the cost savings index of a patient category.

Linear programming does have its limitations. It applies only to situations in which the effects of the different activities are constant, hence the term linear. According to Levin et al. (1986), linearity consists of three facets: (a) the effects of a single variable are proportional, (e.g., doubling the number of visits in the OB-GYN clinic will double the cost of operating the clinic); (b) the interactions among variables must be additive, (e.g., the cost of operating the OB-GYN clinic is the sum of the costs of individual patient appointments; and, (c) the variables must be continuous (e.g., fractional variables must be allowed). Because of the complex and diverse 'products' in health care, this linearity requirement is difficult to obtain.

Linear programming variables defined in health care are associated with patients or disease processes. Since no two

patients or disease processes are the same, variables of this sort can never be proportional, additive or continuous. An example of the difficulty of placing patients into specific diagnosis categories is the diagnosis related groups (DRG). In his study of DRGs in 1983, Hartzke noted that patients cannot be predictively categorized into specific diagnostic categories because of differing severity of illnesses: patients and diseases are not linear. That same difficulty exists when trying to categorize patients into linear programming variables; however, there is potential for using this technique in health care.

In June 1989, Robbins and Tuntiwongpiboon published an article addressing the use of linear programming models in health care. In a simple way, they illustrated how useful linear programming can be in finding feasible and optimal solutions based on resource constraints. Although their contrived application was geared toward DRGs and inpatient case-mix, the framework they established in their article could easily be adopted to an outpatient setting. In fact, Wall (1986) in his study of OB-GYN outpatient workload used a linear programming model as his cost effectiveness technique three years earlier.

As noted by Robbins and Tuntiwongpiboon (1989), one aspect of linear programming that sets it apart from cost effective analysis is the ability to conduct sensitivity analysis. Sensitivity

analysis is the process of examining the range over which the extent of resource consumption, and the optimizing solution are valid (Robbins & Tuntiwongpiboon, 1989, p. 114). In part, linear programming was chosen as the optimizing technique in this study because of sensitivity analysis. Management can use the results of sensitivity analysis for determining the range over which the input data and the optimum solution are valid. This is particularly important since most of the input data was derived by collecting a sample and using its average. Although management may have less than complete confidence in using averages, a wide sensitivity range allows large variations in the input data without affecting the final solution.

Linear Programming Applications

Within the literature, several studies have shown the utility of using mathematical and linear programming models based on patient mix in an attempt to demonstrate the financial impact that patient mix has on the hospital. Baligh and Laughhunn (1969) developed patient classes for a linear model; Goldfarb, Hornbrook, and Rafferty (1980) expanded the linear methodology using a nonlinear approach; Brandeau and Hopkins (1984) demonstrated the power of sensitivity analysis; and, Wall (1986) applied the linear programming technique in an outpatient setting.

Baligh and Laughhunn (1969) developed a linear economic model for case-mix allocation based on the concept of patient equivalence classes. These equivalence classes were defined on the basis of a patient's value to the hospital and his requirements for hospital supplied goods and services. Their objective was to maximize the hospital's output which was defined as the number of patients treated within each equivalence class, subject to resource, budgetary, patient, and policy constraints. These classes were created such that no potential patient failed to belong to a class; that is, classes were collectively exhaustive and mutually exclusive.

Once patients were placed into a specific class, Baligh and Laughhunn suggested that policy decisions, both implicit and explicit, may affect the final solution. These policy decisions involved the use of resources or accepted medical practices, and represented constraints on the objective to maximize hospital output. Two examples of constraints included (a) a teaching hospital's requirement for a sufficient number of patients within each equivalence class for teaching purposes; and, (b) a hospital's policy requirement for the treatment of indigent patients even though no revenue was generated. In both examples, these noneconomic constraints affected the number of patients in the final solution. Coupled with the economic constraints of resource

consumption, the hospital was able to determine an optimal case-mix and cost savings for the hospital.

Although no accepted patient category existed in 1969, Baligh and Laughhunn developed several categories and placed a value on each. Further, they made several policy decisions which affected the final outcome. A similar method of placing a value on patient classes and using policy decisions as constraints to the final solution was followed by Goldfarb, Hornbrook, and Rafferty (1980).

Goldfarb, et al. (1980) described a nonlinear programming model because of the difficulty in defining and measuring a hospital's output. The authors realized that a hospital's output was difficult to define because of the extensive range of treatments which varied substantially in cost, complexity and utility to the hospital. Because of this difficulty, Goldfarb, et al. (1980) introduced dimensions of output into a nonlinear model in order to recognize the multiproduct character of a typical hospital. These dimensions of output became the value coefficients on the model's objective function. The objective of their model was to maximize hospital usage based on the number of patients, case-mix, quality of service, and hospital income while being constrained by the number of available bed days.

Brandeau and Hopkins (1984) developed a linear programming patient mix model for use at Stanford University Hospital to

determine the impact that changes in patient mix by intensity level and payer class had on the revenues, expenses and resources at the hospital (p. 32). They were also interested in the financial impact to the hospital of different reimbursement schemes and levels of reimbursements. Their study demonstrated the power of sensitivity analysis and 'what-if' questioning in linear programming.

Brandeau and Hopkins divided their patients into 14 groups based on DRG intensity levels. They calculated an average charge and length of stay within each of the 383 DRGs then graphed and clustered the resultant data points. The result was three intensity levels for the medical/surgical group of DRGs by payer group (high, moderate, low). They wanted to develop an intensity measure that primarily distinguished between low and high levels of resource use. Their methodology was not intended to be an absolute indicator of intensity or acuity, but simply an artificial mechanism used to segregate medical/surgical patients by differing levels of resource use. (Brandeau & Hopkins, 1984, p. 35).

Their objective was to optimize patient mix under various constraints. The model included upper and lower constraints (bounds) on the number of patients in each group. As defined by the authors, the lower bound reflected the hospitals obligation to treat a specific population (Brandeau & Hopkins, 1984, p. 37). The

lower bounds in their model were similar to the policy decisions incorporated into the model by Baligh and Laughhunn (1969) and Goldfarb et al. (1980).

Finally, Wall (1986) developed a case-mix management model for the allocation of outpatient workload between military and contract physicians in an OB-GYN clinic within a military hospital. His intent was to apply the lessons learned from several inpatient case-mix systems to develop a model capable of 'performing similar functions' in an outpatient setting (Wall, 1986, p. 12). He used a Computerized Medical Record Information System (CMRIS) as a classification framework within the OB-GYN clinic. Essentially, all OB-GYN visits were classified by CMRIS into one of nine groups that expressed the nature of the service requested, resources required, and length of appointment time.

The average contractor fee for visit in each category served as the coefficients for his objective function. The objective of the model was to allocate the OB-GYN visits between military and contract physicians at a minimum cost. The constraints in his model included minimum requirements for clinical proficiency, maximum demand for each category, and total physician time for all clinic visits (Wall, 1986, p. 36). The results of his model demonstrated how changes in unit price, staffing, and demand affected the total cost and workload for the OB-GYN clinic. Wall

(1986) was able to recommend that a linear programming model be used in the negotiation process for contracting OB-GYN procedures of a Primary Medical Care of the Uniform Services (PRIMIS) clinic.

Theoretical Framework

Figure 6 illustrates the conceptual model that was used to develop the study hypothesis. The bottom arrows in the management model depict the current method of scheduling patients in the OB-GYN clinic at RACH. For the most part, only the qualitative component (e.g., judgement, experience) is used to develop the types and frequency of in-house patient appointments. For the

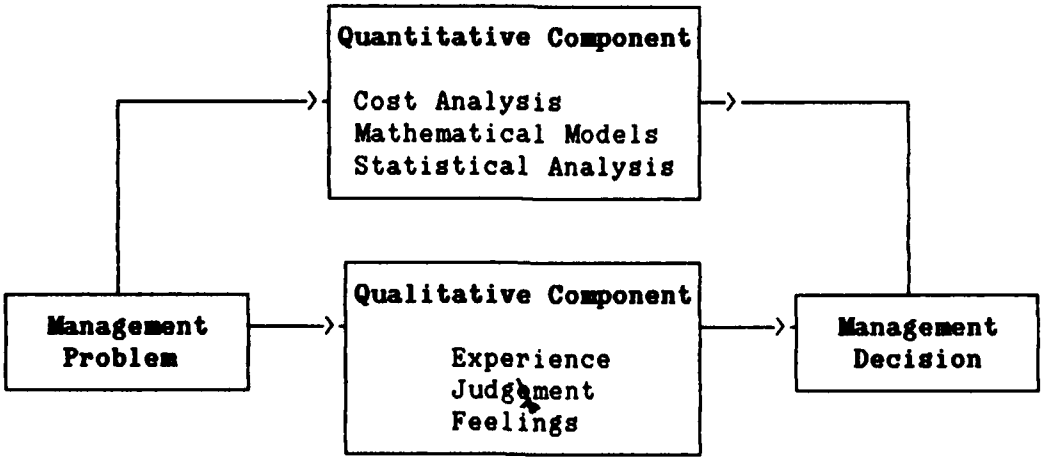

Figure 6. Management model for decision making. (Source: Anderson, D. R., Sweeney, D. J., Williams, T. A. 1988, p. 3).

defined population (those enrolled in CAM and those seeking care at the clinic), the overflow demand is referred by the health care finder to a preferred provider network downtown.

The top arrows in the model further specify the addition of a quantitative component to the decision making process. Several of these techniques (e.g., cost analysis, statistical analysis) are routinely used by hospitals to optimize their resources. The addition of a quantitative component (i.e., linear programming) to the current process of scheduling patients in the OB-GYN clinic serves as the basis for this study.

Purpose

Based on the theoretical framework of decision making, it may be reasoned that adding a quantitative component to the current process of scheduling OB-GYN appointments should significantly reduce the cost of delivering health services to a defined population. The purpose of this study, therefore, was to develop a cost effective model for allocating patient appointments between the OB-GYN clinic and the CAM demonstration project at Fort Sill by adding a quantitative component to the existing templating process. The general approach in this study included:

(a) selecting a month which was used to evaluate the cost effectiveness of adding a quantitative component to scheduling

patient appointments. Because CAM began in June, the desired month had to be after that period.

(b) classifying OB-GYN clinic visits into mutually exclusive categories, each with a basis for consumption of physician time, procedure, cost, and reimbursement. Additionally, several high volume operating room (OR) procedures (e.g., tubal ligations) were selected which accounted for a significant amount of physician time.

(c) measuring the demand for OB-GYN appointments from existing sources of workload data.

(d) bundling these patient categories into group packages which were representative of the entire care process, and reflective of each group's value to the hospital. For this model to be of any value in controlling where patients should be seen, the clinic staff had to be able to place each patient into one of the patient categories when making the appointment. Subsequently, procedures such as appendectomies which result from exploratory laparotomies were not evaluated. Using this methodology reduced the number of possible OR procedures.

(e) identifying the total staff time available to see patients in the OB-GYN clinic. The time element was calculated separately for the OB-GYN physicians, the nurse practitioner, and the clinic nursing staff.

(f) examining the time required for each patient group. The ASM module had existing time periods for each group. Refinements of these times required soliciting expert opinion from the direct health care providers and nursing staff at the OB-GYN clinic. Physician time for the selected OR procedures came from a survey of average time for those procedures using DA Form 4108, Register of Operations. Similarly, average physician time for labor and delivery was extracted from the FS MEDDAC Form 20, Labor and Delivery Log.

(g) determining the cost and reimbursement for each patient group. Since cost accounting at RACH only allowed average cost associated with inpatient and outpatient visits, a cost savings index was developed to attach a value to each patient category and group package.

(h) accounting for any facility or service level policies which required a minimum number of procedures for clinical proficiency.

(i) developing a linear programming model that allocated OB-GYN workload among the RACH and CAM variables for each patient category and group package. This model was based on an objective function which sought to maximize patient category value (cost savings index) under existing constraints.

(j) using the model as a dynamic management planning tool for allocating patient appointments in the OB-GYN clinic, and determining the range over which the linear model solution remains valid.

Methods and Procedures

This study followed the research design established by Wall (1986) in his study of OB-GYN outpatient workload at Silas B. Hays Army Community Hospital. However, several modifications were made in this study to account for the difficulties of placing a value on each patient category and group package. As in the research design by Wall (1986), this study was conducted in three phases, (a) data collection, (b) formulation of the objective function and constraints for the linear model, and (c) an analysis of information derived from the linear programming model for management consideration.

Data Collection

Selected Month

Prior to collecting any data, a monthly template was selected to assess the effect of adding a quantitative technique upon the current process of scheduling patient appointments. Because this study used the CAM beneficiaries as a part of its defined population, the selected month had to be after the start of CAM in June 1989.

Data reported on the Medical Summary Report (MED 302) for Fiscal Year 1988 and 1989 were compiled and used to develop a 2-year monthly average for OB-GYN workload (Appendix C). As can be seen in appendix C, the month most representative of the average percentage and frequency of OB and GYN visits normally seen at the OB-GYN clinic was October 1989. Although the workload reported in April 1988 and November 1988 was much closer to the clinic average of 1012 total visits, the percentages of OB and GYN visits in those months were not representative of the monthly percentages (47% and 53% respectively). Additionally, neither April 1988 nor November 1988 could be selected because the CAM project started in June 1989.

Two advantages for selecting the month of October for this study were that (a) the CAM project had been in operation about four months, and (b) the fiscal year just began. By the month of October, many of the initial problems associated with starting the CAM program had been corrected so as to lessen any impact upon this study. Additionally, claims processing and the CAM database were automated which greatly increased the speed and accuracy of dollar figures used in this study. Another advantage to selecting October was that CAM is a CHAMPUS project, and in the month of October monies were available to pay partnership providers and establish appointments downtown.

Data from October 1989 was used in developing the linear programming model for this study. According to Levin, Rubin, Stinson, and Gardner (1989), building a linear programming model begins with identifying a goal or objective to achieve, determining available resources, and establishing requirements which must be met. Converting this data into mathematical expressions which 'capture the relevant relationships, goals, and restrictions is known as . . . model building' (p. 425).

The objective of the linear programming model in this study followed the first goal of the CAM project--cost savings through cost control. To achieve this goal in the linear programming model, several data elements were collected which quantified the available resources for each patient category such as demand levels, staff times, policy requirements, and category values. Patient categories and their value estimates were captured and used in developing the model's objective function to maximize cost savings. Associated with each of these patient categories was the total demand during the month, and the time required for providers to treat each patient category. Any policies which require a minimum number of clinical procedures to be performed were also incorporated into the linear programming model. Additionally, to reflect the value of each patient category relative to its entire cost and reimbursement potential, several of these patient

categories were bundled as part of an entire care process as defined later in this study.

Patient Categories

The purpose of the data collection phase was to gather data for the linear programming model. Requisite data included the objective function variables, actual demand levels for the month of October, provider times for each variable, clinic proficiency policies, and a value figure for each variable. In this study the objective function variables were defined as the categories of patients normally scheduled at the OB-GYN clinic. This section identifies the OB-GYN patient *categories for* the linear programming model, followed by a section which captures the actual demand levels for each identified category. After the demand levels are determined, the next section discusses the bundling of these patient categories into group packages to derive a patient category value. Finally, in subsequent sections, time, value, and policy estimates are determined for each patient category. Data collected in this phase of the study were used to formulate to model in the model formulation phase.

After selecting the month of interest in this study, data from an existing scheduling system which classified and measured patient visits was used to determine patient categories. The classification system had to be mutually exclusive in terms of

physician time and procedure performed. Because this study addressed the templating process, the classification system had to be simple for those non-medical personnel who scheduled appointments.

The Appointment and Scheduling Module (ASM) of the hospital's Automated Quality of Care Evaluation Support System (AQCESS), as currently implemented, serves the purpose of classifying patient visits into mutually exclusive categories of care. As shown in table 1, all OB-GYN visits are classified into 16 separate categories, each with an assigned length of appointment time. Currently, the OB-GYN staff places each patient into one of these categories based on the care required to treat the medical condition.

Both the patient categories and the time allocations were retrieved from the ASM subsystem, and modified to meet the needs of this study. For example, walk-in visits and post partum visits were categorized as either a GYN follow-up visit or an OB visit to keep the number of variables in the linear programming model at a manageable size. Additionally, the OB physical and ultrasound visits were categorized as OB visits because patients received them after they were assigned to their physician. This brought the number of patient categories to 9 as shown under the model abbreviation section in table 1. The time allocated for some of

the visits was modified to reflect the actual time employed and reported by the OB-GYN staff. In table 1, the entries under the model abbreviations were used in the linear programming model.

Table 1

OB-GYN Patient Categories

Treatment category	Outpatient clinic set: ASM abbreviation		Model abbreviation	Time per visit: Physician	Time per visit: NP
Routine GYN	GYN	1	RtnGYN	20	20
Papanicolaou smear	PAP	2	PAP	20	20
Cryosurgery	GYN	3	Cryo	30	40[a]
Routine OB	O*B	4	OBVisit	20[a]	20
GYN follow-up	GYN FLU	5	GYNFlu	20	20
Post partum	GYN		GYNFlu	20	--
Ultrasound	O*B		OBVisit	20	--
OB history	HIS	6	OBHis	--	120[b,c]
OB physical	OBP		OBVisit	20	--
Complicated OB	O*B		OBVisit	20[a]	--
Tubal	BTL	7	PreOp	30[a]	--
Colposcopy	COL	8	Colpo	30	--
Infertility	NFT	9	Inf	30	--
PreOp visit	GYN		PreOp	30[a]	--
OB walk-in	Walk-in		OBVisit	20	20
GYN walk-in	Walk-in		RtnGYN	20	20

Note. Data reported from the Appointment and Scheduling Module.
[a] Adjusted by the clinic RN, nurse practitioner or clinic chief.
[b] Consists of an initial visit for lab, vitamins and administrative functions.
[c] Scheduled as a 2 hour class for 25 patients.

These abbreviations will be presented again in the model formulation phase (see table 13).

Several high volume OR and Labor and Delivery (L&D) procedures were also tracked to account for physician time on the appointment template (see table 2). Currently, the appointment template blocks off specific times for L&D and OR on each physician (Appendix B). The methods used to determine physician time for these selected OR and L&D procedures were surveying the OR register, patient records, and the L&D log. Because of the extreme variability in both areas, average times were calculated and used as the best estimators of physician time (Appendix D).

Table 2

OB-GYN Patient Categories

	OR/L&D set		
Treatment category	ASM abbreviation	Model abbreviation	Average time per procedure (minutes)[a]
Hysterectomy	GYN	Hyster	139
Tubal	BTL	Tubal	39
C-section	O*B	C_Sec	57
Rtn OB delivery	-	RnOBDel	257[b]
Complicated delivery	-	CmOBDel	275[b]

Note. Data reported from DA Form 4108, Register of Operations, Jan 89 - Aug 89.
[a] Plus 10 additional minutes for cleanup and setup in OR.
[b] Calculated by average times for three stages of labor.

Data shown in table 2 reflect average times for selected OR and L&D procedures. The OR procedures included hysterectomies, tubals, and C-sections, while the L&D procedures included routine and complicated OB deliveries. As stated earlier, in the family practice model at Fort Sill, the OB-GYN clinic does not follow routine OB patients; however, the routine OB delivery category was included in this study, because 10 routine OB patients were seen on CAM during the month of October. For the OR, a nine month sample of DA Form 4108, Register of Operations (see Appendix D) provided time allocations for the selected procedures (e.g., hysterectomy, tubal). Added to these average times was 10 minutes to cleanup and setup for OB-GYN surgery (T. Scott, personal communication, 11 December, 1989).

The labor and delivery time for routine and complicated deliveries was harder to capture. As shown in appendix E, labor time is captured in three stages on the patient's SF 534, Medical Record of Labor. Readily apparent was the extreme variability in total labor time. According to the OB nursing staff, however, the OB-GYN physicians are called during the latter part of stage one, and are expected during the second and third stages of delivery (M. Nahrgang, personal communication, 12 January 1990). As an initial planning factor, this study used the second and third stage averages as the best estimator of physician time for OB deliveries.

However, because the OB-GYN physician normally arrived during the first stage of labor, the planning factor was adjusted by adding half of the first stage average to the second and third stage averages. The results of this calculation are shown in table 2.

These OB-GYN clinic categories (table 1) and operating room categories (table 2) served as the objective function variables in the linear programming model (see Appendix P). Model abbreviations for the 14 variables are identified in table 13, and shown under the objective function section in the linear programming formulation in table 14.

Total Demand

To account for the total demand of all 14 categories in the selected month, the actual number of visits and procedures, both in-house and referred downtown, were counted and used as demand levels for the linear programming model. The demand levels under the total column in table 3 were retrieved from the OB-GYN AQCESS database for those patients seen in the MTF (Appendix F), and the CAM database for those patients seen downtown (Appendix G). The total number of visits in the ACQESS database (950) was 34 less than the number captured in the OB-GYN monthly report (984). Although the data relating to the number of visits in the AQCESS database were different than reported at the clinic, those figures were used as the MTF demand levels because they were readily

available. Additionally, the 91 no-shows and cancellations scheduled during the month were added to the 950 visits for a total of 1041 visits at the MTF (see table 3).

At present, the OB-GYN Health Care Finder has a downtown preferred provider network of three individual providers and one group practice. The demand levels for CAM beneficiaries as shown in table 3 were retrieved from the CAM database (see Appendix G)

Table 3

Patient Category Demand, October 1989

Treatment category	Provider appointments[a]						
	Providers				MTF total[b]	CAM total	Total
	A	B	C	D			
Routine GYN	24	21	44	35	124	67	191
Papanicolaou smear	0	2	1	143	146	1	147
Cryosurgery	0	0	1	8	9	2	11
OB visit[c]	102	82	138	52	374	1	375
GYN follow-up	25	43	50	33	151	40	191
OB history	0	0	0	150	150	0	150
Colposcopy	7	7	19	0	33	8	41
Infertility	0	0	0	0	0	9	9
PreOp visit	14	12	28	0	54	23	77
Total	172	167	281	421	1041	151	1192

Note. Data extracted from appointment roster, AQCESS, October 1989.
[a] The AQCESS database captured 950 appointments.
[b] Includes 91 scheduled appointments for no-shows and cancellations.
[c] Includes routine OB visits, complicated OB visits, OB physicals and ultrasounds.

and added to the total demand level for each patient category. The demand levels for standard CHAMPUS were not evaluated, because the OB-GYN clinic staff had no control over those patients who decided to seek care outside the military system. The actual demand from October was used as the upper limit demand constraint for each patient category.

Table 4 shows the demand level for the five selected OR and L&D procedures in this study. The data for these patient categories were retrieved from the DA Form 4108, Register of Operations for October (Appendix H) and the CAM database (Appendix G). The 10 OB

Table 4

Patient Category Demand, October 1989

	OR/L&D set		
Treatment category	MTF total	CAM total	Total
Hysterectomy	3	6	9
Tubal	6	12	18
C-section	12	0	12
Routine OB delivery	--[a]	10	10
Complicated OB delivery	25[b]	--	25

Note. Data extracted from DA Form 4108, Register of Operations, October 1989, and the CAM database.

[a] Thirty-seven patients were followed and delivered by family practice physicians.

[b] One delivery was stillborn.

deliveries on CAM were not categorized as complicated, so they were placed in the routine OB delivery category.

The figures under the total columns in tables 3 and 4 were inserted in the linear programming model as upper level demand constraints (see table 14). For example, the upper level demand constraint (also called right hand side value) for the routine GYN patient category was set at 191 in the linear programming model as depicted in table 3. Likewise, the upper level demand constraint for a hysterectomy was set at 9 as shown in table 4. This upper constraint methodology was used by Brandeau and Hopkins (1984) in their linear programming model at Stanford University Hospital.

Bundling Process

To reflect the true value these 14 separate categories (clinic and OR categories) represent to the hospital, both in terms of cost and reimbursement, 8 of them were bundled into an average episode of care. Patient categories were bundled, when appropriate, by sampling patient records, using the AQCESS database, extracting secondary data from Patient Administration Systems and Biostatistics Activity (PASBA), and eliciting expert opinion to arrive at an average group package. Those categories that were bundled are listed across the top of table 5.

Because of the difficulty of surveying the CAM patient records, the group packages for the CAM variables were assumed to be similar

to the RACH variables. For example, a colposcopy package for a CAM patient required a routine GYN visit, two PAP smear visits, two GYN follow-up visits, and one colposcopy visit as shown in table 5. Of course, it is possible that a CAM colposcopy package differs from the representative package depicted in table 5. However, due to the difficulty of surveying records in civilian clinics, the RACH and CAM group packages for the linear programming model were assumed to be the same number of visits. This assumption did not

Table 5

OB-GYN Patient Group Packages

	Group packages							
						Deliveries		
Treatment category	Colpo	Cryo	Inf	Hyster	Tubal	Rtn	Comp	C-section
Routine GYN	1	1	1	2	1	-	-	-
Pap smear	2	2	-	-	1	-	-	-
Cryosurgery	-	1	-	-	-	-	-	-
OB visit[a]	-	-	-	-	-	11	15[b]	15[b]
GYN follow-up[c]	2	2	5[b]	2	2	3	3	3
OB history	-	-	-	-	-	1	1	1
Colposcopy	1	1	-	-	-	-	-	-
Infertility	-	-	1	-	-	-	-	-
PreOp visit	-	-	-	1	1	-	-	1

Note. Data retrieved from AQCESS database and individual records.
[a] Includes blood pressure visits, OB physical, ultrasound, consult visit, non-stress test, TOCO test, and tummy checks.
[b] Modified by OB-GYN staff.
[c] Includes post partum visits.

affect the results of this study, since the focus of this study was on the OB-GYN clinic at RACH.

An isolated view of two discrete visits without regard to their entire care processes does not account for the total cost and reimbursement potential to RACH. For example, an infertility package, on average, requires 7 visits which is one visit more than a colposcopy package (see table 5). Because there are more visits, an infertility package provides more reimbursement, and expends more resources than a colposcopy package. However, if one considers infertility and colposcopy as discrete, individual visits, the physician time (30 minutes) and reimbursement figures ($8.40) are the same. The objective of this bundling is to account for the entire episode of care, not each individual visit.

Because of our transient population, some longer episodes of care (e.g., OB delivery) showed a lower number of visits than anticipated (Appendix I). For example, routine and complicated OB patients are scheduled for 14 and 21 prenatal visits respectively. In surveying the OB records, however, the visits for both categories were much lower. No attempt was made to adjust the average number of visits determined by sampling records. These average packages were assumed to be a function of the transient patient population at Fort Sill. The Chief of the OB-GYN Service did, however, modify the complicated OB delivery and cesarean

section prenatal visits based on a recent report of the Public Health Service.

In 1989, the Public Health Service established an expert panel on the content of prenatal care (Public Health Service, 1989). One of the panel's recommendations included increasing the number of prenatal visits for patients at risk. Consistent with the panel's recommendation, the OB-GYN Chief increased the complicated and cesarean section prenatal visits to 15. As shown in table 5, the number of GYN follow-up visits in the infertility group package was also increased by the OB-GYN staff at RACH.

The phrase "entire care process" used throughout this study was defined as the bundled group packages shown in table 5. While surveying the health records to establish these group packages, it was readily apparent that many of these packages had entire care processes lasting several years. For example, a hysterectomy package could begin with an abnormal PAP smear, and evolve through ineffective treatments such as colposcopy, cryosurgery, conization, and laser surgery. Naturally, this process could take several years. Because of the longevity of these packages, it was necessary to put parameters on them.

In this study, the entire care process on all group packages began with the decision (usually a consultation) to perform a specific procedure (e.g., colposcopy), and ended with the last

follow-up visit. Many times, however, these follow-up visits extended for several months. To define an end to the entire care process, each group package was terminated when the patient began seeing her provider for other, unrelated, reasons. This method of defining a group package or entire care process caused some PAP smear visits to be lower than anticipated in several group packages such as colposcopy and cryosurgery.

The bundled group packages in table 5 were incorporated into the linear programming model under the demand constraints section in table 14. Read horizontally, table 5 shows the number of each patient category required by the group packages listed on top. For example, the papanicolaou smear (PAP) category was required in three group packages: two under the colposcopy package, two under the cryosurgery package, and one under the tubal package. In table 14, the PAP demand under the total demand constraints included these group package requirements in addition to the individual in-house and CAM PAP patient categories.

Total Staff Time

Total staff time available to see patients in the OB-GYN clinic was retrieved retrospectively from the Personnel Utilization System of the Medical Expense and Performance Reporting System (MEPRS), each provider's Clinical Survey Worksheet, and the DA Form 4108, Register of Operations for October 1989. The total time was

calculated separately for the OB-GYN physicians, the nurse practitioner, and the clinic nursing staff. The time figures captured for the month of October are shown in table 6.

Both clinic and L&D time for the physicians, nurse practitioner, and nursing staff was derived from the Personnel Utilization System of MEPRS (Appendix J). Total time for operating room procedures (e.g., hysterectomy) had to be derived from the DA Form 4108, Register of Operations for the month of October (Appendix H). In the month of October, the total number of planned OR hours for three OB-GYN physicians was 60 hours. This number did

Table 6

OB-GYN Total Time Figures, October 1989

	OB-GYN clinic/inpatient hours		
category	OB-GYN physicians	Nurse practitioner	Clinic nursing staff
OB-GYN clinic	328.00 (19,680)[a]	128.00 (7,680)	646.00 (38,760)
Decrement[b]	103.33 (6,200)	22.50 (1,350)	285.60 (17,136)
TOTAL	224.67 (13,480)	105.50 (6,330)	360.40 (21,624)
Labor & delivery	163.50 (9,810)	--	--
Operating room[c]	36.44 (2,186)	--	--

Note. Data retrieved from the medical expense reporting system.
[a] Figures in parenthesis are in minutes.
[b] Decremented time for lunch, meetings, ward time, administration.
[c] Captured from the OR block schedule.

not account for emergency procedures, but rather was the total number of hours templated for the OB-GYN service. Since the 60 hours reflected all the OR time, it had to be decremented to account for the percentage of time used by the OR categories in this study. The three OR categories accounted for 897 minutes out of a total of 1477 minutes of OR surgery time in October (Appendix H). This equated to 60.7% of OR surgery time. The planning figure for OR time was set at 60.7% of 60 hours or 2186 minutes (table 6).

As stated earlier, total L&D time came from the Personnel Utilization System of MEPRS for October 1989. The total number of hours captured through this report was 12.5 hours less than the number templated on the ASM module. Because the data on MEPRS was readily available, the planning figure for L&D was set at 163.5 hours (9,180 minutes).

Figures shown in table 6 were placed in the total time constraints section in table 14. These figures represented the total amount of time for the OB-GYN physicians, the nurse practitioner, and the clinic nursing staff. Because the OB-GYN ASM schedule kept track of non-available time (i.e., lunch, meetings, ward time, miscellaneous), these times were decremented from the available time for patients, and placed in the linear programming model. The time constraint in the linear programming model was reported in minutes.

Policy Requirements

At RACH, there were no written policies that required a minimum number of patient categories to be scheduled on the appointment template. However, the Chief of OB-GYN, MAJ Kathyrn Parks, does schedule a GYN clinic for each provider weekly, and a colposcopy clinic for each provider monthly (K. Parks, personal communications, 16 February 1990). Using these clinics as a minimum constraint in the linear programming model would require 24 routine GYN visits, 24 GYN follow-up visits, and 18 colposcopy visits for the OB-GYN physicians. These constraints were placed in the minimum proficiency constraints section as shown in table 14. These minimum demand levels only applied to the OB-GYN physicians. There were no minimum level demands scheduled for the nurse practitioner.

Patient Category Value

Determining the values associated with the separate linear programming variables was difficult at best. This difficulty is not unusual for cost effectiveness studies. A commonly cited difficulty of most cost effectiveness studies is placing value figures on program alternatives (Emery & Schneiderman, 1989). The method used to determine values for the objective function variables in this study was derived from average cost and reimbursement figures. Because this study was concerned with the

cost savings goal of CAM, a cost savings index was developed to derive a value for each linear programming model variable. The following sections discuss cost and reimbursement figures associated with each objective function variable and the development of the cost savings index.

Costs.

Cost accounting at RACH only allowed average cost associated with inpatient and outpatient visits. To arrive at a more representative average cost in this study, only the Army Management Structure Codes (AMSCO) for the OB-GYN cost centers were used for determining the costs of a clinic visit and a hospital day. These average cost figures, shown in table 7, were obtained from the MEPRS database, and used as the cost for each patient category and

Table 7

Cost Figures for OB-GYN Clinic, RACH

	Average costs		
	Clinic visit[a]		
Service	Physician	Nurse practitioner	Hospital day
OB-GYN clinic	$42.20	$38.40	$446.70

Note. Cost figures provided by Resource Management Division, RACH.
[a] Cost figures for a 20 minute outpatient visit.

group package variable for this study (Appendix K). As shown in appendix K, these cost figures included direct, indirect, ancillary, BASOPS, and equipment expenses for the OB-GYN service at RACH.

To account for the costs associated with the inpatient portion of a group package (e.g., tubal ligation), the average length of stay (LOS) for each group was obtained through the AQCESS (Appendix E) and PASBA (Appendix L) databases. The average LOS for each group was multiplied by the cost of a hospital day found in table 7. The total inpatient costs for those group packages that required an inpatient stay are shown in table 8.

Table 8

Average Costs for Selected Inpatient Stays

	OR/L&D			
Treatment category	DRG	Average LOS (days)	Cost per hospital day	Average inpatient cost
Hysterectomy	358, 359	6.80	$ 446.70	$ 3037.56
Tubal	360, 361, 362	3.28	$ 446.70	$ 1465.18
C-section[a]	370, 371	9.31	$ 446.70	$ 4158.78
Rtn OB delivery[a]	373	5.31	$ 446.70	$ 2371.98
Comp delivery[a]	372	6.19	$ 446.70	$ 2765.07

Note. Data retrieved from PASBA, DA Form 4108, Register of Operations, Jan 89 - Aug 89.
[a] Includes average times for mother and child.

Cost figures for patients referred on CAM were obtained from the CAM database (Appendix M). When possible, cost figures on bundled packages contained the same number of patient visits. The only group package that contained a different number of visits was the routine OB delivery. Under CAM, the routine prenatal visits

Table 9

Clinic and OR Category Cost Figures, RACH and CAM, October 1989

Treatment category	Cost figures: RACH: OB-GYN physician	RACH: Nurse practitioner	CAM
Routine GYN visit	$42.20	$38.40	$42.35
Pap smear visit	42.20	38.40	11.94
Cryosurgery visit	63.30	76.80	103.95
OB visit	42.20	38.40	39.66
GYN follow-up visit	42.20	38.40	29.72
OB history visit	--	9.60[a]	103.10
Colposcopy visit	63.30	--	130.90
Infertility visit	63.30	--	61.60
PreOp visit	63.30	--	34.65
Hysterectomy	3037.56	--	5384.68
Tubal	1465.18	--	1713.29
C-section	4158.78	--	4340.75
Rtn OB delivery	2371.98	--	2582.32
Comp delivery	2765.07	--	3457.08

Note. Data retrieved from RMD, RACH, PASBA, and the CAM database.
[a] Based on 25 patients for a 120 minute class.

were grouped (and priced) into 9 prenatal visits. To equate costs of the in-house and CAM routine OB delivery packages, the number of prenatal visits for CAM was calculated for 11 visits. Table 9 contains the results of both in-house and CAM costs. Cost figures for the CAM group packages were retrieved from actual claims data.

Reimbursement.

Reimbursement was determined on each patient category and group package based on the average number of clinic visits. One method of developing a reimbursement figure was to use the diagnosis related group (DRG) outpatient resource allocation measure devised by Health Care Studies and Clinical Investigation Activity (HCSCIA) (Optenberg, Coventry, Baker, & Austin, 1988, p. 7). To develop these ambulatory rates, HCSCIA expanded and recalibrated the outpatient portion of the current Health Care Unit into a workload measure known as the Ambulatory Work Unit (AWU). Essentially, the AWU is a resource intensity weighted index that is assigned to every outpatient cost center within the facility. Through many statistical computations, HCSCIA validated the AWU measure against the DRG case complexity measure. The resultant analysis between the two measures demonstrated a "positive, strong, and statistically significant" correlation. In view of these findings, HCSCIA recommended that the AWU become the weighted classification of ambulatory workload in the Military Health Service System

(MHSS), and that the AWU be used in conjunction with the DRG-based inpatient work unit (IWU) as a resource allocation system (Optenberg, Coventry, Baker, & Austin, 1988, p. 5).

Upon the recommendation from HCSCIA, this study used the Ambulatory Work Unit and the final supply allocation methodology for its reimbursement rates. Each clinic has a resource intensity index that reflects the average amount of resources needed to provide care during a typical visit. Different clinics have different weights. The AWU weights for obstetrics and gynecology are shown in table 10 (Mayer, 1988).

Each AWU and Inpatient Work Unit (IWU) is reimbursed according

Table 10

Reimbursement Rates for Outpatient Visits, OB-GYN Clinic

Service	AWU weight	Reimbursement per MWU	Reimbursement per visit
Obstetrics	0.0260	$355.92	$9.25
Gynecology	0.0236	$355.92	$8.40

Note. Data extracted from HCSCIA, AWU, p C-3).

to the facility unique supply allocation rate. The sum of the AWUs and IWUs equal a facility's Medical Work Unit (MWU). In FY 1990, RACH received $355.92 per MWU.

The reimbursement figures for those patient categories that have an inpatient stay (i.e., tubal ligation, OB delivery) were derived from secondary data received from PASBA (Appendix L). The average reimbursement for the appropriate diagnostic groups, both with and without complications, served as the reimbursement for the inpatient portion. The reimbursement rate was the relative case mix index (RCMI) for the diagnostic groups as shown in table 11. The RCMI was derived by dividing RACH's case mix index (CMI) by the DoD average of .8109 (Appendix N).

The RCMI is a case-mix index which is standardized to reflect a facility's resource intensity in relation to the DoD average. For RACH, a RCMI of 1.35 would indicate that our cost per disposition should be 35 percent higher than average, all other costs and factors being equal. In table 11 the CMI for a complicated OB delivery (DRG 372) was calculated by dividing the relative weighted products (68.5539) by the number of dispositions (81) to arrive at a CMI of 0.8463. This was RACH's case mix index (CMI) for a complicated OB delivery: to standardize that CMI to the DoD average of 0.8109, it was divided by the DoD average. The RCMI for a complicated OB delivery became 1.0437. That RCMI figure would

indicate that our cost for each complicated OB delivery should be 4 percent higher than the DoD average. Both the CMI and RCMI figures were calculated by PASBA as shown in appendix O.

As shown in table 11, the RCMI for each patient category was multiplied by the final supply allocation rate for RACH ($355.92) to develop the supply reimbursement rates used in this study. Since the intent was to bundle the average value of each patient category, this reimbursement methodology served to account for the inpatient time.

Table 11

Reimbursement Rates for Inpatient Stay

	OR/L&D					
Treatment category	Relative weight[a]	No. of disps	CMI[b]	RCMI[c]	Supply allocation rate	Average inpatient reimbursement
Hysterectomy	48.8898	46	1.0628	1.3106	$355.92	$466.48
Tubal	61.1676	88	0.6950	0.8571	$355.92	$305.05
C-section	210.4026	208	1.0115	1.2474	$355.92	$443.97
Rtn OB Del	388.3450	811	0.4788	0.5905	$355.92	$210.15
Comp Del	68.5539	81	0.8463	1.0437	$355.92	$371.47

Note. Retrieved from PASBA CMI/RCMI Data for RACH in FY 1988.
[a] Includes complicating diagnosis DRG.
[b] Total relative weighted products/number of dispositions.
[c] Derived by dividing the CMI by the DoD average of 0.8109.

Once cost and reimbursement figures were calculated for each patient category and group package, a cost savings index was determined. Cost figures for comparable CAM procedures were available through the CAM office. Obviously, CAM supply reimbursement for RACH was zero. The cost savings index was developed on similar in-house and CAM categories (i.e., colposcopy) using cost and reimbursement figures. For ease of interpreting the linear programming solution, the objective function variables contained positive coefficients. Because of this requirement, the indexed number was set at one. In the linear programming model a positive coefficient (greater than zero) also ensured maximum output for each of the objective function variables. For each patient category and group package, cost minus reimbursement was its final cost figure. When comparing in-house and CAM final cost figures, the highest cost for each category became the index (I) number. The final cost figure for each category was denoted as (X). After final and index costs were developed, a cost savings index for both in-house and CAM groups was calculated using the following formula:

$$\text{Cost Savings} = | I - X | + 1$$

The cost savings index was each category's 'value' to the hospital, and each category's coefficient in the objective function equation for the linear programming model (see table 12). As shown in table 12, the cost savings index for a colposcopy visit was 77.00 for the in-house variable and 1.00 for the CAM variable. These numbers were derived from the average cost and reimbursement figures shown in tables 7 through 11. For example, the average cost associated with a routine GYN visit scheduled with an OB-GYN physician at RACH was $42.20 (see table 7). The cost for that same visit under CAM was $42.35 (see table 9). Since RACH did not receive any reimbursement from CAM, the reimbursement figures only applied to RACH variables. The average reimbursement figure for a routine GYN visit was calculated at $8.40 using the final supply allocation rate established by HCSCIA (table 10). The reimbursement figure ($8.40) was subtracted from the cost figure ($42.20) to obtain the final cost figure of $33.80 for the in-house routine GYN variable. The routine GYN visit on CAM was $42.35. As noted in the cost savings index, the higher of these two final cost numbers became the index number (I). Using the cost savings formula, the values associated with both routine GYN variables were 9.55 for RACH and 1.00 for CAM (see table 12).

The same methodology was used for those variables that had an inpatient stay (e.g., hysterectomy). The only difference to the

final cost figures for these variables was to account for costs

Table 12

OB-GYN Patient Category Values

Patient category	Final costs (in $)[a] In	Final costs (in $)[a] Out	Index value	Cost savings index In	Cost savings index Out
Rtn GYN (P)	33.80	42.35	42.35	9.55	1.00
Rtn GYN (N)	30.00	42.35	42.35	13.35	1.00
Pap smear (P)	33.80	11.94	33.80	1.00	22.86
Pap smear (N)	30.00	11.94	30.00	1.00	19.06
Cryosurgery (P)[b,c]	54.90	103.95	103.95	50.05	1.00
Cryosurgery (N)[b,c]	68.40	103.95	103.95	36.55	1.00
OB visit (P)	32.95	39.66	39.66	7.71	1.00
OB visit (N)	29.15	39.66	39.66	11.51	1.00
GYN follow-up (P)	33.80	29.72	33.80	1.00	5.08
GYN follow-up (N)	30.00	29.72	30.00	1.00	1.28
OB history	0.35	39.66	39.66	40.31	1.00
Comp OB del[c]	2393.60	3457.08	3457.08	1064.48	1.00
Tubal[c]	1160.13	1713.29	1713.29	554.16	1.00
Colposcopy[c]	54.90	130.90	130.90	77.00	1.00
Pre-op visit	54.90	34.65	54.90	1.00	21.25
Infertility[c]	54.90	61.60	61.60	7.70	1.00
Hysterectomy[c]	2571.08	5384.68	5384.68	2814.60	1.00
C-section[c]	3714.81	4340.75	4340.75	626.94	1.00
Rtn OB del[c]	2161.83	2582.32	2582.32	420.49	1.00

[a] This figure is derived by subtracting reimbursement from costs.
[b] P = OB-GYN physician; N = Nurse practitioner
[c] Represents a bundled package

associated with the average LOS for each variable. For example, according to PASBA, a hysterectomy patient averaged about 6.8 days in the hospital at approximately $446.70 per day (table 8). That same patient would cost RACH $5384.68 on CAM with no reimbursement. As shown in table 11, the reimbursement rate for a hysterectomy patient averaged $466.48 using the relative case mix index for RACH. As a result, the final cost figure for the RACH hysterectomy variable was $2571.08, whereas the final cost figure for CAM was $5384.68 (table 12). Because the CAM cost figure was the higher of the two, it became the index number (I). Again, using the cost savings formula, the values associated with both *hysterectomy* variables were 2814.60 for RACH and 1.00 for CAM. The cost savings figures for all the linear programming variables are shown in table 12. These figures became the objective function coefficients (or value) in the linear model (see table 14).

Throughout this phase, many types of data were collected as a method of placing values on patients or groups of patients in the linear model. Because linear programming uses objective data to determine the optimal solution, this value methodology was unavoidable. As discussed in the next section, placing a value on patients through cost-effectiveness techniques conjures up rational, unfeeling allocation decisions as well as privacy concerns for the patients involved.

Ethical Consideration

Ethical concerns often arise when cost-effectiveness techniques are used as the basis for rationing or resource allocation (Davis, 1989). One commonly cited ethical issue (see Davis, 1989; Ganiats & Schneiderman, 1988) is the lack of quality of life or health status measures necessary to accomplish cost analysis measures. As in this study, many cost studies place values on program alternatives so that cheaper alternatives can be favored over more expensive ones. It is conceivable, however, that other factors might be judged important enough to make the most cost effective solution less valuable. For example, *society might favor* a $150,000 liver transplant for a 90 year-old, if that person was a highly influential and important government figure.

In developing policies with cost analysis studies, many researchers find it difficult to either quantify or address these factors. Some factors are unavoidable. Nevertheless, cost effectiveness techniques are becoming more popular when decisions of resource allocations have to be made (Ganiats & Schneiderman, 1988). Cost effectiveness analysis is an aid to, not a replacement for, value judgements in identifying the best solution (Davis, 1989). As addressed by Davis (1989) in his article on

cost-effectiveness research, it is up to society to forego any rational cost effective decision in favor of sentimental ideals (e.g., charity).

A further ethical consideration involves patient privacy. Because data used in this study were collected from surveying actual patient records, the anonymity of all patients was assured by collecting requisite data with patient registration numbers rather than by name. This action preserved the anonymity and privacy rights of all patients.

Model Formulation

After collecting appropriate data, the second phase was designed to establish the objective function and constraints for the linear programming model. The objective function variables were the 14 descriptive patient categories and group packages identified in the data collection phase. The coefficients for these variables were calculated using a cost savings index and defined as the variable's 'value'. The model's constraints included total provider time to see patients, minimal appointment demands required to sustain clinical proficiency, and actual demand by patient category during the month of October 1989.

For clarity, the linear programming model variables identified in this study are presented in table 13. These abbreviations were necessary, because the selected linear programming computer package

allowed only 8 characters for each objective function variable. As shown in table 13, when dealing with physician, nurse practitioner, and CAM patient categories, the total number of objective function variables expanded to 33. The linear programming computer package used in this study was a commercially available program called LINDO. LINDO (Linear, Interactive, Discrete Optimizer) is a

Table 13

Objective Function Variables

	Model abbreviations		
	RACH		
Patient category	Physician	Nurse practitioner	CAM
Routine GYN visit	RtnGYNP	RtnGYNNp	RtnGYNOt
Papanicolaou smear	PAPP	PAPNp	PAPOut
Cryosurgery	CryoP	CryoNp	CryoOut
OB visit	OBVisitP	OBVisitN	OBVisitO
GYN follow-up visit	GYNFluP	GYNFluNp	GYNFluOt
OB history	--	OBHisNp	OBHisOut
Colposcopy	ColpoP	--	ColpoOut
Infertility	InfP	--	InfOut
PreOp visit	PreOpP	--	PreOpOut
Hysterectomy	HysterP	--	HysterOt
Tubal	TubalP	--	TubalOut
Cesarean section	C_SecP	--	C_SecOut
Rtn OB delivery	RnOBDelP	--	RnOBDelO
Comp delivery	CmOBDelP		CmOBDelO

Table 14

Linear Programming Model

Objective function

Maximize savings = 9.55 RtnGYNP + 13.35 RtnGYNNp + 1.00 RtnGYNOt + 1.00 PAPP + 1.00 PAPNp + 22.86 PAPOut+ 50.05 CryoP + 36.55 CryoNp + 1.00 CryoOut + 7.71 OBVisitP + 11.51 OBVisitN + 1.00 OBVisitO + 1.00 GYNFluP + 1.00 GYNFluNp + 5.08 GYNFluOt + 40.31 OBHisNp + 1.00 OBHisOut + 77.00 ColpoP + 1.00 ColpoOut + 7.70 InfP + 1.00 InfOut + 1.00 PreOpP + 21.25 PreOpOut + 2814.60 HysterP + 1.00 HysterOt + 554.16 TubalP + 1.00 TubalOut + 626.94 C_SecP + 1.00 C_SecOut + 420.49 RnOBDelP + 1.00 RnOBDelO + 1064.48 CmOBDelP + 1.00 CmOBDelO

Total demand constraints **BUNDLED**

Routine GYN demand: 1 RtnGYNP + 1 RtnGYNNp + 1 RtnGYNOt + 1 ColpoP + 1 CryoP + 1 CryoNp + 1 InfP + 2 HysterP + 1 TubalP <= 191

Papanicolaou smear demand: 1 PAPP + 1 PAPNp + 1 PAPOut + 2 ColpoP + 2 CryoP + 2 CryoNp + 1 TubalP <= 147

Cryosurgery demand: 1 CryoP + 1 CryoNp + 1 CryoOut <= 11

GYN follow-up demand: 1 GYNFluP + 1 GYNFluNp + 1 GYNFluOt + 2 ColpoP + 2 CryoP + 2 CryoNp + 5 InfP + 2 HysterP + 2 TubalP + 3 C_SecP + 3 RnOBDelP + 3 CmOBDelP <= 191

Colposcopy demand: 1 ColpoP + 1 ColpoOut + 1 CryoP + 1 CryoNp <= 41

OB visit demand: 1 OBVisitP + 1 OBVisitN + 1 OBVisitO + 11 RnOBDelP + 15 CmOBDelP + 15 C_SecP <= 375

Table 14 (con't)

Linear Programming Model

Routine delivery demand: 1 RnOBDelP + 1 RnOBDelO <= 10

OB history demand: 1 OBHisNp + 1 OBHisOut + 1 C_SecP + 1 RnOBDelP + 1 CmOBDelP <= 150

Pre-Op visit demand: 1 PreOpP + 1 PreOpOut + 1 HysterP + 1 TubalP + 1 C_SecP <= 77

Infertility demand: 1 InfP + 1 InfOut <= 9

Hysterectomy demand: 1 HysterP + 1 HysterOt <= 9

Tubal demand: 1 TubalP + 1 TubalOut <= 18

Cesarean section demand: 1 C_SecP + 1 C_SecOut <= 12

Complicated delivery demand: 1 CmOBDelP + 1 CmOBDelO <= 25

Minimum Proficiency Constraints

Minimum routine GYN demand: 1 RtnGYNP >= 24

Minimum GYN follow-up demand: 1 GYNFluP >= 24

Minimum colposcopy demand: 1 ColpoP >= 18

Total Time Constraints (in minutes)

Physician clinic time: 20 RtnGYNP + 20 PAPP + 30 CryoP + 20 OBVisitP + 20 GYNFluP + 30 ColpoP + 30 InfP + 30 PreOpP <= 13,480 minutes

Physician L&D time: 257 RnOBDelP + 275 CmOBDelP <= 9,810 minutes

Physician OR time: 57 C_SecP + 139 HysterP + 39 TubalP <= 2,186 minutes

---

Table 14 (con't)

Linear Programming Model

Nurse practitioner time:	20 RtnGYNNp + 20 PAPNp + 40 CryoNp + 20 OBVisitN + 20 GYNFluNp + 5 OBHisNp <= 6,330 minutes
Clinic nurse time:	20 RtnGYNP + 20 RtnGYNNp + 20 PAPP + 20 PAPNp + 30 CryoP + 40 CryoNp + 20 OBVisitP + 20 OBVisitN + 20 GYNFluP + 20 GYNFluNp + 5 OBHisNp + 30 ColpoP + 30 InfP + 30 PreOpP <= 34,224 minutes

software program that solves linear, integer, and quadratic problems on a personal computer. The complete linear programming model is presented in table 14. The figures used in the model were identified and discussed in the data collection phase.

As shown in table 14, one area was bundled in the linear programming model. The total demand constraints section was bundled according to the group packages shown in table 5. For example, since a routine OB delivery package required 11 OB visits (see table 5), the OB visit demand showed 11 for the routine OB delivery (RnOBDelP) variable. As can be seen in table 14, all group package variables listed in table 5 were bundled in the total demand constraints section of table 14. Again, the focus of this study was on the OB-GYN clinic, not the inpatient portion of the OB-GYN service. Operating room and L&D times were tracked as part of the clinic template.

Model Analysis

The last phase of this study was designed to analyze the linear programming model results. The first section in the model analysis phase will present the results of the initial linear programming model. That section will be followed by a discussion of the initial results, and subsequent programming runs. The final section in this phase will provide some conclusions regarding the use of linear programming in scheduling outpatient services. As stated earlier, the linear programming model was intended to be an adjunct in the decision-making process of allocating patient appointments between the OB-GYN clinic and the CAM demonstration project at Fort Sill.

Results

In the initial linear programming formulation, 33 objective function variables (activities) and 22 constraints on those variables were identified as the input data to the linear model (see table 14). Because the process of solving linear programming problems requires a large number of calculations and stepwise iterations, the actual programming was performed by a computer program called LINDO (Appendix P). The results of the initial linear model for the clinic appointments are presented in table 15.

All of the objective variables were defined as integer (whole number) variables, in order to find the optimum integer solution without violating any of the constraints.

The data in table 15 showed a dramatic shift in patient appointments away from the nurse practitioner toward the three OB-GYN physicians. The low number of nurse practitioner visits (262) was the reason why the amount of slack in the nurse practitioner time (see Appendix P) was 3465 minutes out of a total of 6330 minutes available (54.7 percent free time). Two additional

Table 15

Linear Programming Results

	Clinic appointments							
	Actual Results				Model Results			
Treatment category	Physician	NP[a]	CAM	Total	Physician	NP	CAM	Total
Routine GYN	89	35	67	191	79	112	0	191
Pap smear	3	143	1	147	56	0	91	147
Cryosurgery	1	8	2	11	0	0	11	11
OB visit	322	52	1	375	375	0	0	375
GYN follow-up	118	33	40	191	191	0	0	191
OB history	0	150	0	150	0	150	0	150
Colposcopy	33	0	8	41	19	0	22	41
Infertility	0	0	9	9	0	0	9	9
Pre-op visit	54	0	23	77	27	0	50	77
Total	620	421	151	1192	747	262	183	1192

[a] NP = nurse practitioner.

constraints in the discussion phase will correct this shift in patient appointments away from the nurse practitioner. Other observations in the clinic data set involved the changes in the PAP, routine GYN, and pre-op patient categories. Because the cost of PAP smears under CAM was $11.94 (compared to $33.80 at RACH), 91 PAPs were shifted to CAM. Additionally, due to a 13.35 savings value in routine GYN appointments, the nurse practitioner picked up 77 additional routine GYN appointments (112). Finally, the number of pre-op visits required as part of an episode of care in the OB-GYN clinic decreased from 54 to 27. Part of this decrease was due to a shift in 12 cesarean sections.

Table 16

Linear Programming Results

	OR/L&D appointments					
	Actual Results			Model Results		
Treatment category	Physician	CAM	Total	Physician	CAM	Total
Hysterectomy	3	6	9	9	0	9
Tubal	6	12	18	18	0	18
C-section	12	0	12	0	12	12
Rtn OB del	0	10	10	0	10	10
Comp OB del	25	0	25	25	0	25
TOTAL	46	28	74	52	22	74

Table 16 depicts the linear programming results of the L&D and OR patient categories. These variables were also defined as integer values. The major changes in the linear programming model results involved the hysterectomy and cesarean section variables. In October, only 33 percent of the hysterectomies were performed at RACH, but in the model analysis all hysterectomies were scheduled for RACH. An unexpected result of the linear model was the complete shift of cesarean section variables to CAM. Part of this shift could be explained because the savings for RACH was relatively low (626.94) compared to the extensive use of resources (15 prenatal visits, 3 post partum visits, 1 OB history visit, and 1 pre-op visit).

Discussion

Prior to discussing the linear programming results, this section explains some of the terminology (e.g., dual prices, reduced cost) in the linear programming output, and develops a cursory understanding of the initial model results at appendix P.

Linear Programming Output

The output from the linear programming formulation in table 14 is shown at appendix P. In all solution reports, the output has two sections, a "solution" section and a "range" section. Each

section is further divided into two subsections, one for the objective function variables and the second for the constraint rows.

Solution Section

In the solution section of the output, the first subsection deals with the objective function variables. In this study the objective function variables are the 33 patient categories defined in the data collection phase. The first column identifies the variable names (see table 13). Associated with each variable name in the "value" column is the optimum cost savings solution for the initial run of the model. For example, the PAP smear solution suggests that 91 PAP smears (out of a possible 147) be allocated to the CAM project (PAPOUT), and none be allocated to the OB-GYN physicians (PAPP) and nurse practitioner (PAPNP) at RACH. However, in table 15 the number of PAP smears for the OB-GYN physicians shows 56. The apparent difference comes from the group packages shown in table 5. Two PAP smear visits are required in the colposcopy and cryosurgery group packages, and one PAP smear visit is required in each tubal group package. The 19 colposcopies (COLPOP) and 18 tubals (TUBALP) in appendix P require that 56 PAP smear visits be allocated to RACH. As shown in the slack column of

appendix P, this PAP solution leaves zero slack for the PAP constraint since 91 and 56 add up to the total number of PAP smear visits possible (147).

Associated with each variable in the third column is a quantity known as the reduced cost. According to Schrage (1986), its value is the amount by which the cost savings of the variable must be improved before that variable would have a positive value in the optimal solution. Obviously, a variable which already appears in the value column would have a zero reduced cost. In appendix P, a routine GYN visit on CAM has a value of zero and a reduced cost of 12.35. As shown in table 12, the original coefficient of this routine GYN visit (RTNGYNOT) is indexed at 1.00. According to the reduced cost column, the RTNGYNOT variable cost savings index would have to be improved by 12.35 per visit (13.35) in order to show a positive value in the final optimum solution. At the 13.35 value, this variable would be competing with the nurse practitioner routine GYN variable which is also indexed at 13.35. More precisely, the concept of a reduced cost is shown by the following formula (Levin, et al., 1989):

$$\text{Reduced cost} = \frac{\text{Change in optimal objective function value}}{\text{Unit increase of the variable in question}}$$

As previously mentioned, a 12.35 increase in the cost savings value for the routine GYN CAM variable would cause both the RTNGYNOT and the RTNGYNNP variables to be valued at 13.35. At this point, at least 1 RTNGYNOT variable currently at zero would be forced into the final solution. Mathematically, an alternative interpretation of a reduced cost is the rate at which the objective function value would deteriorate because this variable was forced into the final solution. This study does not deal with the alternative interpretation for reduced cost, because the objective function values are derived from a cost savings formula indexed at one. Determining the deterioration of an optimal cost savings index value would prove to be useless.

The second subsection in the solution output deals with the 22 constraint rows. The first column identifies the row, and the second column determines what is left for that constraint (slack or surplus) after the optimum solution is reached. In the constraint rows, slack is the amount of resource not used and surplus is the additional amount of resource required in the optimal solution. The PAP smear example earlier showed a zero slack when all 147 PAP visits were allocated.

Associated with each constraint row in the third column is a quantity known as the dual prices (also known as shadow prices). According to Schrage (1986), the dual price is the rate at which

the optimum solution will change as the right-hand-side of the constraint is increased. The hysterectomy constraint serves as an excellent example of the dual price concept. Since the objective function unit of measure is cost savings and the unit of the hysterectomy constraint is each procedure, the unit of the hysterectomy dual price is cost savings per procedure. According to Schrage's definition of a dual price, each hysterectomy performed at RACH (HYSTERP) will improve the optimum solution by 2749.72 (see Appendix P).

Another way to look at the dual price is to understand that giving up one of the hysterectomy procedures will cost 2749.72 in the optimum solution value. More precisely, the concept of the dual price for any constraint is shown by the following formula (Levin, et al., 1989):

$$\text{Dual price} = \frac{\text{Change in optimal objective function value}}{\text{Unit increase in right-hand-side coefficient}}$$

A word of caution is necessary before using reduced cost and dual prices data from the model output. For example, if the dual price of the routine GYN constraint row is 13.35, then, by definition, increasing the number of routine GYN appointments available will improve the optimum solution by 13.35 for each of the first few (possibly only one) visits added. At some point,

however, as more visits become available, the value of these visits would not increase and might even decrease. Values listed under the reduced cost and dual prices columns are only limited to 'small changes' in resource availability. Schrage (1986) suggests that reduced cost and dual prices values are valid as long the 'character of the optimal solution does not change,' i.e., changes in resource availability do not affect the current binding constraints (p. 22).

Range Section

The range section of the model output is also referred to as the sensitivity analysis report. This section indicates the amounts by which the objective function coefficients or the constraint right-hand-side ranges can be changed without affecting the character of the optimal solution. As in the solution section, this section has two subsections, one for the objective function variables and the second for the constraint rows.

Both subsections report a range over which the optimum solution is valid using three columns: current value, allowable increase, and allowable decrease. Changes made within these ranges will not affect the character of the optimal solution. For example, the current objective function coefficient (cost savings index) for a nurse practitioner routine GYN visit is 13.35. The 3.8 in the fourth column means that the costs savings index of that routine

GYN visit (RTNGYNNP) could be decreased by up to 3.8 per visit without affecting the 112 visits allocated to the nurse practitioner (or any other routine GYN variables) in the optimal solution. This is plausible because, a decrease of 3.8 would make the coefficient of this variable similar to that of the OB-GYN routine GYN visit (9.55). The INFINITY value under the third column of the CAM cryosurgery visit (CRYOOUT) means that increasing the cost savings index of that variable by any positive amount would have no affect on the allocation of cryosurgery visits in the optimal solution. This makes sense because the maximum number of cryosurgery visits possible is already being allocated on CAM (11).

Likewise, if the right-hand-side values of any constraint row is changed within the range shown in the second subsection, then the character of the optimal solution will not change. For example, if the right-hand-side of the PAP row is decreased by more than 91, then the optimal solution would change. This would make sense since the constraint would become binding on the 56 PAP smear visits necessary for the tubal and colposcopy group packages. This change would also affect the reduced cost and dual prices in the model. The right-hand-side of the PAP constraint could be increased by an infinite amount without affecting the final

solution. This is intuitive since there are 91 PAP smears (PAPOUT) available for use by the OB-GYN staff if needed, so adding more visits should have no affect.

Initial Linear Programming Results

There were several interesting observations in the initial linear programming model results. One of the first areas of interest was the delivery of the routine OB patients. In this study 10 patients were identified as routine OB deliveries, and all 10 were allocated to the CAM project in the linear model as originally scheduled in October. None of the 10 were allocated back to RACH even though each patient had a 420.94 cost savings value over CAM (see table 12). In fact, according to the reduced cost column in appendix P, the cost savings for a routine OB delivery patient category (RTNOBDELP) would have to improve by 377.92 before any of the 10 routine OB patients would be allocated to RACH. As shown in appendix Q, when the cost savings index of the routine OB delivery category was increased 377.92, the routine OB delivery category increased for RACH (3.0) and decreased for CAM (7.0). Notice also, that this change in the cost savings of the routine OB delivery affected the allocation of the complicated OB delivery and colposcopy patient categories due to resource constraints. This example serves as an illustration of how linear programming allows implicit evaluation of all alternatives

simultaneously. Because all the patient categories are simultaneously competing for limited resources, the change in the cost savings value of one variable (i.e., routine OB delivery) affects the allocation of several variables when the final objective (maximize cost savings) is achieved.

The shift of all 12 cesarean section patients from RACH to CAM was a notable change in the initial linear model results. Although each RACH cesarean section has a savings value of 626.94, the model would not allocate any to RACH unless the cost savings for RACH (C_SECP) increased 458.79 (see the reduced cost column). An increase in the cost savings value for the RACH cesarean section variable would force some of the 12 patients to be seen at RACH at the expense of some of the 25 complicated OB delivery patients already allocated to RACH. This is intuitive because of competition for the scarce number of OB visits (375) already showing zero slack for the initial model.

The infertility and cryosurgery patient categories are another area of interest for this study. As the linear model depicted in appendix P, both categories allocated all of the possible patient visits to CAM. The cost savings values for both variables would have to increase more than 40 for either variable to be forced into the final solution. In the competition for resources, the initial model would seem to indicate that RACH should not do any

cryosurgery or infertility visits. Interestingly, the Chief of OB-GYN Services has already stopped providing the infertility service to beneficiaries at RACH. The linear model results would agree with her decision.

One finding under the dual prices column is the negative value of the minimum demand constraints for routine and follow-up GYN visits. Ironically, according to the dual prices column in appendix P, RACH is actually loosing money on the 24 required routine GYN visits (3.80 per visit) and the 24 required routine GYN follow-up visits (7.47 per visit). The reason for the loss of money on these visits is that the visits could be used more effectively elsewhere, if it were not for the minimum requirement constraint. For example, RACH could save 3.80 per visit if the minimum OB-GYN physician requirement of 24 routine GYN visits were no longer a requirement. This makes sense because the visits would be allocated to the nurse practitioner (RTNGYNNP) which can save an additional 3.80 per visit over the OB-GYN variable (RTNGYNP) (i.e., 13.35 for the RTNGYNNP versus 9.55 for the RTNGYNP).

As mentioned earlier in the results section, both the hysterectomy and the tubal variables were allocated totally to RACH. It should not come as a surprise, then, to see the highest dual prices associated with these variables (Appendix P). Because of the high potential for cost savings under the dual prices column

for two of the three OR categories (i.e., hysterectomy, tubal), the OR time constraint showed all but 233 minutes of OR time being used. This equated to an 89.3 percent usage factor (1953 minutes out of 2186 minutes) for the OR, at the expense of clinic time for the OB-GYN physicians (11.4% use) and the nurse practitioner (45.3% use). Notice also, that the clinic nurse usage rate was 20.3% (4,395 minutes out of a possible 21,624 minutes). Two additional constraints in the next section will minimize this obvious skew toward OR procedures.

Forced Linear Model

One of the areas of concern from the results of the initial linear programming model was the apparent shift away from the OB-GYN clinic appointments toward the in-house OR and L&D procedures. Because this study looked at scheduling outpatient services, the following constraints were added to the original model. These additional constraints were used to allocate (or force) the OB-GYN physicians and nurse practitioner to see the actual number of clinic visits captured during October 1989.

```
Total clinic visits (Nurse practitioner):  1 RTNGYNNP + 1 PAPNP + 1
                                           CRYONP + 1 OBVISITN + 1 GYNFLUNP +
                                           1 OBHISNP >= 421

Total clinic visits (OB-GYN physicians):  1 RTNGYNP + 1 PAPP + 1
                                          CRYOP + 1 OBVISITP + 1 GYNFLUP + 1
                                          INFP + 1 PREOPP + 1 COLPOP >= 620
```

The right-hand-side values for these two constraints come from the actual number of clinic visits captured in the ASM module of AQCESS as shown in table 15. As expected, the OR and L&D usage rate dropped from 89.3% and 70.1% in the initial model to 19.1% and 0% in the forced model (Appendix R). In fact, only three hysterectomy patients were allocated to RACH. All other OR and L&D patients were allocated to CAM, because of the extensive use of resources required to meet the clinic visits. (Remember, the model did not account for resource availability beyond that captured by Table 17

Linear Programming Results (Forced Model)

	Clinic appointments							
	Actual Results				Model Results			
Treatment category	Physician	NP[a]	CAM	Total	Physician	NP	CAM	Total
Routine GYN	89	35	67	191	48	143	0	191
Pap smear	3	143	1	147	144	0	3	147
Cryosurgery	1	8	2	11	0	0	11	11
OB visit	322	52	1	375	247	128	0	375
GYN follow-up	118	33	40	191	191	0	0	191
OB history	0	150	0	150	0	150	0	150
Colposcopy	33	0	8	41	18	0	23	41
Infertility	0	0	9	9	0	0	9	9
Pre-op visit	54	0	23	77	77	0	0	77
Total	620	421	151	1192	725	421	46	1192

[a] NP = nurse practitioner.

the Personnel Utilization Survey). Notice also that the OB-GYN physician and the nurse practitioner usage rates increased dramatically to 98.8% and 97.5% respectively. The clinic nursing staff was also used 90.1% of the time.

The purpose of the forced model was to allocate the total number of clinic visits on the providers to see which patient categories would be scheduled at RACH. Readily apparent was the increase in the number of physician appointments beyond the minimum level performed in October (722 versus 620). This increase was due

Table 18

Linear Programming Results (Forced Model)

	Clinic appointments					
	Actual Results			Model Results		
Treatment category	RACH	CAM	Total	RACH	CAM	Total
Routine GYN	124	67	191	191	0	191
Pap smear	146	1	147	144	3	147
Cryosurgery	9	2	11	0	11	11
OB visit	374	1	375	375	0	375
GYN follow-up	151	40	191	191	0	191
OB history	150	0	150	150	0	150
Colposcopy	33	8	41	18	23	41
Infertility	0	9	9	0	9	9
Pre-op visit	54	23	77	77	0	77
TOTAL	1041	151	1192	1146	46	1192

primarily to the high number of PAP visits, GYN follow-up visits, and pre-op visits (see table 17). Although the nurse practitioner was allocated 421 clinic visits, only three of the possible six patient categories were used: routine GYN, OB visit, and OB history. One obvious weakness to this model was the shift of PAP smears and GYN follow-up visits away from the nurse practitioner.

Because this study was concerned with the allocation of patient appointments between RACH and CAM, a truer representation of the forced model was developed by combining the two RACH provider columns. The data in table 18 reflect the allocation of patient appointments between RACH and CAM, regardless of which type provider saw the patient. As shown in the initial linear model, all cryosurgery visits were allocated on CAM and only about 40 percent of all colposcopy visits were allocated to RACH. The two biggest differences between the initial and forced linear models were the shift of 88 PAP smear and 50 pre-op visits to RACH. The shift in these two categories was the predominant reason why RACH was allocated 105 more visits under the forced model.

As shown in the reduced cost column of appendix R, the linear model actually forced provider minimum clinic visits in the final solution to the detriment of the OR and L&D variables. Notice that RACH procedures such as hysterectomies, tubals, cesarean sections, and complicated OB deliveries have negative reduced costs figures

assigned to them. Using the alternative interpretation of reduced cost, these OR and L&D procedures would cause significant reductions in the optimum final solution. These negative values make sense, however, because the forced model ensured that the actual number the clinic visits seen in October were the minimum number of clinic visits in the optimum solution.

The dual prices column was also indicative of the importance placed on the clinic visits in the forced model. As shown in appendix R, constraints for routine and follow-up GYN visits, PAP smear visits, and pre-op visits had the highest values in the dual prices column. Simply put, increasing the demand levels (right-hand-side values) for these constraints would improve the optimum solution. Conversely, the dual prices for the nurse practitioner and OB-GYN physician visit constraints were negative values (-18.06 and -21.86 respectively). These negative values by convention mean that increasing these constraint right-hand-side values will cause the optimum solution to deteriorate. This makes sense, because increasing the minimum number of provider clinic visits would take away from the hysterectomy and colposcopy group packages already in the final solution.

Sensitivity Analysis

As noted earlier in this study, one aspect of linear programming that sets it apart from other cost effective analysis

techniques is the ability to conduct sensitivity analysis. By definition, sensitivity analysis is the process of examining the range over which the extent of resource consumption, and the optimizing solution are valid (Robbins & Tuntiwongpiboon, 1989, p. 114). In LINDO, the reduced cost and dual prices columns provide some sensitivity analysis; however, this information is optionally supplemented with the range section of the output.

The range section of the initial linear programming model (Appendix P) provides the range of validity for both the patient category values and the demand levels. Changes made within these ranges will not affect the optimum final solution. These ranges, in effect, demonstrate the sensitivity of the model's solution. Basically, the wider the range for a variable, the more stable the variable's solution. Changes made to the input data in the linear model (e.g., increase the cost savings value for a variable) will not change the character of the optimal solution if these changes are made within the range of validity. Naturally, changes made to variables that have a small range, have a higher chance of falling outside the established range. Once changes fall outside the range of validity, the character of the solution changes.

The data in table 19 reflect the range of validity for the cost savings values and demand levels for the patient categories in this study. Only two patient categories (six variables) have cost

Table 19

Range of Validity

Treatment category	Patient categories[a]					
	Cost Savings Value			Demand Levels		
	Low	Actual	High	Low	Actual	High
Routine GYN (P)[b]	0.00	9.55	13.35			
Routine GYN (N)[b]	9.55	13.35	20.12	79	191	364
Routine GYN (Out)	0.00	1.00	13.35			
Pap smear (P)	0.00	1.00	22.86			
Pap smear (N)	0.00	1.00	22.86	56	147	INF[b]
Pap smear (Out)	1.00	22.86	26.25			
Cryosurgery (P)	0.00	50.05	78.00			
Cryosurgery (N)	0.00	36.55	78.00	0	11	INF
Cryosurgery (Out)	0.00	1.00	INF			
OB visit (P)	0.00	7.71	66.52			
OB visit (N)	0.00	11.51	66.52	155	375	375
OB visit (Out)	0.00	1.00	66.52			
GYN followup (P)	0.00	1.00	8.46			
GYN followup (N)	0.00	1.00	8.46	189	191	235
GYN followup (Out)	0.00	5.08	8.46			
OB history (N)	1.00	40.31	865.43	25	150	843
OB history (Out)	0.00	1.00	40.31			
Colposcopy (P)	70.23	77.00	555.77	19	41	INF
Colposcopy (Out)	0.00	1.00	7.77			
Pre-op visit (P)	0.00	1.00	21.25	27	77	INF
Pre-op visit (Out)	1.00	21.25	500.02			
Infertility (P)	0.00	7.70	56.66	0	9	INF
Infertility (Out)	0.00	1.00	INF			

[a] The patient categories reflect those for the OB-GYN clinic.
[b] P = OB-GYN physician; N = Nurse practitioner; INF = INFINITY

savings ranges that are less than 15: the routine GYN visits and the pre-op visits. Two other categories have cost savings ranges less than 25. Changes made to the cost savings index of these variables could affect the final solution if those changes fall outside the range. For example, if the GYN follow-up cost savings index for the OB-GYN physician increased 7.47 (which is possible), the cost savings value would fall outside the range of validity. At that point, the final solution would allocate more than 24 GYN follow-up visits for the physician variable (GYNFLUP) (see Appendix P). The same logic holds true for the other variables; however, notice that several other variables have much wider ranges (e.g., OB history visits).

Naturally, a change in the cost savings value for the GYN follow-up visits could fall outside the range of validity more easily than a change for the nurse practitioner OB history visit (see table 19). As shown in table 19, it would take an increase of 825.12, before the OB history range is exceeded. In fact, it is not likely that RACH could ever increase the savings index 825 on one outpatient visit. As a result, the allocation on the OB history visits should not change even with major changes to its cost savings index. This information is important, because much of the input data used in the linear model was captured with averages which are subject to variations.

On the demand side, notice that the demand range for the OB visit variables and the actual demand levels are the same (375); whereas, the cost savings range suggests an increase in the savings index of over 55 to allocate any visits in the final solution. This is intuitive, though, since none of the OB visit variables had any additional demand allocated to them: all 375 visits were consumed in the group packages of this study. However, if the cost savings index were increased over 55, two things would happen: (a) the high end of the demand level range would increase, and (b) the number of OB visits allocated to the in-house variables would increase. Like the *cost savings* values, the demand level values provide a range of validity. Knowing the stability of the demand levels is important, because the demand values are subject to variations.

Conclusions

The problem for this study was to develop a cost effective model of allocating patient appointments between the OB-GYN clinic and the CAM demonstration project at Fort Sill. Currently, the Chief of the OB-GYN clinic establishes patient appointments by developing appointment templates based on experience with the patient population. A linear programming model was developed to allocate 14 different OB-GYN patient categories between the OB-GYN clinic and the CAM project based on the each category's value and

resource consumption pattern. The model was designed as a adjunctive management tool in determining the OB-GYN outpatient appointment schedule.

Although the linear model results in this study did not suggest a new way of allocating patient appointments, some interesting observations were noted. Consistent with a recent decision by the OB-GYN clinic chief, no infertility visits should be allocated to RACH. As shown in table 18, all 9 infertility visits were allocated to the CAM network of providers. Another observation of the model results involved the scheduling of cryosurgery appointments. According to the model, none of the 11 possible visits should be scheduled at RACH. This is in sharp contrast to the almost 82% of the cryosurgery visits scheduled at the OB-GYN clinic during October. Along with the cryosurgery appointments, only about half of the colposcopy patients (18) should be scheduled at RACH. In the place of the colposcopy and cryosurgery visits, the OB-GYN clinic chief should schedule more routine and follow-up GYN appointments.

Study Weaknesses

There are, however, several weaknesses with the linear model in this study. One of the first caveats to using a linear model in health care is the classification of individual patients into exact patient categories such as a routine and follow-up GYN visits.

Fitting patients into mutually exclusive, discrete, linear categories somehow lessens the individuality of patients and obviously skews the optimal solution. Unfortunately, this weakness cannot be avoided.

Another weakness of this study was the use of average cost figures for the selected patient categories. Since the current cost accounting system could not capture accurate costs associated with specific patient diagnoses or visits, average cost figures were used. The consequence of this methodology was that every 20 minute clinic visit was assumed to cost RACH the same amount of money, *regardless of the type of visit*. The obvious problem to this method of accounting for cost figures was the failure to recognize different resource consumption rates for the various types of patient visits.

Finally, this study developed a reimbursement methodology based on a case-mix measurement system. At present, only 25 percent of the military supply reimbursement system is predicated on a case-mix system using relative weighted products. Part of the problem with implementing a case-mix index as the Army reimbursement system is the effect such a reimbursement system would have on specific military treatment facilities--some of them would lose a large amount of supply money.

Summary

The linear model in this study is an initial attempt to provide quantitative data to administration in developing appointment templates. Future studies in this area should begin with the capture of hard, accurate, input data for the linear model. Since this type of data is not available, and quite expensive to capture, administration can not have complete confidence in the model results. Additionally, concurrent measurement studies of physician and nurse resource patterns for the various patient categories are needed to improve the accuracy of the model results.

With the advent of a managed care initiative in the military system, commanders need to know which patient categories should be allocated to the MTF and which should be seen on CAM. The linear model is a practical first step in an attempt to answer this question. By using linear programming as a cost-effectiveness technique, management can begin to understand patient categories in terms of value estimates, resource consumption patterns, and the simultaneous affect these categories have on the resources of the OB-GYN clinic. With this cursory understanding of the patient categories, the OB-GYN Chief can begin to develop appointment schedules which manage treatment location and demonstrate a cost savings for RACH.

References

Aaron, H., & Breindel, C. L. (1988). The evolution toward 'managed' health care. Medical Group Management Journal, 35(5), 62-4.

Anderson, D. R., Sweeney, D. J., & Williams, T. A. (1988). An introduction to management science: Quantitative approaches to decision making (5th ed.). St Paul: West Publishing Co.

Baligh, H. H., & Laughhunn, D. J. (1969). An economic and linear model of the hospital. Health Services Research, 4, 293-303.

Borland, P. (1987). Trends in second-generation PPOs. Health Affairs, 6(4), 75-81.

Brandeau, M. L., & Hopkins, D. S. (1984). A patient mix model for hospital financial planning. Inquiry, 21(1), 32-44.

CAMPO. (1989). Catchment area management project, Fort Sill, OK.

CHAMPUS Division. (1988). Demonstration proposal, United States army catchment area management (CAM). Health Services Command.

Congressional Budget Office. (1988). Reforming the military health care system. Washington, DC: U.S. Government Printing Office.

Davis, J. E. (1989). Decision analysis: A prescriptive method for decision and cost-effectiveness research. The Journal of Family Practice, 29(4), 367-369.

Emery, D. D., Schneiderman, L. J. (1989). Cost-effectiveness analysis in health care. Hastings Center Report, 12(4), 8-13.

Fact Sheet. (1989). Fort Sill Facts. Public Affairs Office. Fort Sill, OK.

Fact Sheet. (1987). Military- Civilian Health Services Partnership Program. Washington, D.C.: OASD(HA).

Flinn, D. E., McMahon, T. C., & Collins, M. F. (1987). Health maintenance organizations and their implications for psychiatry. Hospital and Community Psychiatry, 38(3), 255-262.

Ganiats, T. G., & Schneiderman, L. J. (1988). Principles of cost-effectiveness research. The Journal of Family Practice, 27(1), 77-84.

Gisin, G. J. Jr., & Sewell, B. C. (1989). Financial management in ambulatory care: New initiatives for cost containment in the military health care system. Journal of Ambulatory Care Management, 12(2), 87-92.

Goldfarb, M., Hornbrook, M., & Rafferty, J. (1980). Behavior of the multiproduct firm, a model of the nonprofit hospital system. Medical Care, 18(2), 185-201.

Grimaldi, P. L. (1988). Measuring managed care: Does it really save money? Healthcare Financial Management, 42(4), pp. 25-32.

Hartzke, L. (1983). Diagnosis related groups: Concept and use. Madison, WI: NTIS.

Hollis, B. R. (1986). Methodology, myths, and maths of DRG's. In J. M. Virgo (Ed.), Restructuring health policy: An international

challenge (pp. 271-289). Edwardsville, IL: International Health Economics and Management Institute.

Horwitz, M. (1989). Quality, ambulatory care, and the 'Holy Grail'. Journal of Ambulatory Care Management, 12(2), 16-30.

Information Paper. (1989). Demonstration Projects - Army. DASG-RMP.

Joglekar, P. N. (1984). Cost-benefit studies of health care programs. Evaluations and the Health Professions, 7(3), 285-301.

Kendel, P. J. (1989). Cost control: Still an uphill battle. Modern Healthcare, 19(3), 27-28.

Kongstvedt, P. R. (1989). The managed health care handbook. Pittsburgh, PN: Aspen Publishers Inc.

Levin, R. I., Rubin, D. S., Stinson, J. P. & Gardner, E. S. (1989). Quantitative approaches to management (7th ed.). New York: McGraw-Hill.

Levin, R. I., Rubin, D. S., & Stinson, J. P. (1986). Quantitative approaches to management (6th ed.). New York: McGraw-Hill.

Mayer, W. (1988, August). Fiscal year 1989 diagnosis related groups based resource allocation guidance. Memorandum for the Assistant Secretary of the Army (M&RA).

Memorandum. (1988, January). Implementation of Military- Civilian Health Services Partnership Program. Fort Sam Houston: HSC.

National Data Corporation. (1988). AQCESS: Appointment and scheduling appointment factors. Rockville, MD: Author.

Neumann, B. R. (1983). Cost-effectiveness issues and research studies. The Journal of Long-Term Care Administration, 4(3), 48-53.

Optenberg, S. A., Coventry, J. A., & Austin, V. A. (1988, April). Military health service system, ambulatory work unit. Fort Sam Houston, TX: U.S. Army Health Services Command.

Phelps, C. E., Hosek, S. D., Buchanan, J. L., Palmer, A. R., Lohr, K. N., & Witsberger, C. (1984). Health care in the military. Santa Monica, CA: Rand.

Public Health Service. (1989). Caring for our future: The content of prenatal care. Washington D.C.: Department of Health and Human Services.

Robbins, W. A., Tuntiwongpiboon, N. (1989, June). Linear programming: A useful tool in case-mix management. Healthcare Financial Management, pp. 114-116.

Schrage, L. (1986). Linear, integer and quadratic programming with lindo. Palo Alto, CA: Scientific Press.

Spurlock, D. L. (1988). Catchment area management demonstration projects. Memorandum for the Assistant Secretary of Defense (Health Affairs).

Wall, J. C. (1986). A case mix management model for cost effective allocation of outpatient workload between military physicians and contract physicians in the obstetrics and gynecology clinic

of Silas B. Hays Army Community Hospital. Unpublished Manuscript, pp. 1-65.

Warner, D. M., Holloway, D. C. (1978). Decision making and control for health administration. Ann Arbor, MI: Health Administration Press.

Weinstein, M. C. (1986). Challenges for cost-effectiveness research. Medical Decision Making, 6(4), 194-198.

Definitions

AQCESS - Automated Quality of Care Evaluation Support System. AQCESS is a computerized system intended to support quality of care and patient administration processing.

ASM - Appointment and Scheduling Module. One of 6 modules in AQCESS. This module automates the outpatient clinic scheduling process and the appointment booking process.

AWU - Ambulatory Work Unit. A resource intensity weighted index for outpatient visits.

BCA - Benefit-cost Analysis

CAM - Catchment Area Management Project. A DoD managed care initiative currently being tested at Fort Sill.

CEA - Cost-effectiveness Analysis

CHAMPUS - Civilian Health and Medical Program of the Uniform Services. A DoD sponsored supplemental cost-sharing insurance plan.

CMI - Case Mix Index. A resouce intensity measure derived by dividing relative weighted products by number of dispositions.

CMRIS - Computerized Medical Record Information System. A database of clinical information implemented at Fort Ord.

DHCP - Direct Health Care Provider Program. A program which allows the MTF hospital commander to contract with providers to deliver medical services with the MTF.

Direct Care System - The military segment of the DoD health care system

DoD - Department of Defense

DRG - Diagnosis Related Groups. A classification system which categorizes patients into comparable groups with similar LOS and resource consumption patterns.

GYN - Gynecology

HCF - Health Care Finder. An individual designated to facilitate to referral of patients to military and civilian health care services.

IWU - Inpatient Work Unit. A resource intensity weighted index for inpatient diagnoses.

Definitions

LINDO - Linear, Interactive, and Discrete Optimizer. A software program capable of solving linear programming models on a personal computer.

LOS - Length of Stay

L&D - Labor and Delivery

MEPRS - Medical Expense and Performance Reporting System. The cost accounting system at RACH.

MHSS - Military Health Services System. The entire DoD health care system with its two components: CHAMPUS and the direct care system.

MTF - Military Treatment Facility

MWU - Medical Work Unit. The sum of AWUs and IWUs in the resource allocation system.

OB - Obstetrics

OR - Operating Room

RACH - Reynolds Army Community Hospital

RCMI - Relative Case Mix Index. The MTF CMI standardized to the DoD CMI of .8109.

TDA - Tables of Distribution and Allowances. An organizational blueprint of manpower and equipment based on mission.

CLINIC OB/GYN

CALL, TDY AND LEAVE ROSTER (any absences) FOR Oct '89
(month)

	MON	TUES	WED	THUR	FRI
	DATE 2	DATE 3	DATE 4	DATE 5	DATE 6
HCP NAME			✓ OBG P 0900		
Provider A	AM OR	AM OR	AM	AM LV	AM LV
	PM GYN? for MAKE? 1400 1520 WIE	PM LdD C	PM CT	PM LV	PM LV
HCP NAME					
Provider B	AM LdD/ORA	AM LdD/ORA	AM LdD	AM LdD	AM LdD
	PM LdD C	PM CT	PM LdD	PM LdD	PM LdD C
HCP NAME					
Provider C	AM CT	AM Colpo ✓	AM ✓ 0900 OB	AM Change CT	AM OB FR AM ✓
	PM CT	PM OBTY PM ✓	PM GYN 1330 - 1520 ✓ C	PM CT C	PM GYN FR PM ✓
HCP NAME					
	AM	AM	AM	AM	AM
	PM	PM	PM	PM	PM
HCP NAME					
	AM	AM	AM	AM	AM
	PM	PM	PM	PM	PM
HCP NAME					
	AM	AM	AM	AM	AM
	PM	PM	PM	PM	PM

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* ALL WED
NO APPTS until P 0900

CLINIC OB/GYN

CALL, TDY AND LEAVE ROSTER (any absences) FOR Oct '89
(month)

	MON	TUES	WED	THUR	FRI
	DATE 9	DATE 10	DATE 11	DATE 12	DATE 13
[redacted] HCP NAME					OB FE AM
Provider A	AM LV	AM LV	AM LV	AM LV	AM GYN FE PM
[redacted]	PM LV	PM LV	PM LV	PM LV	PM C
HCP NAME			OB WE AM after 0900		OB FE AM
Provider B	AM L&D	AM CT	AM 1100	AM GYN	AM
	PM L&D C	PM CT	PM Colpo	PM L&D C	PM CT
HCP NAME					
Provider C	AM Holiday	AM L&D	AM L&D	AM L&D	AM L&D
	PM	PM L&D C	PM L&D C	PM CT	PM L&D
HCP NAME					
	AM	AM	AM	AM	AM
	PM	PM	PM	PM	PM
HCP NAME					
	AM	AM	AM	AM	AM
	PM	PM	PM	PM	PM
HCP NAME					
	AM	AM	AM	AM	AM
	PM	PM	PM	PM	PM

"REPRODUCED AT GOVERNMENT EXPENSE"

CLINIC OB/GYN

CALL, TDY AND LEAVE ROSTER (any absences) FOR Oct '89
(month)

	MON	TUES	WED	THUR	FRI
	DATE 16	DATE 17	DATE 18	DATE 19	DATE 20
HCP NAME Provider A	AM L&D/ORA	AM L&D/ORA	AM L&D	AM L&D	AM L&D
	PM L&D	PM L&D c	PM CT	PM L&D	PM L&D c
HCP NAME Provider B	AM OR	AM CO/PO ✓	AM OB WOR until 1100 ✓ 0900	AM OBG 4 Appt ✓	AM OB FR AM ✓
	PM GYN ✓ WIE 1400 c	PM CT	PM L&D c	PM CT	PM GYN FR PM ✓
HCP NAME Provider C	AM CT	AM OR	AM OBN AM ✓ 0900	AM GYN ✓	AM OBG ✓ 4 Appt
	PM CT	PM GYN Clinic start at 1330 Clinic per MJT after 1530	PM GYN 1230 1520	PM OB TH PM ✓ c	PM CT
HCP NAME	AM	AM	AM	AM	AM
	PM	PM	PM	PM	PM
HCP NAME	AM	AM	AM	AM	AM
	PM	PM	PM	PM	PM
HCP NAME	AM	AM	AM	AM	AM
	PM	PM	PM	PM	PM

"REPRODUCED AT GOVERNMENT EXPENSE"

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CLINIC OB/GYN

CALL, TDY AND LEAVE ROSTER (any absences) FOR Oct '89
(month)

	MON	TUES	WED	THUR	FRI
	DATE 23	DATE 24	DATE 25	DATE 26	DATE 27
HCP NAME Provider A	AM CT	AM CPR	AM OB W AM ✓ start 0900	AM Admin	AM OBG
	PM CT	PM OB TH PM start at 1330	PM ✓ Colpo LAST Appt 1300 C	PM GYN FE PM ✓ C	PM CT
HCP NAME Provider B	AM OR	AM OR	AM OBG ✓	AM Colpo ✓	AM OB FE AM ✓
	PM GYN WIC ✓ 1400	PM L&D C	PM CT	PM OBTH PM ✓	PM GYN FE PM ✓
HCP NAME Provider C	AM L&D/OEA	AM L&D/OEA	AM L&D	AM L&D	AM L&D
	PM L&D C	PM CT	PM L&D	PM L&D	PM L&D C
HCP NAME	AM	AM	AM	AM	AM
	PM	PM	PM	PM	PM
HCP NAME	AM	AM	AM	AM	AM
	PM	PM	PM	PM	PM
HCP NAME	AM	AM	AM	AM	AM
	PM	PM	PM	PM	PM

CLINIC OB/GYN

CALL, TDY AND LEAVE ROSTER (any absences) FOR Oct '89
(month)

	MON	TUES	WED	THUR	FRI
	DATE 30	DATE 31	DATE	DATE	DATE
HCP NAME Provider A	AM L&D	AM L&D	AM	AM	AM
	PM L&D c	PM CT	PM	PM	PM
HCP NAME Provider B	AM OR	AM TDY COLPO	AM	AM	AM
	PM GYN W I & 1400	PM OB TU PM TDY	PM	PM	PM
HCP NAME Provider C	AM CT	AM OR	AM	AM	AM
	PM CT	PM L&D c	PM	PM	PM
HCP NAME	AM	AM	AM	AM	AM
	PM	PM	PM	PM	PM
HCP NAME	AM	AM	AM	AM	AM
	PM	PM	PM	PM	PM
HCP NAME	AM	AM	AM	AM	AM
	PM	PM	PM	PM	PM

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1 Feb 88

CLINIC OB/GYN C

CALL, TDY AND LEAVE ROSTER (any absences) FOR July 89
(month)

	MON	TUES	WED ✓	THUR ✓	FRI
HCP NAME	DATE 3	DATE 4	DATE 5	DATE 6	DATE 7 ✓
Provider D	AM: T.H.	AM: H.T.	AM: OBC 0820-1100	AM: GynC 0850-1100	AM: OBC 0820-1100
	PM: T.H.	PM: H.T	PM: Gyn 1300-1520	PM: Gyn 1300-1520	PM: Gyn 1040 1300-1520
HCP NAME	10	11 ✓	12	13	14
Provider D	AM: Gyn 0820-1100	AM: OB Clinic NO PT	AM: OBC 0820-1100	AM: GynC 0820-1100	AM: NO PT, CPR
	PM: Gyn 1300-1520	PM: Gyn 1400-1530 HW Mtg 1300	PM: Gyn 1300-1520	PM: Gyn 1300-1520	PM: Gyn 1300-1520
HCP NAME	17	18 ✓	19	20	21
Provider D	AM: Gyn 0820-1100	AM: OB Clinic NO PT	AM: OBC 0850-1100 Freeze	AM: Gyn 0850-1100	AM: OBC 0820-1100
	PM: Gyn 1300-1520	PM: Gyn 1300-1440 MC Grad Rds 1530.	PM: Gyn 1300-1500 Unit 1530	PM: Gyn 1300-1520	PM: Gyn 1300-1520
HCP NAME	24	25 ✓	26	27	28
Provider D	AM: Gyn 0820-1120	AM: OB Clinic NO PT	AM: OBC 0850-1100	AM: Gyn 0820-1100	AM: CT
	PM: GynC 1300-1520	PM: Gyn 1300-1520	PM: Gyn 1300-1520	PM: Gyn 1300-1520	PM: CT
HCP NAME	31				
Provider D	AM: CT	AM	AM		AM
	PM: CT	PM	PM	PM	PM
HCP NAME	AM	AM	AM	AM	AM
	PM	PM	PM	PM	PM

COPY OF TEMPLATES

MONDAY - GYN Clinic

GYMOAM AM	GYMOPM PM	OR - MONDAY
0700 - Ward	1230 - F/U	0700 - Ward
0730 - Mtg	1250 - ~~N Infert~~ f/u	0730 -1500 OR
0820 - F/U	1320 - GYN	1530 - Ward
0840 - GYN	1340 - MIS	
0900 - Colpo	1400 - ~~BTL~~ f/u	
0920 - MIS	1420 - Colpo	
0940 - ~~BTL~~ f/u	1440 - GYN	
1000 - GYN	1500 - GYN	
1020 - MIS	1520 - MIS	
1040 - Colpo	1540 - 1600 Ward	
1100 - MIS		
1130 - 1230 LUNCH		

Effect 1 June 89
Also see Change eff Jan 89 for CS not indicated on sheet

TUESDAY

GYTUAM AM	OBTUPM (NO OR)	OR - TUESDAY
0700 - Ward	1230 - Ward	0700 - Ward
0730 - Mtg	1240 - OB	0730 - 1500 OR
0800 - F/U	1300 - OB	1530 - Ward
0820 - GYN	1320 - OB	
0840 - ~~BTL~~ f/u	1340 - OB	
0900 - GYN	1400 - OB	
0920 - ~~MIS~~	1420 - OB	
0940 - Colpo	1440 - OB	
1000 - MIS	1500 - OB	
1020 - GYN	1520 - OB	
1040 - Colpo	1540 - Ward	
1100 - Ward	1600 - Ward	
1130 - 1230 LUNCH		

WEDNESDAY - (NO OR)

OBWEAM AM	GYWEPM PM
0730 - Mtg	1230 - 1330 - CME
0820 - Ward	1340 - F/U
0840 - OB	1400 - Colpo
0900 - OB Phy	1420 - ~~BTL~~ f/u
0930 - OB	1440 - MIS
0950 - OB	1500 - GYN
1010 - OB	1520 - GYN
1040 - OB	1540 - GYN
100 - OB	1600 - Ward
1130 - 1230 LUNCH	

Wed Admin

950 LOB
1010 LOB
1020 LOB
1040 LOB

on Admin Days

CONTINUE ON NEXT PAGE

WEDNESDAY - (OR)

OBWOR AM	GYWOR PM
0700 - Ward	1100 - 1400 - OR
0730 - Mtg	1420 - LUNCH
0840 - OB	1500 - Colpo
0900 - OB Phy	1520 - GYN
0930 - OB	1540 - GYN
0950 - OB	1600 - Ward
1010 - OB Phy	
1040 - OB	
1100 - 1400 - OR	

THURSDAY - GYTHAM AM	GYTHPM PM
0730 ~~- Ward~~ GYN Revised 15 Aug 89	1230 - F/U
0800 - GYN	1250 - Colpo
0820 - F/U	1320 - GYN
0840 - Colpo	1340 - ~~BTL~~ f/u
0900 - MIS	1400 - MIS
0920 - ~~BTL~~ f/u	1420 - GYN
0940 - GYN	1440 - ~~GYN~~ f/u only
1000 - MIS	1500 - GYN
1020 - GYN	1520 - ~~N Infert~~ f/u
1040 - GYN	1540 - MIS
1100 - MIS	1600 - Ward
1130 - 1230 LUNCH	

FRIDAY - OBFRAM	GYFRPM
0730 - Ward OBTHPM	1230 -Ward
0800 - OB	1300 - GYN
0820 - OB	1320 - F/U
0840 - OB	1340 - Colpo
0900 - OB Phy	1400 - GYN
0930 - OB	1420 - MIS
0950 - OB	1440 - Colpo
1010 - OB Phy	1500 - GYN
1040 - OB	1520 - ~~BTL~~ f/u
1100 - OB	1540 - MIS
1130 - 1230 LUNCH	1600 - Ward

Ad Fri

0950 OB
1010 OB
1020 OB
1040 OB

On Admin Day only Wed & Friday

OB Template Wd Fri Am

OBWE AM 9 (14)

0800 OB FR AM
0810
0820
0830
0840 OBP
0910
0920
0930
0940
0950
1000 OBP

1040
1050
1100

* of OBW OR
stop with 1000 appt
NBW OR

Colpo PM

23 Aug 89

1230
1300
1330
1400
1430
1500

OB PM

1230
1240
1250
1300 OBP
1330
1340
1350
1400 OBP
1430
1440
1450
1500
1510

GYN clo

Last appt to check around
1530
No 1550!

New { GYN
GYNWI
GYNLD

Admin OB	Colpo
0840	0800
0850	0830
0900	0900
0910	0930
0920	1000
0940	1030
0950	1100 Mis
1000 Mis	
1010	
1020	
1040	
1050	
1100 Mis	

Adm OB

Colpo

Admin (Regardless of day)
0730 - 940 Ward

Every 30 min
Adm am

1000 OBG
1020 OBG
~~1100~~ 1130 OBG
1100 OBG

1130 → CT

More likely to be booked with Gyn pts - Rec they default to gyn credit + will book the Admin OB sheet when OB appts are needed.

Appendix C

Monthly OB-GYN Workload Data

Month	OB				GYN				OB-GYN Clinic	
	Outpatient Visits	Inpatient Visits	Total Visits	Percentage of Workload	Outpatient Visits	Inpatient Visits	Total Visits	Percentage of Workload	Total Workload	Change from Average
DEC 87	461	26	487	50%	466	20	486	50%	973	-39
JAN 88	492	24	516	49%	529	13 #	542	51%	1058	46
FEB 88	527	33	560	46%	632	13 #	645	54%	1205	193
MAR 88	552	36	588	48%	615	29	644	52%	1232	220
APR 88	558	39	597	53%	500	28	528	47%	1125	113
MAY 88	517	20	537	54%	444	19 #	463	46%	1000	-12
JUN 88	493	24	517	42%	663	38 #	701	58%	1218	206
JUL 88	580	4	584	49%	562	36	598	51%	1182	170
AUG 88	663	25	688	47%	733	29	762	53%	1450	438
SEP 88	613	16	629	50%	600	37 #	637	50%	1266	254
OCT 88	469	18	487	46%	542	32	574	54%	1061	49
NOV 88	550	15	565	50%	524	31	555	50%	1120	108
DEC 88	537	12	549	46%	618	33	651	54%	1200	188
JAN 89	578	18	596	52%	543	13	556	48%	1152	140
FEB 89	457	16	473	48%	503	16	519	52%	992	-20
MAR 89	483	19	502	40%	728	35	763	60%	1265	253
APR 89	418	11	429	40%	612	34	646	60%	1075	63
MAY 89	434	15	449	37%	725	39 #	764	63%	1213	201
JUN 89	392	18	410	45%	476	31	507	55%	917	-95
JUL 89	243	10	253	37%	412	17	429	63%	682	-330
AUG 89	433	10	443	48%	463	18	481	52%	924	-88
SEP 89	436	15	451	46%	512	22 #	534	54%	985	-27
OCT 89	463	9	472	47%	521	8	529	53%	1001	-11
MONTHLY AVG	454	17	471	47%	517	24	541	53%	1012	

\# Denotes a deviation from the OB-GYN Clinic monthly report
* Denotes a deviation from the Medical Summary Report (MED 302)

Note. Derived from the Medical Summary Report (MED 302).

Appendix D

Register of Operations, RACH, Jan - Aug 1989

Register Number	Service	Operation	Anesthesia Time (min)	Surgery Time (min)
LAPAROSCOPIC TUBAL				
657319	GYN	Laparoscopic Tubal Ligation	70	33
Not on Log	GYN	Laparoscopic Tubal Ligation	95	35
658755	GYN	Laparoscopic Tubal Ligation	77	47
659684	GYN	Laparoscopic Tubal Ligation	45	28
660131	GYN	Laparoscopic Tubal Ligation	60	26
660133	GYN	Laparoscopic Tubal Ligation	60	25
660331	GYN	Laparoscopic Tubal Ligation	55	23
660421	GYN	Laparoscopic Tubal Ligation	110	46
660515	GYN	Laparoscopic Tubal Ligation	80	33
660711	GYN	Laparoscopic Tubal Ligation	80	37
660883	GYN	Laparoscopic Tubal Ligation	95	50
661129	GYN	Laparoscopic Tubal Ligation	50	22
661236	GYN	Laparoscopic Tubal Ligation	45	25
661234	GYN	Laparoscopic Tubal Ligation	45	32
663419	GYN	Laparoscopic Tubal Ligation	45	29
658141	GYN	Laparoscopic Tubal Ligation, D&C	65	30
658068	GYN	Laparoscopic Tubal Ligation	58	33
657647	OB	Post Partum Laparoscopic BTL	55	37
658492	OB	Post Partum Laparoscopic BTL	50	32
658616	GYN	Post Partum Laparoscopic BTL	45	33
658615	GYN	Post Partum Laparoscopic BTL	40	26
658948	GYN	Post Partum Laparoscopic BTL	25	14
658579	GYN	Post Partum Laparoscopic BTL	40	25
659208	GYN	Post Partum Laparoscopic BTL	55	44
659358	OB	Post Partum Laparoscopic BTL	40	17
659355	OB	Post Partum Laparoscopic BTL	50	12
659779	OB	Post Partum Laparoscopic BTL	100	54
660070	OB	Post Partum Laparoscopic BTL	70	22
660084	OB	Post Partum Laparoscopic BTL	50	25
660321	OB	Post Partum Laparoscopic BTL	55	30
660528	OB	Post Partum Laparoscopic BTL	75	46
660652	OB	Post Partum Laparoscopic BTL	80	42
661061	OB	Post Partum Laparoscopic BTL	55	24
661588	OB	Post Partum Laparoscopic BTL	55	27
661766	OB	Post Partum Laparoscopic BTL	55	15
661971	OB	Post Partum Laparoscopic BTL	55	31
662168	OB	Post Partum Laparoscopic BTL	45	18
662196	OB	Post Partum Laparoscopic BTL	60	13
662294	OB	Post Partum Laparoscopic BTL	55	24
662710	OB	Post Partum Laparoscopic BTL	65	25
663134	OB	Post Partum Laparoscopic BTL	45	26
663340	OB	Post Partum Laparoscopic BTL	75	11
		Average time per procedure (minutes)	60.24	29.21
		Standard deviation	17.84	10.31
		Maximum time	110.00	54.00
		Minimum time	25.00	11.00

Appendix D

Register of Operations, RACH, Jan - Aug 1989

Register Number	Service	Operation	Anesthesia Time (min)	Surgery Time (min)
		Total Time (minutes)	2,530	1,227
		Percentage of Total Time	7.67%	6.45%
LAPAROTOMY				
658469	GYN	Explor Laparotomy	175	47
Not on Log	GYN	Explor Laparotomy	95	66
659961	GYN	Explor Laparotomy	125	101
659831	GYN	Explor Laparotomy	105	77
659425	GYN	Explor Laparotomy, Oophor, Appy	110	84
660628	GYN	Diag Scope, Exp Lap, Salpin, Appy	180	133
662428	GYN	Laparotomy, Culdocentesis	80	47
660641	GYN	Diag Scope, Explor Laparotomy	130	100
661696	GYN	Diag Scope, Explor Lap, D&C	90	56
661821	GYN	Diag Scope, Explor Lap, D&C	80	50
662176	GYN	Diag Scope, Exp Lap, Culdocentesis	85	31
661822	GYN	Diag Scope, Laparotomy, Repair	155	117
658670	GYN	Explore Lap, D&C, Culdocentesis	190	136
662857	GYN	Explor Lap, Culdocentesis, Salpin	130	40
Not on Log	GYN	Explor Lap, Culdocentesis, Appy	105	64
661323	GYN	Explor Lap, Culdocentesis, Appy	135	95
660457	GYN	Laparotomy, Appy	155	98
662877	GYN	Explor Laparotomy	100	67
657338	GYN	Diag Scope, Exp Lap, Appy, EUA	190	135
659861	GYN	Exp Lap, D&C, Culdocentesis, EUA	140	77
660698	GYN	Diag Scope, Lap, EUA	175	106
		Average time per procedure (minutes)	130.00	82.24
		Standard deviation	36.22	31.33
		Maximum time	190.00	136.00
		Minimum time	80.00	31.00
		Total Time (minutes)	2,730	1,727
		Percentage of Total Time	8.28%	9.07%
LAPAROSCOPY				
657320	GYN	Diagnostic Scope	100	65
657684	GYN	Diagnostic Scope, D&C	90	40
658446	GYN	Diagnostic Scope, D&C	245	195
660132	GYN	Diag Scope, D&C, Cerv BX	75	26
658811	GYN	Diagnostic Scope, Culdocentesis	110	35
Not on Log	GYN	Diagnostic Scope, Culdocentesis	90	17
657486	GYN	Diagnostic Scope	93	23
6571869	GYN	Diagnostic Scope	90	32
657973	GYN	Diagnostic Scope	45	24
659701	GYN	Diagnostic Scope	105	83
659911	GYN	Diagnostic Scope	90	35
660246	GYN	Diagnostic Scope	85	31
660329	GYN	Diagnostic Scope	70	32

Appendix D

Register of Operations, RACH, Jan - Aug 1989

Register Number	Service	Operation	Anesthesia Time (min)	Surgery Time (min)
661130	GYN	Diagnostic Scope	80	37
Not on Log	GYN	Diagnostic Scope	80	20
661725	GYN	Diagnostic Scope	55	20
661824	GYN	Diagnostic Scope	65	18
661908	GYN	Diagnostic Scope	65	18
661954	GYN	Diagnostic Scope	80	21
662569	GYN	Diagnostic Scope	55	18
662674	GYN	Diagnostic Scope, D&C	75	22
657534	GYN	Diagnostic Scope	55	33
662735	GYN	Diagnostic Scope	55	25
663089	GYN	Diagnostic Scope, D&C	90	26
663113	GYN	Diagnostic Scope	100	40
663115	GYN	Diagnostic Scope, D&C	85	32
663249	GYN	Diagnostic Scope	55	20
663316	GYN	Diagnostic Scope	85	30
663365	GYN	Diagnostic Scope	45	30
663562	GYN	Diagnostic Scope, D&C	80	27
657750	GYN	Diag Scope, D&C, EUA	95	50
658512	GYN	Diagnostic Scope, EUA	115	60
661587	GYN	Diagnostic Scope, EUA	50	22
662784	GYN	Diag Scope, Meddle Ex, EUA	90	60
		Average time per procedure (minutes)	83.62	37.26
		Standard deviation	33.64	31.27
		Maximum time	245.00	195.00
		Minimum time	45.00	17.00
		Total Time (minutes)	2,843	1,267
		Percentage of Total Time	8.62%	6.66%
REPAIR				
659422	GYN	Posterior Repair	115	65
658819	GYN	Posterior Repair	85	47
662123	GYN	Anterior Repair	105	42
660860	GYN	Perineal Repair, EUA	105	40
659343	GYN	Marsup of Bartholin Cyst	50	15
660674	GYN	Marsup of Bartholin Cyst	70	34
		Average time per procedure (minutes)	88.33	40.50
		Standard deviation	22.67	14.93
		Maximum time	115.00	65.00
		Minimum time	50.00	15.00
		Total Time (minutes)	530	243
		Percentage of Total Time	1.61%	1.28%
OR DELIVERY				
658988	OB	Vaginal Delivery	255	255
661707	OB	Vaginal Delivery	180	180

Appendix D

Register of Operations, RACH, Jan - Aug 1989

Register Number	Service	Operation	Anesthesia Time (min)	Surgery Time (min)
662171	OB	Vaginal Delivery	318	313
		Average time per procedure (minutes)	251.00	249.33
		Standard deviation	56.41	54.44
		Maximum time	318.00	313.00
		Minimum time	180.00	180.00
		Total Time (minutes)	753	748
		Percentage of Total Time	2.28%	3.93%
TOTAL ABDOMINAL HYSTERECTOMY, APPENDECTOMY				
658440	GYN	TAH, Appy	265	180
658643	GYN	TAH, Appy	135	92
658928	GYN	TAH, Appy	330	267
659302	GYN	TAH, Appy	220	163
660479	GYN	TAH, Appy	185	143
661911	GYN	TAH, Appy	135	89
662250	GYN	TAH, Appy	220	145
662571	GYN	TAH, Appy	145	105
663203	GYN	TAH, Appy	165	75
663424	GYN	TAH, Appy	133	97
667250	OB	TA Hysterectomy, C-Section	215	135
		Average time per procedure (minutes)	195.27	135.55
		Standard deviation	59.79	52.49
		Maximum time	330.00	267.00
		Minimum time	133.00	75.00
		Total Time (minutes)	2,148	1,491
		Percentage of Total Time	6.52%	7.83%
VAGINAL HYSTERECTOMY				
658114	GYN	Vaginal Hysterectomy	235	160
658441	GYN	Vaginal Hysterectomy	150	125
659718	GYN	Vaginal Hysterectomy	240	162
660675	GYN	TVH, Post Repair	220	153
661099	GYN	TVH, Post Repair	60	60
661099	GYN	TVH, Post Repair	180	150
661909	GYN	Vaginal Hysterectomy	145	103
663199	GYN	Vaginal Hysterectomy	140	89
		Average time per procedure (minutes)	171.25	125.25
		Standard deviation	56.72	35.37
		Maximum time	240.00	162.00
		Minimum time	60.00	60.00
		Total Time (minutes)	1,370	1,002
		Percentage of Total Time	4.16%	5.26%

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Register of Operations, RACH, Jan - Aug 1989

Register Number	Service	Operation	Anesthesia Time (min)	Surgery Time (min)
658066	GYN	Cone Biopsy, D&C	75	43
658273	GYN	Cone Biopsy, D&C	65	45
658562	GYN	Cone Biopsy	50	36
659327	GYN	Cone Biopsy, Scope	120	67
659424	GYN	Cone Biopsy	65	41
660022	GYN	Cone Biopsy, D&C	90	46
660290	GYN	Cone Biopsy, Tubal	95	45
661420	GYN	Cone Biopsy	100	88
		Average time per procedure (minutes)	82.50	51.38
		Standard deviation	21.36	16.24
		Maximum time	120.00	88.00
		Minimum time	50.00	36.00
		Total Time (minutes)	660	411
		Percentage of Total Time	2.00%	2.16%

********** MISCELLANEOUS **********

659887	GYN	Ureterosacral Ligation	135	64
663280	GYN	Excision	75	17
659459	OB	Uterine Curettage	75	45
662503	GYN	Ectopic Pregnancy	110	28
662803	GYN	Examination Under Anesthesia	45	7
662823	GYN	Examination Under Anesthesia	45	13
		Average time per procedure (minutes)	80.83	29.00
		Standard deviation	32.71	19.86
		Maximum time	135.00	64.00
		Minimum time	45.00	7.00
		Total Time (minutes)	485	174
			1.47%	0.91%
		TOTAL TIME (minutes)	32,966	19,033

Appendix D

Register of Operations, RACH, Jan 1989 - Aug 1989

Register Number	SSN	Service	Operation	Anesthesia Time (min)	Surgery Time (min)	Days in Hospital (Patient)	Days in Hospital (Child)
CESAREAN SECTION							
657403	8664	OB	C-Section	70	60	3	3
657412	1359	OB	C-Section	45	44	4	4
657459	0958	OB	C-Section	75	45	3	3
657469	7433	OB	C-Section	75	34	3	3
657462	4903	OB	C-Section	90	40	4	4
657508	3842	OB	C-Section	100	50	5	5
657547	9734	OB	C-Section	70	65	3	3
657708	8649	OB	C-Section	70	50	4	4
657738	2180	OB	C-Section	60	53	6	6
657736	9543	OB	C-Section	87	80	7	0
657906	7654	OB	C-Section	125	61	5	4
658028	3817	OB	C-Section	120	66	4	3
658189	1095	OB	C-Section	99	65	4	3
658194	8978	OB	C-Section	75	75	5	4
658260	9072	OB	C-Section	60	50	4	3
658377	3065	OB	C-Section	65	39	3	1
658452	4631	OB	C-Section	46	24	3	1
658489	8434	OB	C-Section	120	80	3	3
658529	2629	OB	C-Section	60	46	4	4
658542	6266	OB	C-Section	90	70	11	10
658573	5855	OB	C-Section	102	44	5	4
Not on Log	NA	OB	C-Section	60	47	NA	NA
658639	4259	OB	C-Section	65	35	4	3
Not on Log	NA	OB	C-Section	100	48	NA	NA
658878	9507	OB	C-Section	75	53	4	3
658958	2878	OB	C-Section	65	59	4	4
659207	4879	OB	C-Section	85	40	7	6
659275	0315	OB	C-Section	70	37	3	3
659469	1482	OB	C-Section	130	62	11	1
659517	4207	OB	C-Section	70	45	4	4
659614	1806	OB	C-Section	105	70	10	10
659377	3322	OB	C-Section	105	63	16	3
659806	6547	OB	C-Section	60	50	13	12
659909	7775	OB	C-Section	90	52	5	3
660110	6992	OB	C-Section	90	48	4	4
660113	7426	OB	C-Section	39	48	4	4
660095	6675	OB	C-Section	105	69	4	4
Not on Log	NA	OB	C-Section	105	52	NA	NA
660186	6718	OB	C-Section	75	45	4	4
660224	1602	OB	C-Section	45	37	4	1
660220	6760	OB	C-Section	55	29	5	4
660459	9623	OB	C-Section, BTL	75	42	3	3
660536	7670	OB	C-Section	59	24	6	3
660573	2783	OB	C-Section	75	39	5	1
660852	8830	OB	C-Section, BTL	100	55	3	3

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Register of Operations, RACH, Jan 1989 - Aug 1989

Register Number	SSN	Service	Operation	Anesthesia Time (min)	Surgery Time (min)	Days in Hospital (Patient)	Days in Hospital (Child)
660875	5791	OB	C-Section	90	31	4	3
660882	3957	OB	C-Section	70	51	3	3
660879	4961	OB	C-Section	70	39	8	4
660947	8694	OB	C-Section	70	48	10	10
660938	6512	OB	C-Section	90	41	4	3
660970	3638	OB	C-Section, BTL	110	50	4	3
660987	1652	OB	C-Section	115	53	5	5
661064	3534	OB	C-Section	55	33	4	3
661111	7327	OB	C-Section	100	57	5	5
661160	8868	OB	C-Section	110	59	4	3
661251	1472	OB	C-Section	90	53	4	3
661266	6874	OB	C-Section	105	43	6	3
661301	3840	OB	C-Section	40	33	3	3
661310	0283	OB	C-Section	50	32	9	9
661313	0769	OB	C-Section	35	35	4	4
661365	8814	OB	C-Section	120	55	5	5
661399	8085	OB	C-Section	150	72	4	1
661455	4625	OB	C-Section, BTL	94	48	5	4
661620	2058	OB	C-Section	65	30	7	5
661819	9518	OB	C-Section	65	25	4	4
661921	6193	OB	C-Section	100	38	4	4
662170	7656	OB	C-Section	100	78	4	3
662229	6356	OB	C-Section, BTL	65	30	4	3
662264	6154	OB	C-Section, BTL	95	37	12	10
662351	6749	OB	C-Section	100	33	5	4
662401	4054	OB	C-Section	73	47	4	3
Not on Log	NA	OB	C-Section	80	33	NA	NA
662578	6247	OB	C-Section, BTL	110	42	12	5
662904	6168	OB	C-Section	85	25	16	4
Not on Log	NA	OB	C-Section	50	29	NA	NA
663028	7240	OB	C-Section	105	57	4	4
662972	0532	OB	C-Section	150	35	5	1
Not on Log	NA	OB	C-Section	55	19	NA	NA
663541	4037	OB	C-Section	100	25	6	5
663578	4221	OB	C-Section	55	33	4	4
			Average time per procedure (minutes)	82.80	46.74	5.38	3.93
			Standard deviation	24.87	14.23	2.93	2.19
			Maximum time	150.00	80.00	16	12
			Minimum time	35.00	19.00	3	0
			Total Time (minutes)	6,624	3,739		
			Percentage of Total Time	20.09%	19.64%		
REPEAT CESAREAN SECTION							
657475	5452	OB	Rep C-Section	100	58	4	4
657551	8796	OB	Rep C-Section	135	84	10	10

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Register of Operations, RACH, Jan 1989 - Aug 1989

Register Number	SSN	Service	Operation	Anesthesia Time (min)	Surgery Time (min)	Days in Hospital (Patient)	Days in Hospital (Child)
657781	9389	OB	Rep C-Section	100	81	6	6
657937	1217	OB	Rep C-Section	110	56	4	3
658004	7047	OB	Rep C-Section, BTL	105	55	4	4
658416	2828	OB	Rep C-Section	100	56	3	3
658747	3360	OB	Rep C-Section	80	55	4	3
658830	7383	OB	Rep C-Section	95	57	5	4
658926	8626	OB	Rep C-Section	130	50	4	3
659014	0530	OB	Rep C-Section	100	49	10	8
659054	2808	OB	Rep C-Section	90	56	5	5
659147	9685	OB	Rep C-Section	90	60	6	3
659149	9131	OB	Rep C-Section	115	66	7	3
Not on Log	NA	OB	Rep C-Section	100	26	NA	NA
Not on Log	NA	OB	Rep C-Section	105	57	NA	NA
659493	3258	OB	Rep C-Section	90	54	4	3
659492	0194	OB	Rep C-Section	85	52	4	3
659621	9458	OB	Rep C-Section, BTL	90	55	4	4
659658	0004	OB	Rep C-Section, BTL	90	58	3	3
659995	5376	OB	Rep C-Section, BTL	100	57	5	1
660009	4030	OB	Rep C-Section, BTL	55	46	5	5
660193	9316	OB	Rep C-Section	75	58	3	2
660292	1089	OB	Rep C-Section	100	48	4	3
660486	2305	OB	Rep C-Section	105	40	4	3
660483	0305	OB	Rep C-Section	66	29	4	3
660713	8977	OB	Rep C-Section, BTL	70	31	3	1
660877	8601	OB	Rep C-Section, BTL	100	51	4	3
661094	3122	OB	Rep C-Section	55	39	3	3
661037	6473	OB	Rep C-Section, BTL	90	40	6	3
Not on Log	NA	OB	Rep C-Section	60	39	NA	NA
661371	3970	OB	Rep C-Section	100	60	4	4
Not on Log	NA	OB	Rep C-Section	50	26	NA	NA
661940	8484	OB	Rep C-Section	50	38	8	8
662252	7832	OB	Rep C-Section	75	30	3	3
662556	2958	OB	Rep C-Section, BTL	70	33	4	4
663090	5851	OB	Rep C-Section, BTL, Appy	100	42	8	7
Not on Log	NA	OB	Rep C-Section, BTL	80	36	NA	NA
663427	6158	OB	Rep C-Section	43	6	4	3
			Average time per procedure (minutes)	88.26	48.26	4.82	3.79
			Standard deviation	21.18	14.91	1.85	1.79
			Maximum time	135.00	84.00	10	10
			Minimum time	43.00	6.00	3	1
			Total Time (minutes)	3,354	1,834		
			Percentage of Total Time	10.17%	9.64%		

LAPAROTOMY, TUBAL

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Register of Operations, RACH, Jan 1989 - Aug 1989

Register Number	SSN	Service	Operation	Anesthesia Time (min)	Surgery Time (min)	Days in Hospital (Patient)	Days in Hospital (Child)
657318	8044	GYN	BTL, D&C	65	40		
Not on Log	NA	GYN	BTL	75	32		
658963	4532	GYN	BTL	70	35		
658516	3398	GYN	BTL	220	163		
657314	1533	OB	BTL	50	39		
657431	8461	GYN	Laparotomy, BTL	40	20		
657420	4941	GYN	Laparotomy, BTL	45	26		
657553	5086	GYN	Mini Laparotomy, BTL	110	65		
657693	8862	GYN	Laparotomy, BTL	50	17		
657872	4306	GYN	Laparotomy, BTL	60	30		
657974	2269	GYN	Laparotomy, BTL	45	20		
658067	4325	GYN	Mini Laparotomy, BTL	65	42		
658140	1953	GYN	Laparotomy, BTL	45	26		
658511	9219	GYN	Mini Laparotomy, BTL	80	39		
658872	5869	GYN	Mini Laparotomy, BTL	95	73		
659241	6819	GYN	Laparotomy, BTL	80	32		
659291	8604	GYN	Mini Laparotomy, BTL	100	48		
659533	9985	GYN	BTL	55	49		
659532	4654	GYN	Mini Laparotomy, BTL	110	54		
659926	9109	GYN	Mini Laparotomy, BTL	85	39		
660018	0383	GYN	BTL	75	20		
660090	8602	GYN	Mini Laparotomy, BTL	65	25		
660250	7588	GYN	Mini Laparotomy, BTL	60	45		
660241	0306	GYN	Mini Laparotomy, BTL	95	51		
661131	7357	GYN	Laparoscopy, BTL	80	38		
661235	8881	GYN	BTL	40	23		
661479	2130	GYN	Laparotomy, BTL	62	62		
661477	2067	GYN	BTL	43	16		
661658	8386	GYN	BTL	75	25		
662154	3512	GYN	BTL	75	32		
662956	7467	GYN	BTL	85	62		
663114	5336	GYN	Laparotomy, BTL	80	29		
663200	0197	GYN	BTL	75	33		
663252	8940	GYN	BTL	65	21		
663247	5739	GYN	BTL	65	19		
663281	0533	GYN	BTL	70	9		
663622	4524	GYN	BTL	70	13		
662021		OB	Explor Laparotomy, PPBTL	110	95		
661835	6619	GYN	BTL, Diag Scope, Exp Lap, D&C	80	50		
657775	3063	GYN	Explor Lap, BTL	140	116		
			Average time per procedure (minutes)	76.59	41.90		
			Standard deviation	31.11	28.59		
			Maximum time	220.00	163.00		
			Minimum time	40.00	9.00		
			Total Time (minutes)	3,140	1,718		
			Percentage of Total Time	9.52%	9.03%		

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Register of Operations, RACH, Jan 1989 - Aug 1989

Register Number	SSN	Service	Operation	Anesthesia Time (min)	Surgery Time (min)	Days in Hospital (Patient)	Days in Hospital (Child)
DILITATION AND EVACUATION							
659151		GYN	Dilitation & Evacuation	60	15		
657884		GYN	Dilitation & Evacuation	60	4		
657967		GYN	Dilitation & Evacuation	30	16		
658018		GYN	Dilitation & Evacuation	60	35		
658060		GYN	Dilitation & Evacuation	40	10		
658120		GYN	Dilitation & Evacuation	50	32		
658275		GYN	Dilitation & Evacuation	35	19		
658386		GYN	Dilitation & Evacuation	100	39		
658518		GYN	Dilitation & Evacuation	25	12		
658762		GYN	Dilitation & Evacuation	25	12		
658306		GYN	Dilitation & Evacuation	30	15		
658890		GYN	Dilitation & Evacuation	25	13		
658993		GYN	Dilitation & Evacuation	65	32		
659076		GYN	Dilitation & Evacuation	90	25		
659519		GYN	Dilitation & Evacuation	65	22		
659650		GYN	Dilitation & Evacuation	70	27		
659960		GYN	Dilitation & Evacuation	25	16		
660165		GYN	Dilitation & Evacuation	50	10		
660295		GYN	Dilitation & Evacuation	90	45		
661524		GYN	Dilitation & Evacuation	36	16		
661706		GYN	Dilitation & Evacuation	35	19		
Not on Log		GYN	Dilitation & Evacuation	40	30		
662138		GYN	Dilitation & Evacuation	55	21		
662225		GYN	Dilitation & Evacuation	50	5		
662293		GYN	Dilitation & Evacuation	50	5		
Not on Log		GYN	Dilitation & Evacuation	25	9		
662428		GYN	Dilitation & Evacuation	35	4		
662533		GYN	Dilitation & Evacuation	65	55		
662736		GYN	Dilitation & Evacuation	55	10		
662879		GYN	Dilitation & Evacuation	60	33		
663099		GYN	Dilitation & Evacuation	60	5		
663602		GYN	Dilitation & Evacuation	55	10		
663209		GYN	D&E, Culdocentesis	90	47		
Not on Log		GYN	D&E, Culdocentesis	75	70		
			Average time per procedure (minutes)	52.97	21.71		
			Standard deviation	21.19	15.52		
			Maximum time	100.00	70.00		
			Minimum time	25.00	4.00		
			Total Time (minutes)	1,801	738		
			Percentage of Total Time	5.46%	3.88%		

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Register of Operations, RACH, Jan - Aug 1989

Register Number	Service	Operation	Anesthesia Time (min)	Surgery Time (min)
TOTAL ABDOMINAL HYSTERECTOMY				
657525	GYN	Total Abd Hysterectomy	230	167
657914	GYN	Total Abd Hysterectomy	140	102
658116	GYN	Total Abd Hysterectomy	155	129
658648	GYN	Total Abd Hysterectomy	165	119
658862	GYN	Total Abd Hysterectomy	245	198
658863	GYN	Total Abd Hysterectomy	205	160
659061	GYN	Total Abd Hysterectomy	135	109
659826	GYN	Total Abd Hysterectomy	130	86
660435	GYN	Total Abd Hysterectomy	165	124
660673	GYN	Total Abd Hysterectomy	155	101
661043	GYN	Total Abd Hysterectomy	115	74
661038	GYN	Total Abd Hysterectomy	110	75
661291	GYN	Total Abd Hysterectomy	150	104
661576	GYN	Total Abd Hysterectomy	220	190
661628	GYN	Total Abd Hysterectomy	202	158
661731	GYN	Total Abd Hysterectomy	295	181
661793	GYN	Total Abd Hysterectomy	180	140
663561	GYN	Total Abd Hysterectomy	165	103
		Average time per procedure (minutes)	175.67	128.89
		Standard deviation	47.37	37.77
		Maximum time	295.00	198.00
		Minimum time	110.00	74.00
		Total Time (minutes)	3,162	2,320
		Percentage of Total Time	9.59%	12.19%
DILIATION & CURETTAGE				
657557	GYN	Diliation & Curettage	65	32
658646	GYN	Diliation & Curettage	60	20
658865	GYN	Diliation & Curettage	120	92
658965	GYN	Diliation & Curettage	21	7
659107	GYN	Diliation & Curettage	35	18
659301	GYN	Diliation & Curettage	70	37
659822	GYN	Diliation & Curettage	65	33
660017	GYN	Diliation & Curettage	70	30
660735	GYN	Diliation & Curettage	65	30
660708	GYN	Diliation & Curettage	40	9
661423	GYN	Diliation & Curettage	50	14
662590	GYN	Diliation & Curettage	40	10
658650	GYN	Diliation & Curettage, EUA	80	35
658961	GYN	Diliation & Curettage, EUA	55	27
		Average time per procedure (minutes)	59.71	28.14

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Register of Operations, RACH, Jan - Aug 1989

Register Number	Service	Operation	Anesthesia Time (min)	Surgery Time (min)
		Standard deviation	22.90	20.29
		Maximum time	120.00	92.00
		Minimum time	21.00	7.00
		Total Time (minutes)	836	394
		Percentage of Total Time	2.54%	2.07%
		TOTAL TIME (minutes)	32,966	19,033

Routine OB Delivery Group Package

Register Number	SSN	Labor stage[a] 1st	2nd	3rd	Labor Time[a]	No. of[b] post partum Visits	Days in hospital (patient)	Days in hospital (child)
531015	7556	635	20	18	520	6	3	3
601225	0591	450	70	7	167	2	2	2
611201	7383	1010	7	11	1028	2	3	1
540208	6757	255	10	8	363	4	2	2
530119	9543	760	15	10	550	4	3	3
590609	5975	265	7	5	247	3	4	3
551008	2548	435	13	4	342	3	3	2
510131	5023	635	25	12	372	2	2	1
650311	9286	309	5	10	144	2	2	2
591231	1455	560	82	4	386	3	4	3
660412	4933	375	3	3	256	2	2	2
640928	4103	290	22	11	218	4	2	2
571118	2092	1080	67	27	1234	2	9	1
450412	2461	503	3	11	397	3	2	2
691006	8043	640	106	7	598	5	2	2
640213	2114	427	18	3	448	2	2	2
710429	9811	270	32	3	365	3	3	3
570131	5023	635	25	12	372	2	N/A	N/A
681113	9434	300	14	5	554	4	2	2
661102	8740	535	71	4	490	3	4	3
700625	8968	540	138	4	702	3	6	3
620730	5978	293	5	2	150	3	N/A	N/A
630114	4477	75	13	8	51	5	2	2
530224	6675	175	6	5	16	6	4	4
620101	6571	223	3	9	67	2	3	3
591206	0265	70	7	10	652	2	2	2
610222	3153	192	9	4	55	4	2	2
540427	5113	625	13	5	523	4	4	2
AVG # of min		449	29	8	402			
STD		246	34	5	276			
Max # of min		1080	138	27	1234			
Min # of min		70	3	2	16			

Average # of postpartum visits	3
Standard deviation	1
Maximum number of visits	6
Minimum number of visits	2

Average LOS (days)	3.04	2.27
Standard deviation	1.56	0.71

Complicated OB Delivery Group Package

Register Number	SSN	Labor Stage[a] 1st	2nd	3rd	Labor Time[a]	No. of[b] Post Partum Visits	Days in Hospital (Patient)	Days in Hospital (Child)
611202	7383	1015	2	5	1017	1	5	3
620924	9565	190	13	6	39	1	3	2
173173	5440	305	5	3	903	2	3	2
610727	8215	104	162	6	1649	2	3	2
621018	4678	140	28	6	1619	2	3	2
530119	9593	400	15	7	407	2	2	2
660412	4933	375	3	3	256	3	2	2
571118	2092	1080	67	27	1229	2	9	1
630921	3540	450	10	10	410	1	N/A	N/A
571110	5210	250	5	5	500	3	4	4
630511	3548	470	55	17	2017	3	3	2
N/A	1950	375	65	5	745	3	3	3
601214	1426	1375	58	9	2093	2	0	10
710128	1247	545	29	4	458	4	4	3
560224	1484	180	119	3	283	1	N/A	N/A
590609	5975	325	7	5	307	7	N/A	N/A
640928	4103	290	22	11	218	3	N/A	N/A
681235	2986	540	27	10	97	3	2	2
651001	3374	340	5	10	435	1	6	2
631004	2823	690	80	5	755	4	3	3
610612	9647	450	180	2	1022	5	4	3
560504	8131	80	18	4	42	2	N/A	N/A
601109	8950	395	17	7	494	4	3	3
591206	0265	70	7	10	662	2	N/A	N/A
661101	4735	695	15	8	208	1	3	3
720210	9375	640	43	12	555	4	4	3
570131	5023	635	25	12	372	3	N/A	N/A
N/A	3063	315	10	29	99	1	2	2
AVG # of min		454	39	9	675			
STD		302	46	6	568			
Max # of min		1375	180	29	2093			
Min # of min		70	2	2	39			

Average # of postpartum visits	3
Standard deviation	1
Maximum number of visits	7
Minimum number of visits	1

Complicated OB Delivery Group Package

Register Number	SSN	Labor Stage[a] 1st	2nd	3rd	Labor Time[a]	No. of[b] Post Partum Visits	Days in Hospital (Patient)	Days in Hospital (Child)
						Average LOS (days)	3.38	2.81
						Standard deviation	1.73	1.74
						Maximum LOS	9	10
						Minimum LOS	0	1

Note. Extracted from SF 534, Medical Record of Labor, RACH.
[a] Reported in minutes.
[b] Extracted from Supplemental Medical Data, DA 4700; Emergency Care and Treatment Form, SF 558; Chronicological Record of Medical Care, SF 600.

Month of October 1989

CLINIC/HCP	WI & SC	CLINIC APPTS	CLINIC/PNT CANC	NO-SHOWS	TOTAL SEEN
Internal Med	219	17	4	1	236
Internal Med	203	38	3	0	241
Internal Med	195	16	7	0	211
Internal Med	69	65	2	3	134
Dermatology	271	23	5	4	294
Ophthalmology	119	207	17	0	326
Ophthalmology (TECH)	13	13	0	0	26
ENT	307	177	13	11	484
ENT (TECH)	4	2	0	0	6
Optometry	621	79	11	5	700
Optometry	151	163	15	4	314
Optometry	16	261	15	0	277
Optometry	19	262	23	0	281
Optometry (TECH)	0	20	0	0	20
OB/GYN Provider A	104	51	10	2	155
OB/GYN Provider B	97	75	0	0	172

Month of October 1989

CLINIC/HCP	WI & SC	CLINIC APPTS	CLINIC/PNT CANC	NO-SHOWS	TOTAL SEEN
OB/GYN Provider C	158	99	20	4	257
OB/GYN Provider D	116	250	36	19	366
Pediatrics	114	34	27	1	148
Pediatrics	77	34	4	1	111
Pediatrics	46	461	44	8	507
Pediatrics	100	101	11	1	201
Orthopedics	214	92	9	12	306
Orthopedics	303	80	17	13	383
Orthopedics	254	193	18	31	447
Podiatry	204	136	18	15	340
Podiatry (TECH)	0	0	0	0	0
Physical Therapy	0	210	4	0	210
Physical Therapy	0	94	6	1	94
Physical Therapy	0	257	2	0	257
Physical Therapy	0	75	1	0	75
Physical Therapy Treatments	538	3,542	76	6	4,080

DEPARTMENT OF THE ARMY
HEADQUARTERS US ARMY MEDICAL DEPARTMENT ACTIVITY
FORT SILL, OKLAHOMA 73503-6300

REPLY TO ATTENTION OF

HSUA-SOB 3 November 1989

MEMORANDUM FOR: Chief, Department of Surgery, Reynolds Army Community Hospital, Fort Sill, Oklahoma 73503-6300

SUBJECT: Monthly Report for October 1989

	YEARLY TOTAL	MONTHLY TOTAL
1. Total Outpatient Visits	9,807	984
A. Obstetrics	4,312	463
B. Gynecology	5,495	521
2. Total Hospital Admissions	1,557	119
A. Obstetrics	850	70
B. Gynecology	707	49
3. Infants Delivered	692	62
A. Livebirths	680	61
B. Stillbirths	12	1
C. Twins	0	0
D. Neonatal Deaths	0	0
E. Perinatal Deaths	0	0
4. Fetal Presentation	692	62
A. Cesarean Sections	141	12
B. Primary C-Section	91	9
C. Repeat C-Section	50	3
D. Anesthetics	692	62
E. Mothers Delivered	692	62
5. Comments		
A. Maternal Deaths	0	0
B. Neonatal Deaths	0	0
C. Stillborn Rate	17/1000	16/1000
D. Perinatal Deaths	0	0
E. Primary Section Rate	13%	15%
F. Total Section Rate	20%	19%
6. Gynecology Surgery		41.
7. Non-Availability Statements issued for October (Mammograms/US)		0.
8. Non-Availability Statements for CHAMPUS to deliver in October		30.

October Catchment Area Management Demand Level

Date	Type appointment	Patient category	Appointment date
10/20/89	Abnormal PAP	PAP	10/25/89
09/13/89	Abdominal Pain	Routine GYN	10/05/89
09/13/89	Abdominal Pain	Routine GYN	10/06/89
10/04/89	Amenorrhea	Routine GYN	10/23/89
09/25/89	Amenorrhea - Follow up	GYN Follow-up	10/23/89
10/05/89	Amenorrhea - Follow up	GYN Follow-up	10/23/89
09/27/89	Back and Abdominal Pain	Routine GYN	10/10/89
10/12/89	Cervical Dysplasia	Routine GYN	10/24/89
09/14/89	Cervical Polyps	Routine GYN	10/25/89
09/06/89	Cervical Polyps	Routine GYN	10/10/89
10/19/89	Cervical Polyps	Routine GYN	10/26/89
10/18/89	Cervical Polyps	Routine GYN	10/19/89
10/02/89	Cervical Polyps	Routine GYN	10/16/89
10/05/89	Chronic Cervicitis	Routine GYN	10/06/89
10/13/89	Chronic Pelvic Pain	Routine GYN	10/17/89
09/13/89	Chronic Pelvic Pain	Routine GYN	10/09/89
10/23/89	Chronic Pelvic Pain	Routine GYN	10/23/89
09/22/89	Chronic Pelvic Pain	Routine GYN	10/02/89
09/18/89	Chronic Pelvic Pain	Routine GYN	10/26/89
09/12/89	Chronic Pelvic Pain/Cyst	Routine GYN	10/03/89
10/02/89	Class III PAP	GYN Follow up	10/16/89
09/06/89	Colposcopy	Colposcopy	10/02/89
10/09/89	Colposcopy	Colposcopy	10/12/89
09/15/89	Colposcopy	Colposcopy	10/06/89
09/11/89	Colposcopy	Colposcopy	10/11/89
10/16/89	Colposcopy	Colposcopy	10/17/89
09/28/89	Colposcopy	Colposcopy	10/16/89
10/11/89	Colposcopy	Colposcopy	10/19/89
10/02/89	Complications from Tubal	GYN Follow up	10/02/89
10/16/89	Cone Biopsy	Routine GYN	10/17/89
10/16/89	Conization	Routine GYN	10/18/89
10/24/89	Cryosurgery	Cryosurgery	10/00/89
10/31/89	Cryosurgery	Cryosurgery	10/00/89
09/18/89	Cryosurgery	GYN Follow up	10/13/89
10/18/89	Ovarian Cyst	Routine GYN	10/19/89
09/28/89	Cystocelle	Routine GYN	10/09/89
10/10/89	Cystocelle	Routine GYN	10/24/89
10/12/89	Cystocelle	Routine GYN	10/23/89
09/18/89	D&C	Routine GYN	10/06/89
10/12/89	D&C	Routine GYN	10/13/89
10/24/89	Scope	Routine GYN	10/27/89
10/18/89	Scope	GYN Follow up	10/25/89

October Catchment Area Management Demand Level

Date	Type appointment	Patient category	Appointment date
09/13/89	Infertility	Infertility	10/24/89
10/03/89	Uterine Fibroids	GYN Follow up	10/04/89
09/05/89	Dysmenorrhea	GYN Follow up	10/02/89
10/26/89	Dysplasia	GYN Follow up	10/31/89
08/03/89	Dysplasia	GYN Follow up	10/03/89
09/06/89	EMB	GYN Follow up	10/04/89
10/19/89	Endometrial Biopsy	GYN Follow up	10/24/89
10/17/89	Endometriosis	GYN Follow up	10/18/89
09/12/89	Endometriosis	Routine GYN	10/05/89
10/06/89	Endometriosis	Routine GYN	10/24/89
10/11/89	Enlarged Uterus	Routine GYN	10/16/89
09/28/89	Estrogen Deficency	Routine GYN	10/30/89
10/04/89	Fibroid Uterus	Routine GYN	10/05/89
09/27/89	Fibroid Uterus	Routine GYN	10/13/89
10/16/89	Fibroid Uterus	GYN Follow up	10/31/89
10/10/89	Fibroid Uterus	Routine GYN	10/13/89
09/13/89	Fibroids	Routine GYN	10/05/89
10/11/89	Colposcopy	GYN Follow up	10/12/89
09/25/89	Routine GYN	Routine GYN	10/10/89
09/28/89	Routine GYN	Routine GYN	10/09/89
10/20/89	CIN I	GYN Follow up	10/20/89
10/18/89	Colposcopy	Colposcopy	10/20/89
10/16/89	Dysplasia	Routine GYN	10/26/89
10/02/89	Hypermenorrhea	GYN Follow up	10/17/89
10/13/89	Hysterectomy	Hysterectomy	10/16/89
10/10/89	Hysterectomy	Hysterectomy	10/11/89
10/02/89	Hysterectomy	Hysterectomy	10/06/89
09/25/89	Hysterectomy	Hysterectomy	10/04/89
10/10/89	Hysterectomy	Hysterectomy	10/27/89
10/03/89	Hysterectomy	Hysterectomy	10/04/89
10/13/89	Hysterectomy	Hysterectomy	10/17/89
10/16/89	Hysterectomy	GYN Follow up	10/31/89
10/04/89	Infertility	Infertility	10/24/89
10/02/89	Infertility	Infertility	10/05/89
10/19/89	Infertility	Infertility	10/25/89
10/23/89	Infertility	Infertility	10/30/89
09/11/89	Infertility	Infertility	10/17/89
10/04/89	Infertility	Infertility	10/12/89
10/11/89	Infertility	Infertility	10/24/89
09/20/89	Infertility	GYN Follow up	10/02/89
09/13/89	Infertility	Infertility	10/05/89
10/03/89	Infertility	GYN Follow up	10/06/89
09/18/89	Infertility	GYN Follow up	10/17/89

October Catchment Area Management Demand Level

Date	Type appointment	Patient category	Appointment date
09/19/80	Menstral Bleeding	Routine GYN	10/05/89
09/08/89	Irregular Mensus	Routine GYN	10/05/89
09/18/89	Irregular Bleeding	Routine GYN	10/10/89
10/06/89	Irregular Mensus	Routine GYN	10/20/89
10/25/89	Scope	Routine GYN	10/25/89
10/02/89	Scope	Routine GYN	10/09/89
10/20/89	Scope	Routine GYN	10/30/89
10/10/89	Scope	Routine GYN	10/18/89
10/10/89	Scope	Routine GYN	10/11/89
10/30/89	Scope	Routine GYN	10/30/89
10/13/89	Laparotomy	Routine GYN	10/13/89
10/19/89	Laparotomy	GYN Follow up	10/25/89
10/04/89	Laparotomy	Routine GYN	10/09/89
09/28/89	Fibroid Uterus	Routine GYN	10/12/89
10/05/89	Left LQ Pain	Routine GYN	10/20/89
10/17/89	Menopausal Syndrome	Routine GYN	10/23/89
09/27/89	Metromenorrhagia	Routine GYN	10/10/89
09/22/89	Mild Cellular Atypia	GYN Follow up	10/19/89
09/15/89	Ovarian Pain	Routine GYN	10/12/89
10/24/89	Pelvic Mass	GYN Follow up	10/27/89
09/21/89	Pelvic Pain	Routine GYN	10/05/89
10/12/89	Pelvic Pain	Routine GYN	10/17/89
09/14/89	Pelvic Pain	Routine GYN	10/23/89
10/10/89	Pelvic Pain	Routine GYN	10/18/89
10/13/89	Pre Op[a]	Pre Op	10/16/89
10/10/89	Pre Op	Pre Op	10/11/89
10/02/89	Pre Op	Pre Op	10/06/89
09/25/89	Pre Op	Pre Op	10/04/89
10/10/89	Pre Op	Pre Op	10/27/89
10/03/89	Pre Op	Pre Op	10/04/89
10/13/89	Pre Op	Pre Op	10/17/89
10/16/89	Pre Op	Pre Op	10/05/89
10/03/89	Pre Op	Pre Op	10/06/89
10/08/89	Pre Op	Pre Op	10/13/89
10/10/89	Pre Op	Pre Op	10/12/89
10/06/89	Pre Op	Pre Op	10/30/89
10/23/89	Pre Op	Pre Op	10/19/89
10/02/89	Pre Op	Pre Op	10/02/89
09/28/89	Pre Op	Pre Op	10/03/89
09/22/89	Pre Op	Pre Op	10/03/89
09/25/89	Pre Op	Pre Op	10/23/89
10/06/89	Pre Op	Pre Op	10/09/89
10/05/89	Pre Op	Pre Op	10/10/89

October Catchment Area Management Demand Level

Date	Type appointment	Patient category	Appointment date
10/04/89	Pre Op	Pre Op	10/09/89
10/04/89	Pre Op	Pre Op	10/09/89
10/05/89	Pre Op	Pre Op	10/12/89
09/26/89	Pre Op	Pre Op	10/10/89
09/19/89	Pelvic Pain w/Left Mass	GYN Follow up	10/02/89
10/04/89	PID	Routine GYN	10/23/89
10/13/89	Ovarian Cysts	Routine GYN	10/20/89
09/14/89	Fibroids	Routine GYN	10/06/89
10/02/89	Endometriosis	Routine GYN	10/16/89
10/12/89	Routine GYN	Routine GYN	10/30/89
09/12/89	Spotting	Routine GYN	10/18/89
09/25/89	Dysplasia	Routine GYN	10/18/89
10/03/89	Tubal	GYN Follow up	10/05/89
10/08/89	Tubal	GYN Follow up	10/06/89
10/10/89	Tubal	Tubal	10/13/89
10/06/89	Tubal	Tubal	10/12/89
10/23/89	Tubal	GYN Follow up	10/30/89
10/02/89	Tubal	Tubal	10/19/89
09/28/89	Tubal	GYN Follow up	10/02/89
09/22/89	Tubal	GYN Follow up	10/03/89
09/25/89	Tubal	Tubal	10/03/89
10/06/89	Tubal	GYN Follow up	10/23/89
10/05/89	Tubal	GYN Follow up	10/09/89
10/04/89	Tubal	GYN Follow up	10/10/89
09/26/89	Tubal	GYN Follow up	10/09/89
10/02/89	Tubal	Tubal	10/20/89
10/11/89	Tubal	GYN Follow up	10/12/89
10/05/89	Tubal	GYN Follow up	10/16/89
10/13/89	Tubal	Tubal	10/17/89
10/12/89	Tubal	GYN Follow up	10/24/89
10/04/89	Tubal	Tubal	10/11/89
10/18/89	Tubal	Tubal	10/24/89
10/05/89	Tubal	Tubal	10/07/89
10/05/89	Tubal	GYN Follow up	10/11/89
09/20/89	Tubal	GYN Follow up	10/03/89
10/10/89	Tubal	GYN Follow up	10/17/89
09/26/89	Tubal	Tubal	10/02/89
10/03/89	Tubal	Tubal	10/13/89
10/04/89	Tubal	Tubal	10/05/89
09/19/89	Vaginal Polys	Routine GYN	10/05/89
10/24/89	Vaginitis	GYN Follow up	10/24/89
10/18/89	D&C	Routine GYN	10/20/89
09/08/89	OB	OB Delivery	10/05/89

October Catchment Area Management Demand Level

Date	Type appointment	Patient category	Appointment date
10/23/89	OB	OB Visit	10/23/89
10/02/89	OB	OB Delivery	10/03/89
09/05/89	OB	OB Delivery	10/10/89
09/29/89	OB	OB Delivery	10/13/89
09/07/89	OB	OB Delivery	10/02/89
09/12/89	OB	OB Delivery	10/06/89
10/05/89	OB	OB Delivery	10/05/89
10/18/89	OB	OB Delivery	10/20/89
10/12/89	OB	OB Delivery	10/12/89
10/03/89	OB	OB Delivery	10/05/89

Note. Extracted from CAM database.
* Packaged as part of the tubal visit.

Appendix H

Operating Room Demand Level for October, 1989

Register Number	SSN	Service	Operation	Anesthesia Time (min)	Surgery Time (min)	Diagnosis
664433	4724	GYN	Total Abdominal Hysterectomy	145	97	Fibroids
664432	9602	GYN	Total Abdominal Hysterectomy	135	88	Fibroids
664510	4007	GYN	Culdo, Lap, Scope	145	55	Ectopic Preg
664483	1750	GYN	Scope	52	25	Pelvic Pain
664560	6079	OB	C-Section	180	154	C-Section
664513	2993	GYN	Scope	55	22	N/A
664582	4815	GYN	Dilitation & Curettage	65	10	DUB
664623	5775	GYN	Dilitation and Evacuation	40	15	Missed AB
664620	1088	GYN	Dilitation and Evacuation	50	19	Missed AB
664614	3195	GYN	Dilitation and Evacuation	30	5	Spontaneous AB
664692	3608	OB	C-Section	60	25	C-Section
664687	1356	OB	C-Section	60	28	C-Section
664686	2309	OB	C-Section	60	35	C-Section
664727	6086	OB	C-Section	85	53	C-Section
664796	2328	OB	Rep C-Section	140	38	Pre-eclampsia
664746	4197	OB	C-Section	100	37	C-Section
664908	8710	GYN	Dilitation & Curettage	85	9	Incomplete AB
664852	8733	GYN	Scope, Laparotomy	165	119	N/A
664956	1716	OB	Rep C-Section	95	27	Rep C-Section
664917	9361	OB	Rep C-Section	80	30	C-Section
664916	2536	GYN	Scope, Tubal	75	20	Pelvic Pain
664966	3268	GYN	Scope, D&C	60	23	DUB
669979	3757	GYN	Scope	65	29	DUB, Pain
665094	0045	GYN	Dilitation and Evacuation	25	3	Incomplete AB
665048	0356	GYN	Lap, Salpingo	190	140	Pelvic Pain
665049	1599	GYN	Cone Biopsy	55	22	CIN III
665129	3298	OB	C-Section	55	24	C-Section
665111	7104	GYN	Total Abdominal Hysterectomy	180	110	N/A
665167	4987	OB	Rep C-Section	95	37	Term Preg
665180	8341	GYN	BTL, Scope	60	13	Ectopic Preg
665190	8264	OB	C-Section	65	27	C-Section
665210	2151	GYN	Culdo, Salpingo, Lap	100	37	Ectopic Preg
665101	6571	OB	PPBTL	35	13	N/A
665270	6245	GYN	Dilitation and Evacuation	170	7	Incomplete AB
N/A	7752	GYN	Dilitation and Evacuation	60	8	Incomplete AB
665251	4089	GYN	Laparotomy	70	10	AB Mass
665253	6757	GYN	BTL, Scope	70	41	N/A
665248	7084	GYN	Laparotomy, EUA	60	20	N/A
665249	5888	GYN	Marsup of Bartholin Cyst	45	2	N/A
			Total OR time (in minutes)	3362	1477	
			Hysterectomies	3		
			Tubals	4		
			C-Sections	12		
			Decremented OR time (in minutes)		897	

Note. Data extracted from DA Form 4108, Register of Operations, RACH, October 1989

Colposcopy Group Package

Reg number	SSN	Routine GYN visit	PAP*	Follow-up GYN visit	Colposcopy
660314	2594	1	2	1	1
N/A	0414		2	2	2
N/A	2285	1	1	2	1
620812	3394		1	2	1
610429	6501		2	2	1
610617	0627	2	1	2	1
461103	4027		1	1	1
611118	8988		1	2	1
536197	2484	1	2	2	1
650702	5208	1	1	1	1
560422	8594		2	2	1
651020	4678		2	1	1
640614	9904		1	2	1
591113	7933	1	1		1
210703	8518	2	3		1
541126	0293		1	1	1
650911	3169	1	1	1	1
650502	7918	1	1	2	1
N/A	2929		1	1	1
600212	8446	1	2	1	1
531119	8517	2	3	2	1
570808	1693	2	1	2	2
620126	9424	1	2	2	1
540518	1358	1	2	2	1
700402	6892	1	1	1	1
680810	4685		2	1	1
610205	2037	1	2	2	1
Average # of visits		1	2	2	1
Standard deviation		0.4	0.6	0.5	0.3
Maximum # of visits		2	3	2	2
Minimum # of visits		1	1	1	1

Cryosurgery Group Package

Reg number	SSN	Routine GYN visit	PAP*	Follow-up GYN visit	Colposcopy	Cryosurgery
631119	4036	1	2	1	1	1
390918	3296	1	2	1	1	1
690926	9843	1	2	2	1	1
611204	5113	1	2	2	1	1
530806	5103	1	2	1	1	1
680131	6794		1	2	1	1
501116	1989	1	2	2	2	1
680723	8960		2	2	2	1
580823	4704		2	1	2	1
670805	0547	1	1	2	1	1
560325	7132		2	3	1	1
651130	9290		1	2	1	1
621130	1335	2	1	2	1	1
651116	3634		2	1	1	1
421010	9389	1	2	1	1	1
490517	6006	1	1	2	1	1
551128	4058	2	2	2	1	1
591206	0265		1	2	1	1
N/A	5418	1	1	2	1	1
631210	1153	1	1	2	1	1
590713	1216	1	2	1	1	1
660806	7716	1	2	2	1	1
660814	4880		1	2	1	1
N/A	8881		1	2	1	1
Average # of visits		1	2	2	1	1
Standard deviation		0.3	0.5	0.5	0.3	0.0
Maximum # of visits		2	2	3	2	1
Minimum # of visits		1	1	1	1	1

Note. Extracted from dysplasia records for CY 1989, AQCESS.

* For planning purposes, PAPs are scheduled every 3 months for the first year after colposcopy or cryosurgery, and every 6 months the second year

Infertility Group Package

Reg number	SSN	Routine GYN visit	Follow-up GYN visit	Infertility
520630	8458	1	2	1
530414	6508	1	3	1
N/A	4880	1	3	1
570801	4381	1	3	1
641216	6992	1	4	1
590604	3168	1	3	1
560729	0794	1	1	1
580215	6547	2	2	1
621106	6763	1	2	1
580720	5500	1	2	1
571018	2851	1	3	1
540709	2629	1	3	1
600308	5555	1	2	1
550926	7259	1	2	1
620718	3382	2	5	1
451220	1164	1	3	1
N/A	7323	1	1	1
651023	1246	1	2	1
580414	2692	1	4	1
610317	0930	1	2	1
540710	2048	1	6	1
491128	7981	1	2	1
570405	9360	2	4	1
N/A	1272	1	3	1
570905	6134	1	3	1
680214	6687	2	3	1
570822	2407	1	2	1
500307	7889	1	2	1
N/A	5552	1	2	1
650201	3662	1	5	1
Average # of visits		1	3	1
Standard deviation		0.3	1.1	0.0
Maximum number of visits		2	6	1
Minimum number of visits		1	1	1

Note. Extracted from infertility records, CY 1989, AQCESS.

Prenatal Visits for Routine OB Delivery

Register number	SSN	No. of Prenatal visits
690827	2456	9
660321	7895	7
651004	3257	5
611108	3597	8
630718	2389	2
690909	2863	13
690926	4806	12
700614	7288	10
610832	4938	12
700227	7428	15
540705	2017	12
570131	7473	12
630603	9729	12
670510	7450	14
630425	5163	10
620120	1462	12
631026	1418	13
640113	0281	13
680602	0363	7
650115	0769	11
700210	5925	11
661210	8935	13
721107	5711	12
551025	4269	12
651220	7521	11
680904	7189	11
630623	5535	11
644004	5413	11
700120	7564	11
580728	9912	12
630329	1135	11
610922	2518	12
640309	3481	13
470302	7815	11
670516	6345	4
640621	4107	11
660804	4359	7
Average # of prenatal visits		11
Standard deviation		3
Maximum number of visits		15
Minimum number of visits		2

Prenatal Visits for Complicated OB Delivery

Register Number	SSN	No. of Prenatal Visits
630628	3067	12
667052	1081	12
610807	2120	13
620725	2980	14
521021	3579	13
620510	1705	14
651029	1375	8
621318	5845	19
660622	6711	12
N/A	8545	7
600306	9554	12
650922	3972	14
661216	1240	14
620318	7149	20
620205	4397	12
630623	9971	7
	Average # of prenatal visits	13
	Standard deviation	3
	Maximum number of visits	20
	Minimum number of visits	7

Note. Extracted from Prenatal and Pregnancy Medical Record, SF 533, RACH, November and December, 1989.

Group Package for Tubal Ligations

Register Number	SSN	ROUTINE [a] GYN VISITS	PAP	FOLLOW-UP GYN VISITS	PRE-OP [a] VISITS
620101	6571	1	1	1	1
550669	2763		1	2	1
610515	2790	1	1	1	1
560718	5336	1		2	1
610122	4532	1	1	1	1
650617	3512	1	1	2	1
630515	2130	2		2	1
600711	8391	2		1	1
501120	0005	2	1	1	
660326	7439	1	1	2	1
630220	1953	2		3	1
600613	7653	2	1	2	1
590405	3467	1	1	1	1
560502	3398	1		3	1
570317	1357	1		2	1
660113	7467	1	1	2	1
620912	8881	2	1	2	1
Average # of visits		1	1	2	1
Standard deviation		0.5	0.0	0.6	0.0
Maximum number of visits		2	1	3	1
Minimum number of visits		1	1	1	1

[a] This includes the consult visit
[b] Many times an endo biopsy was performed during a pre-op visit

Group Package for Hysterectomies

Register Number	SSN	ROUTINE [a] GYN VISITS	FOLLOW-UP GYN VISITS	PRE-OP [b] VISITS
420322	7104	2	1	1
550901	5519	2	3	1
640210	9058	2	2	1
510917	2193	1	2	1
490912	4473	1	2	1
460325	9602	2	2	1
420814	9925		2	1
610617	0627		2	1
450821	8776	3	3	1
570504	8568	3	2	1
610200	5032	2	3	1
N/A	9890	3	2	1
N/A	4091	1	3	1
390414	8588	2	3	1
N/A	7182	1	4	1
440227	9483	2	1	1
400113	6454	1	2	1
471226	2461	2	4	1
470728	6648	3	2	2
N/A	7848	2	2	1
440601	8611	2	4	2
551014	3114	2	2	1
630215	4559	2	1	1
401120	5664	2	3	1
591127	2552	2	2	1
Average # of visits		2	2	1
Standard deviation		0.6	0.8	0.3
Maximum number of visits		3	4	2
Minimum number of visits		1	1	1

Note. Data extracted from Medical Records, January 1989 to 31 December 1989, AQCESS

[a] Many patients may have had D&C, multiple cryosurgeries, PAPs or colposcopies for several years prior to a hysterectomy These previous visits are not counted

[b] Many times an endo biopsy was performed during a pre-op visit

PREPARED 89 NOV 21 — JCA - PERSONNEL UTILIZATION SYSTEM
PERSONNEL EXPENSE DISTRIBUTION REPORT MONTH ENDING 89 OCT 31 PCN DXXXX-NAC-5301
USA MEDDAC, FT SILL

JCA CODE: HCXB OB/GYN CLINIC COST POOL

NAME	ID CODE	BRANCH	GRADE	DUTY POSITION	PMOS/ SSI/JOB	AVAILABLE HOURS	FTE MM	EXPENSE	CLINICIAN EXPENSE
	A2730	SW	E5	MEDNCO	91B20Y1	168.00	1.00	$2,448.00	
	B3457	GS	04	SECTYP	00318	103.00	.61	$1,811.37	
	B3942	GS	05	PN	00520	166.00	1.00	$2,839.17	
	C1113	GS	04	NA	00621	107.50	.64	$1,899.07	
	H1709	GS	04	MEDCLK	00879	95.00	.57	$1,745.34	
	H4119	GS	04	MEDCKT	00579	164.00	.98	$1,439.66	
	K6349	GS	05	PN	00620	85.50	.51	$1,917.27	
	L7635	MA	M1	PASTU	003A	56.00	.34	$1,031.72	
	N3620	GS	09	SUPCN	00610	134.00	.80	$3,129.17	
	P7051	AN	04	DESNUR	00382	128.00	.76	$3,184.00	
	R2113	SW	E6	CNCO	91B30	136.00	.81	$2,533.90	
	R9001	XX		CLK		52.00	.00	$0.00	
	S0949	GS	04	NA	00521	151.00	.90	$1,720.83	
	T9057	GS	03	FILCLK	00305	132.00	.79	$1,604.91	
				WORK CENTER TOTAL		1681.00	9.71	$29,403.48	

Provider D

Surv 3.29
CNO 6.42

DCA - PERSONNEL UTILIZATION SYSTEM
PERSONNEL EXPENSE DISTRIBUTION REPORT MONTH ENDING 89 OCT 31 PCN DXXXX-NAC-5301
USA MEDDAC, FT SILL

PREPARED 89 NOV 21

DCA CODE: DCEA GYNECOLOGY CLINIC

NAME	ID CODE	BRANCH	GRADE	DUTY POSITION	PROG/ BSI/JOB	AVAILABLE HOURS	FTE MM	EXPENSE	CLINICIAN EXPENSE
Provider B	[illegible]	70	04	OB/GYN	60J00	57.25	.34	$1,532.39	
Provider A	[illegible]	70	04	OB/GYN	60J00	30.45	.18	$927.60	
Provider C	[illegible]	70	03	OB/GYN	60J00	44.80	.27	$995.80	
				WORK CENTER TOTAL		132.50	.79	$3,455.79	

PREPARED 89 NOV 01 — DCA - PERSONNEL UTILIZATION SYSTEM
PERSONNEL EXPENSE DISTRIBUTION REPORT MONTH ENDING 89 OCT 31 PCN DXXXX-MAC-5301
USA FREDRICK FT SILL

DCA CODE: DCCA OBSTETRICS CLINIC

NAME	ID CODE	BRANCH	GRADE	DUTY POSITION	PMOS/ SSI/JOB	AVAILABLE HOURS	FTE MM	EXPENSE	CLINICIAN EXPENSE
Provider B	[illegible]	MC	04	OB/GYN	60J00	97.25	.34	$1,532.39	
Provider A	P21CC	MC	04	OB/GYN	60J00	71.05	.43	$2,164.40	
Provider C	SF201	MC	03	OB/GYN	60J00	67.20	.40	$1,493.70	
				WORK CENTER TOTAL		195.50	1.17	$5,190.49	

UCA - PERSONNEL UTILIZATION SYSTEM

PREPARED ON NOV 11 PERSONNEL EXPENSE DISTRIBUTION REPORT MONTH ENDING 89 OCT 31 PCN DXXXX-NAC-5301

USA MEDDAC, FT SILL

UCA CODE: XXXA GYNECOLOGY INPATIENT

NAME	ID CODE	BRANCH	GRADE	DUTY POSITION	PMOS/ SSI/JOC	AVAILABLE HOURS	FTE MM	EXPENSE	CLINICIAN EXPENSE
Provider B	[illegible]	MC	04	OB/GYN	60JCO	80.15	.48	$2,145.86	$2,145.86
Provider A	[illegible]	MC	04	OB/GYN	60JCO	50.75	.30	$1,546.00	$1,546.00
Provider C	[illegible]	MC	03	OB/GYN	60JCO	33.60	.20	$746.85	$746.85
				UCA CENTER TOTAL		164.50	.98	$4,438.71	$4,438.71

PREPARED BY MCV C1

UCA - PERSONNEL UTILIZATION SYSTEM
PERSONNEL EXPENSE DISTRIBUTION REPORT MONTH ENDING 99 OCT 31 PCN DXXXX-NAC-5301
USA MEDDAC, FT SILL

UCA CODE: ACSA OUTPATIENTS

NAME	ID CODE	BRANCH	GRADE	DUTY POSITION	PROS/ SSI/JOS	AVAILABLE HOURS	FTE MM	EXPENSE	CLINICIAN EXPENSE
Provider B	53420	MC	04	CB/GYN	50J00	34.35	.20	$919.56	$919.56
Provider A	P0130	MC	04	C/OB GY	50J00	50.75	.30	$1,546.00	$1,546.00
Provider C	53201	MC	05	OB/GYN	50J00	78.40	.46	$1,742.65	$1,742.65
				WORK CENTER TOTAL		163.50	.96	$4,208.21	$4,208.21

Appendix K

Reynolds Army Community Hospital Costs

	EXPENSES					
	Direct	Overhead	Ancillary	BASOPS	Equipment	Total
OB-GYN Inpatient (Wards 3E and 3W)	$101,576	$67,688	$9,980	$7,442	$2,713	$189,399
OB-GYN Outpatient	$35,782	$8,744	$12,019	$3,746	$865	$61,156
with OB-GYN Physicians	$32,356	$8,744	$12,019	$3,746	$865	$57,730
with Nurse Practitioner	$27,136	$8,744	$12,019	$3,746	$865	$52,510

OB-GYN Clinic Visits:	950	Total Minutes on October Template:	27,360
Number of No-Shows:	91		
Total Number of Visits:	1041		

	Monthly Expenses	Cost per Visit	Cost per Minute
Outpatient Visit w/OB-GYN Physicians	$57,730	$55.46	$2.11
Outpatient Visit w/Nurse Practitioner	$52,510	$50.44	$1.92

		Monthly Expenses	Cost per Bed Day
OB-GYN Bed Days:	424	$189,399	$446.70

Note. Data extracted from Medical Expense and Reporting System, OB-GYN, RACH

Appendix L

FREQUENCY OF DRGS WITH BED DAYS
MDC 13 AND 14
FY 88, FT SILL

TOP 28 DIAGNOSIS RELATED GROUPS WITH HIGHEST FREQUENCIES

RANK	DRG CODE	DIAGNOSIS RELATED GROUP TITLE	DSPO	- - DAYS - - TOTAL	MEAN
1	373	VAGINAL DELIVERY W/O COMPLICATING DIAGNOSES	811	2373	2.93
2	379	THREATENED ABORTION	187	402	2.15
3	383	OTHER ANTEPARTUM DIAGNOSES WITH MEDICAL COMPLICATIONS	172	598	3.48
4	370	CESAREAN SECTION WITH CC	104	561	5.39
5	371	CESAREAN SECTION W/O CC	104	502	4.83
6	372	VAGINAL DELIVERY WITH COMPLICATING DIAGNOSES	81	300	3.70
7	384	OTHER ANTEPARTUM DIAGNOSES W/O MEDICAL COMPLICATIONS	59	146	2.47
8	361	LAPAROSCOPY & INCISIONAL TUBAL INTERRUPTION	59	216	3.66
9	380	ABORTION W/O D&C	54	125	2.31
10	381	ABORTION WITH D&C, ASPIRATION CURETTAGE, OR HYSTEROTOMY	52	105	2.02
11	359	UTERINE & ADNEXA PROC FOR NON-MALIGNANCY AGE <70 W/O CC	33	213	6.45
12	364	D&C, CONIZATION EXCEPT FOR MALIGNANCY	33	113	3.42
13	374	VAGINAL DELIVERY WITH STERILIZATION AND/OR D&C	27	77	2.85
14	382	FALSE LABOR	24	34	1.42
15	369	MENSTRUAL & OTHER FEMALE REPRODUCTIVE SYSTEM DISORDERS	23	48	2.09
16	378	ECTOPIC PREGNANCY	22	96	4.36
17	376	POSTPARTUM AND POST ABORTION DIAGNOSES W/O O.R. PROCEDURE	17	41	2.41
18	362	ENDOSCOPIC TUBAL INTERRUPTION	16	49	3.06
19	368	INFECTIONS, FEMALE REPRODUCTIVE SYSTEM	15	69	4.60
20	360	VAGINA, CERVIX & VULVA PROCEDURES	13	24	1.85
21	358	UTERINE & ADNEXA PROC FOR NON-MALIGNANCY AGE >69 &/OR CC	13	100	7.69
22	356	FEMALE REPRODUCTIVE SYSTEM RECONSTRUCTIVE PROCEDURES	13	89	6.85
23	377	POSTPARTUM AND POST ABORTION DIAGNOSES WITH O.R. PROCEDURE	7	13	1.86
24	366	MALIGNANCY, FEMALE REPRODUCTIVE SYSTEM AGE >69 AND/OR CC	3	41	13.67
25	367	MALIGNANCY, FEMALE REPRODUCTIVE SYSTEM AGE <70 W/O CC	2	1	0.50
26	365	OTHER FEMALE REPRODUCTIVE SYSTEM O.R. PROCEDURES	2	15	7.50
27	363	D & C, CONIZATION & RADIO-IMPLANT, FOR MALIGNANCY	2	6	3.00
28	357	UTERINE & ADNEXA PROCEDURES FOR OVARIAN OR ADNEXAL MALIG	1	15	15.00
		TOTAL	1949	6372	3.27

NOTE: OF THE 1949 RECORDS WITH AN OB/GYN DRG (353-384) THERE WERE 1643 RECORDS WITH ONE OR MORE SURGICAL PROCEDURES.

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Appendix M

FY 1990 CAM Cost Figures

Patient Category	CPT code	Allowable charge	Negotiated amount
Routine GYN visit	90080	$113.30	$42.35
Papanicolaou smear	88150	$15.50	$11.94
Cryosurgery visit	57511	$135.00	$103.95
Routine OB visit	90070	$51.50	$39.66
GYN follow-up visit	90060	$38.60	$29.72
OB history visit	90020	$51.50	$39.66
Colposcopy visit*	57452	$170.00	$130.90
Infertility visit	90017	$80.00	$61.60
Pre-Op visit	90070	$51.50	$34.65

Group packages	CPT code	Allowable charges	Physician charges	Hospital charges	Total charges
Rtn OB delivery	59400	$1,133.00	$872.41	$2,209.91	$3,082.32
Hysterectomy	58150	$1,515.00	$1,166.55	$4,218.13	$5,384.68
Tubal (BTL)	58600	$883.75	$680.49	$1,032.80	$1,713.29
C-section	59500	$1,296.00	$997.92	$3,342.83	$4,340.75
Comp OB delivery	59899	---	$1,600.00	$2,457.08	$3,457.08

Note. Extracted from CAM database.
* Excludes biopsy

TABLE D-1

DEPARTMENT OF DEFENSE DIAGNOSIS RELATED GROUP (DRG) ANALYSIS
FISCAL YEAR 1985 RELATIVE WEIGHTED PRODUCTS (RWP) AND
CASE MIX INDICES (CMI)
(FINAL MODIFIED 1987 CHAMPUS WEIGHTS)

SERVICE	TOTAL FREQUENCY (LESS DRGS 469/470)	TOTAL RWPS	CASE MIX INDEX (CMI)	RELATIVE CASE MIX INDEX (RCMI)
DOD	957901	776716	0.8109	1.0000
ARMY	409503	351395	0.8579	1.0581
AIR FORCE	310347	240660	0.7755	0.9564
NAVY	237971	184653	0.7759	0.9570

DEPARTMENT OF DEFENSE DIAGNOSIS RELATED GROUP (DRG) ANALYSIS
FISCAL YEAR 1986 RELATIVE WEIGHTED PRODUCTS (RWP) AND
CASE MIX INDICES (CMI)
(FINAL MODIFIED 1987 CHAMPUS WEIGHTS)

SERVICE	TOTAL FREQUENCY (LESS DRGS 469/470)	TOTAL RWPS	CASE MIX INDEX (CMI)	RELATIVE CASE MIX INDEX (RCMI)
DOD	865706	711011	0.8213	1.0129
ARMY	399111	343730	0.8599	1.0605
AIR FORCE	282442	222912	0.7892	0.9733
NAVY	183553	144369	0.7865	0.9700

DEPARTMENT OF DEFENSE DIAGNOSIS RELATED GROUP (DRG) ANALYSIS
FISCAL YEAR 1987 RELATIVE WEIGHTED PRODUCTS (RWP) AND
CASE MIX INDICES (CMI)
(FINAL MODIFIED 1987 CHAMPUS WEIGHTS)

SERVICE	TOTAL FREQUENCY (LESS DRGS 469/470)	TOTAL RWPS	CASE MIX INDEX (CMI)	RELATIVE CASE MIX INDEX (RCMI)
DOD	870295	718104	0.8252	1.0177
ARMY	419763	360406	0.8586	1.0589
AIR FORCE	285943	228094	0.7977	0.9838
NAVY	164589	129604	0.7873	0.9711

Appendix O

'ASE MIX INDEX AND RELATIVE CASE MIX INDEX FOR 3 '3' FOR THE PERIOD 87274 TO 8827
(DRG 356-384)

DRG	TOTAL RWP	RECORDS	CMI	RCMI
356	12.1862	13	0.9374	1.1560
357	2.0570	1	2.0570	2.5367
358	14.9232	13	1.3064	1.6110
359	31.9066	33	0.9669	1.1923
360	7.9703	13	0.6131	0.7561
361	46.6494	59	0.7907	0.9750
362	6.5479	16	0.4092	0.5047
363	1.2732	2	0.6366	0.7851
364	21.6992	33	0.6576	0.8109
365	2.4140	2	1.2070	1.4883
366	5.3078	3	1.7693	2.1819
367	0.4684	2	0.2342	0.2888
368	9.6566	15	0.6438	0.7939
369	9.9040	23	0.4306	0.5310
370	113.1128	104	1.0876	1.3413
371	97.2898	104	0.9355	1.1536
372	68.5539	81	0.8463	1.0437
373	388.3450	811	0.4788	0.5905
374	18.4316	27	0.6827	0.8418
376	7.9764	17	0.4692	0.5786
377	4.3526	7	0.6218	0.7668
378	18.3198	22	0.8327	1.0269
379	62.0611	187	0.3320	0.4094
380	18.2389	54	0.3378	0.4165
381	23.1902	52	0.4460	0.5500
382	3.5496	24	0.1479	0.1824
383	70.2279	172	0.4083	0.5035
384	25.5286	59	0.4327	0.5336
ALL	1094.2220	1949	0.5614	0.6924

09 MAY 1989

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Initial Linear Programming Model Results

LP OPTIMUM FOUND AT STEP 19
OBJECTIVE FUNCTION VALUE: 73375.1900

SOLUTION SECTION

VARIABLE	VALUE	REDUCED COST
RTNGYNP	24.000000	.000000
RTNGYNNP	112.000000	.000000
RTNGYNOT	.000000	12.350000
PAPP	.000000	21.860000
PAPNP	.000000	21.860000
PAPOUT	91.000000	.000000
CRYOP	.000000	27.950000
CRYONP	.000000	41.450000
CRYOOUT	11.000000	.000000
OBVISITP	.000000	58.808330
OBVISITN	.000000	55.008330
OBVISITO	.000000	65.518330
GYNFLUP	24.000000	.000000
GYNFLUNP	.000000	7.465000
GYNFLUOT	.000000	3.385000
OBHISNP	125.000000	.000000
OBHISOUT	.000000	39.310000
COLPOOUT	22.000000	.000000
INFP	.000000	48.975000
INFOUT	9.000000	.000000
PREOPP	.000000	20.250000
PREOPOUT	50.000000	.000000
HYSTERP	9.000000	.000000
HYSTEROT	.000000	2748.720000
TUBALP	18.000000	.000000
TUBALOUT	.000000	478.770000
C_SECP	.000000	458.790000
C_SECOUT	12.000000	.000000
RNOBDELP	.000000	377.916700
RNOBDELO	10.000000	.000000
CMOBDELP	25.000000	.000000
CMOBDELO	.000000	.000000
COLPOP	19.000000	.000000

ROW	SLACK OR SURPLUS	DUAL PRICES
RTNGYN)	.000000	13.350000
PAP)	.000000	22.860000
CRYOSURG)	.000000	1.000000
GYNFLU)	.000000	8.465000
COLPO)	.000000	1.000000
OBVISIT)	.000000	66.518330

Initial Linear Programming Model Results

RNOBDEL)	.000000	1.000000
OBHIS)	.000000	40.310000
PREOP)	.000000	21.250000
INF)	.000000	1.000000
HYSTER)	.000000	2749.720000
TUBAL)	.000000	479.770000
C_SEC)	.000000	1.000000
CMOBDEL)	.000000	1.000000
M_RTNGYN)	.000000	-3.800000
M_GYNFLU)	.000000	-7.465000
M_COLPO)	1.000000	.000000
PH_CL_TM)	11950.000000	.000000
N_P_TM)	3465.000000	.000000
NURSE_TM)	17229.000000	.000000
L&D_TM)	2935.000000	.000000
OR_TIME)	233.000000	.000000

NO. ITERATIONS= 19

RANGE SECTION

RANGES IN WHICH THE BASIS IS UNCHANGED:

OBJ COEFFICIENT RANGES

VARIABLE	CURRENT COEF	ALLOWABLE INCREASE	ALLOWABLE DECREASE
RTNGYNP	9.550000	3.800000	INFINITY
RTNGYNNP	13.350000	6.770000	3.800000
RTNGYNOT	1.000000	12.350000	INFINITY
PAPP	1.000000	21.860000	INFINITY
PAPNP	1.000000	21.860000	INFINITY
PAPOUT	22.860000	3.385000	21.860000
CRYOP	50.050000	27.950000	INFINITY
CRYONP	36.550000	41.450000	INFINITY
CRYOOUT	1.000000	INFINITY	1.000000
OBVISITP	7.710000	58.808330	INFINITY
OBVISITN	11.510000	55.008330	INFINITY
OBVISITO	1.000000	65.518330	INFINITY
GYNFLUP	1.000000	7.465000	INFINITY
GYNFLUNP	1.000000	7.465000	INFINITY
GYNFLUOT	5.080000	3.385000	INFINITY
OBHISNP	40.310000	825.124900	39.310000
OBHISOUT	1.000000	39.310000	INFINITY
COLPOOUT	1.000000	6.770000	1.000000
INFP	7.700000	48.975000	INFINITY
INFOUT	1.000000	INFINITY	1.000000
PREOPP	1.000000	20.250000	INFINITY
PREOPOUT	21.250000	478.770000	20.250000
HYSTERP	2814.600000	INFINITY	2748.720000

Initial Linear Programming Model Results

HYSTEROT	1.000000	2748.720000	INFINITY
TUBALP	554.160000	INFINITY	478.770000
TUBALOUT	1.000000	478.770000	INFINITY
C_SECP	626.940000	458.790000	INFINITY
C_SECOUT	1.000000	INFINITY	1.000000
RNOBDELP	420.490000	377.916700	INFINITY
RNOBDELO	1.000000	INFINITY	1.000000
CMOBDELP	1064.480000	INFINITY	458.790000
CMOBDELO	1.000000	458.790000	1.000000
COLPOP	77.000000	478.770000	6.770000

RIGHTHAND SIDE RANGES

ROW	CURRENT RHS	ALLOWABLE INCREASE	ALLOWABLE DECREASE
RTNGYN	191.000000	173.250000	112.000000
PAP	147.000000	INFINITY	91.000000
CRYOSURG	11.000000	INFINITY	11.000000
GYNFLU	191.000000	44.000000	2.000000
COLPO	41.000000	INFINITY	22.000000
OBVISIT	375.000000	.000000	220.000000
RNOBDEL	10.000000	INFINITY	10.000000
OBHIS	150.000000	693.000000	125.000000
PREOP	77.000000	INFINITY	50.000000
INF	9.000000	INFINITY	9.000000
HYSTER	9.000000	1.000000	9.000000
TUBAL	18.000000	1.000000	18.000000
C_SEC	12.000000	INFINITY	12.000000
CMOBDEL	25.000000	INFINITY	.000000
M_RTNGYN	24.000000	112.000000	24.000000
M_GYNFLU	24.000000	2.000000	24.000000
M_COLPO	18.000000	1.000000	INFINITY
PH_CL_TM	13480.000000	INFINITY	11950.000000
N_P_TM	6330.000000	INFINITY	3465.000000
NURSE_TM	21624.000000	INFINITY	17229.000000
L&D_TM	9810.000000	INFINITY	2935.000000
OR_TIME	2186.000000	INFINITY	233.000000

Initial Linear Programming Results

LP OPTIMUM FOUND AT STEP 19

SOLUTION SECTION

VARIABLE	VALUE	REDUCED COST
RTNGYNP	24.000000	.000000
RTNGYNNP	113.000000	.000000
RTNGYNOT	.000000	12.350000
PAPP	.000000	21.860000
PAPNP	.000000	21.860000
PAPOUT	93.000000	.000000
CRYOP	.000000	27.950380
CRYONP	.000000	41.450380
CRYOOUT	11.000000	.000000
OBVISITP	.000000	58.808300
OBVISITN	.000000	55.008290
OBVISITO	.000000	65.518300
GYNFLUP	24.000000	.000000
GYNFLUNP	.000000	7.465190
GYNFLUOT	.000000	3.385190
OBHISNP	124.000000	.000000
OBHISOUT	.000000	39.310000
COLPOOUT	23.000000	.000000
INFP	.000000	48.975950
INFOUT	9.000000	.000000
PREOPP	.000000	20.250000
PREOPOUT	50.000000	.000000
HYSTERP	9.000000	.000000
HYSTEROT	.000000	2748.720000
TUBALP	18.000000	.000000
TUBALOUT	.000000	478.769600
C_SECP	.000000	458.790000
C_SECOUT	12.000000	.000000
RNOBDELP	3.000000	.000000
RNOBDELO	7.000000	.000000
CMOBDELP	23.000000	.000000
CMOBDELO	2.000000	.000000
COLPOP	18.000000	.000000

ROW	SLACK OR SURPLUS	DUAL PRICES
RTNGYN)	.000000	13.350000
PAP)	.000000	22.860000
CRYOSURG)	.000000	1.000000
GYNFLU)	.000000	8.465190
COLPO)	.000000	1.000000
OBVISIT)	.000000	66.518300

Initial Linear Programming Results

RNOBDEL)	.000000	1.000000
OBHIS)	.000000	40.310000
PREOP)	.000000	21.250000
INF)	.000000	1.000000
HYSTER)	.000000	2749.720000
TUBAL)	.000000	479.769600
C_SEC)	.000000	1.000000
CMOBDEL)	.000000	1.000000
M_RTNGYN)	.000000	-3.800000
M_GYNFLU)	.000000	-7.465190
M_COLPO)	.000000	-.000380
PH_CL_TM)	11980.000000	.000000
N_P_TM)	3448.333000	.000000
NURSE_TM)	17242.330000	.000000
L&D_TM)	2796.667000	.000000
OR_TIME)	233.000000	.000000

NO. ITERATIONS= 19

RANGE SECTION

OBJ COEFFICIENT RANGES

VARIABLE	CURRENT COEF	ALLOWABLE INCREASE	ALLOWABLE DECREASE
RTNGYNP	9.550000	3.800000	INFINITY
RTNGYNNP	13.350000	478.769600	.000380
RTNGYNOT	1.000000	12.350000	INFINITY
PAPP	1.000000	21.860000	INFINITY
PAPNP	1.000000	21.860000	INFINITY
PAPOUT	22.860000	478.769600	.000190
CRYOP	50.050000	27.950380	INFINITY
CRYONP	36.550000	41.450380	INFINITY
CRYOOUT	1.000000	INFINITY	1.000000
OBVISITP	7.710000	58.808300	INFINITY
OBVISITN	11.510000	55.008290	INFINITY
OBVISITO	1.000000	65.518300	INFINITY
GYNFLUP	1.000000	7.465190	INFINITY
GYNFLUNP	1.000000	7.465190	INFINITY
GYNFLUOT	5.080000	3.385190	INFINITY
OBHISNP	40.310000	.000569	39.310000
OBHISOUT	1.000000	39.310000	INFINITY
COLPOOUT	1.000000	INFINITY	.000380
INFP	7.700000	48.975950	INFINITY
INFOUT	1.000000	INFINITY	1.000000
PREOPP	1.000000	20.250000	INFINITY
PREOPOUT	21.250000	478.769600	20.250000
HYSTERP	2814.600000	INFINITY	2748.720000
HYSTEROT	1.000000	2748.720000	INFINITY
TUBALP	554.160000	INFINITY	478.769600

Initial Linear Programming Results

TUBALOUT	1.000000	478.769600	INFINITY
C_SECP	626.940000	458.790000	INFINITY
C_SECOUT	1.000000	INFINITY	1.000000
RNOBDELP	798.406800	191.507800	.000152
RNOBDELO	1.000000	.000152	1.000000
CMOBDELP	1064.480000	.000207	220.033200
CMOBDELO	1.000000	220.033200	.000207
COLPOP	77.000000	.000380	INFINITY

RIGHTHAND SIDE RANGES

ROW	CURRENT RHS	ALLOWABLE INCREASE	ALLOWABLE DECREASE
RTNGYN	191.000000	172.416700	113.000000
PAP	147.000000	INFINITY	93.000000
CRYOSURG	11.000000	INFINITY	11.000000
GYNFLU	191.000000	6.000000	2.000000
COLPO	41.000000	INFINITY	23.000000
OBVISIT	375.000000	7.333333	30.000000
RNOBDEL	10.000000	INFINITY	7.500000
OBHIS	150.000000	689.666600	124.333300
PREOP	77.000000	INFINITY	50.000000
INF	9.000000	INFINITY	9.000000
HYSTER	9.000000	1.000000	3.000000
TUBAL	18.000000	1.000000	3.000000
C_SEC	12.000000	INFINITY	12.000000
CMOBDEL	25.000000	INFINITY	1.833333
M_RTNGYN	24.000000	113.000000	24.000000
M_GYNFLU	24.000000	2.000000	6.000000
M_COLPO	18.000000	1.000000	3.000000
PH_CL_TM	13480.000000	INFINITY	11980.000000
N_P_TM	6330.000000	INFINITY	3448.333000
NURSE_TM	21624.000000	INFINITY	17242.330000
L&D_TM	9810.000000	INFINITY	2796.667000
OR_TIME	2186.000000	INFINITY	233.000000

Linear Programming Model Results (Forced Clinic Visits)

LP OPTIMUM FOUND AT STEP 92
OBJECTIVE VALUE = 21905.7800

SOLUTION SECTION

VARIABLE	VALUE	REDUCED COST
RTNGYNP	24.000000	.000000
RTNGYNNP	143.000000	.000000
RTNGYNOT	.000000	30.410000
PAPP	108.000000	.000000
PAPNP	.000000	3.800001
PAPOUT	3.000000	.000000
CRYOP	.000000	52.940000
CRYONP	.000000	70.240010
CRYOOUT	11.000000	.000000
OBVISITP	247.000000	.000000
OBVISITN	128.000000	.000000
OBVISITO	.000000	28.570000
GYNFLUP	149.000000	.000000
GYNFLUNP	.000000	3.800001
GYNFLUOT	.000000	17.780000
OBHISNP	150.000000	.000000
OBHISOUT	.000000	57.370000
COLPOOUT	23.000000	.000000
INFP	.000000	117.150000
INFOUT	9.000000	.000000
PREOPP	74.000000	.000000
PREOPOUT	.000000	1.610001
HYSTERP	3.000000	-2682.200000
HYSTEROT	6.000000	.000000
TUBALP	.000000	-430.310000
TUBALOUT	18.000000	.000000
C_SECP	.000000	-32.579990
C_SECOUT	12.000000	.000000
RNOBDELP	.000000	32.730020
RNOBDELO	10.000000	.000000
CMOBDELP	.000000	-492.980000
CMOBDELO	25.000000	.000000
COLPOP	18.000000	.000000

ROW	SLACK OR SURPLUS	DUAL PRICES
RTNGYN)	.000000	31.410000
PAP)	.000000	22.860000
CRYOSURG)	.000000	1.000000
GYNFLU)	.000000	22.860000
COLPO)	.000000	1.000000
OBVISIT)	.000000	29.570000

Linear Programming Model Results (Forced Clinic Visits)

RNOBDEL)	.000000	1.000000
OBHIS)	.000000	58.370000
PREOP)	.000000	22.860000
INF)	.000000	1.000000
HYSTER)	.000000	1.000000
TUBAL)	.000000	1.000000
C_SEC)	.000000	1.000000
CMOBDEL)	.000000	1.000000
M_RTNGYN)	.000000	.000000
M_GYNFLU)	125.000000	.000000
M_COLPO)	.000000	-24.990000
PH_CL_TM)	160.000000	.000000
N_P_TM)	160.000000	.000000
NURSE_TM)	2134.000000	.000000
L&D_TM)	9810.000000	.000000
OR_TIME)	1769.000000	.000000
N_P_VIS)	.000000	-18.060000
PHY_VIS)	.000000	-21.860000
26)	2.000000	.000000

NO. ITERATIONS= 101
BRANCHES= 5 DETERM.= -1.000E 0
BOUND ON OPTIMUM: 21905.78