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This study was conducted to determine the organizational level at which inpatient beds should be managed. This study compared centralized and decentralized management of inpatient beds. The study found decentralized management by the clinical service chief to be the most appropriate level. The author recommends integration of a complimentary preadmission testing program to maximize the benefits.

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A STUDY TO DETERMINE AND EVALUATE THE ORGANIZATIONAL LEVEL AT WHICH INPATIENT BEDS SHOULD BE MANAGED WITHIN A MEDICAL CENTER

A Graduate Research Project
Submitted to the Faculty of Baylor University
in Partial Fulfillment of the Requirements for the
Degree of Master of Health Care Administration

by

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May 4, 1984

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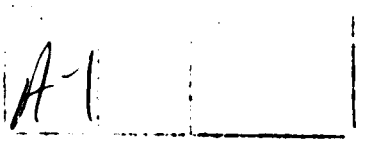


CHAPTER I

Introduction

Of ever growing concern within the military health care system is the necessity of getting by with limited or even dwindling resources, of increasing productivity, and of containing costs. A major focus of this concern has been the issue of excess hospital bed capacity within the Department of Defense (DOD). Some members of Congress have prescribed hospital closures in specific attempts to reduce regional bed capacity (e.g., San Francisco Bay area). There is fairly widespread agreement within DOD that the services have excess hospital beds, though there is no consensus on how many, or more especially, which beds are surplus. A legitimate question at this point would be: Who is managing these beds within the Department of Army (DA) hospitals? The answer currently varies among hospitals, ranging from a centralized management form (Chief of Patient Administration) to decentralized form (Clinical Department Chiefs). There is nothing currently within DOD or DA regulation and policy which addresses the level and criteria for the management of hospital beds.

Military medical treatment facilities (MTF) are currently in a position similar to civilian hospitals. They, too, have an inherent responsibility to provide optimal health care to eligible beneficiaries at a level consistent with resource availability. This infers that as the disease patterns in the serviced community change, the resources (monies, staff, space, equipment) will be altered proportionately. Civilian hospitals are motivated to perform such resource allocation in order to maintain or alter their market share for a particular service. Military MTFs must do so not only to optimally meet the needs of the population, but to insure efficient utilization of staff, space, and equipment. These resources are

extremely scarce in most MTFs and must be utilized to their maximum advantage.

Military MTFs obtain a proportionate share of Army Medical Department (AMEDD) monies based upon workload as measured by Medical Care Composite Units (MCCU). The greatest factors contributing to this productivity measure are the number of admissions and the number of daily beds occupied which are referred to as Hospitalization Composite Units (HCU). If a MTF is to obtain an appropriate level of funding, each must insure that inpatient beds are effectively managed and available in quantities compatible with population demand for such resources. Patients who require an inpatient bed for either elective or nonelective procedures represent potential workload. If the particular category of bed required is unavailable, the admission cannot be made and productivity on MCCU generation declines. This reduced MCCU measure eventually results in reduced funding allocated to the MTF. Therefore, it is both financially and ethically advantageous to the MTF to insure that inpatient resources are allocated consistent with population demand.

At Brooke Army Medical Center (BAMC), no staff element has been held responsible for the overall management of inpatient beds to facilitate the control of the admission process for elective procedures, appropriate and timely staffing of the wards, adequate and timely support of the teaching programs, and the timely acquisition of supplies for the various wards. Currently, the responsibility for assignment and accountability of beds within the hospital is shared between the Patient Administration Division (PAD) and Nursing Service. The responsibility varies depending on the time of day (day, evening, night) and the type of admission. The ultimate decision on admission to a ward is really made by the head staff nurse on duty at the time. This decision is based on filled beds or inadequate staff, without regard to the occupancy figures being maintained by PAD. This results in patients being moved between wards unnecessarily

many times during a stay. Also, because of admitting diagnoses or an emergency, there are only certain wards to which a patient can be admitted so the nursing staff must do the best job possible with the staff resources available on that day. Thus, some days they are understaffed and other days, overstaffed. Over the last twelve months, the average occupancy has been 75 percent. Some wards, such as OB/GYN, had a variation of 25 percent to 120 percent occupancy from one month to the next; while others like pediatrics, consistently averaged 55 percent occupancy rate.

Empty beds represent significant capital investment with no return and create inefficient use of professional personnel and excessive operating costs. Low occupancy makes a hospital appear inefficient and unpopular with Congress and DOD. Thus, it is essential that BAMC and The Army Surgeon General determine the appropriate level at which the hospital beds should be managed to facilitate the appropriate mix of beds, staffing, supplies, and equipment to meet the inevitable variations in patient demand as efficiently as possible.

Statement of the Research

To determine and evaluate the organizational level at which inpatient beds should be managed.

Objectives

The objectives of the study are:

1. To complete a comprehensive review of the literature which includes a review of Army and other local medical center regulations and policies to ascertain if beds can be managed: (a) Centrally by the Deputy Commander for Clinical Services (DCCS), (b) Centrally by PAD (Admission Office), (c) Decentrally, by the Clinical Service Chiefs, or (d) Decentrally by the Day/Evening/Night Nursing Supervisors. Encompassed within the review will be an analysis of these levels

of management upon HCUs or similar productivity measurements, occupancy, patient complaints and nosocomial infections, patient management problems, and teaching program accreditation.

2. To analyze the current method of managing inpatient beds by PAD and the Nursing Service.

3. To evaluate the four alternatives in Objective One above, based upon the following established standards:

a. Generate sufficient HCUs (average daily beds occupied times one plus average daily admissions times ten) to increase the current funding level.

b. Target occupancy to minimize patient moves between wards to reduce patient complaints and nosocomial infection.

c. Target occupancy to be 80-85 percent, to facilitate resource utilization.

d. Target occupancy to reduce patient management problems (medication errors and patient falls).

e. Generate sufficient occupancy to maintain a viable accredited teaching program.

4. To test a selected alternative by implementing it for one quarter to see if the level of management improved HCUs, reduced patient complaints, nosocomial infections and patient management errors, facilitated resource utilization, and insured flexibility to maintain sufficient workload to keep an accredited teaching program. Once the test is completed, a descriptive analysis will be done with no attempt made to make statistical inferences.

Criteria

1. The alternative with the highest weighted value based upon the following established standards as determined by Churchman-Ackoff:

a. Generate sufficent HCUs to increase the current funding level.

b. Target occupancy to minimize patient moves between wards to reduce patient complaints and nosocomial infection.

c. Target occupancy to be 80-85 percent to facilitate resource utilization.

d. Target occupancy to reduce patient management problems (medication errors and patient falls).

e. Generate sufficient occupancy to maintain a viable accredited teaching program.

2. Selected alternative will be evaluated using qualitative evaluation methods (survey of records and staff members).

Assumptions

1. The average occupancy rate is expected to remain the same.

2. The substantial daily variance in ward census coupled with the relative inflexibility of nursing personnel ward assignments suggest that certain wards are frequently either under or overstaffed.

3. There are distinct possibilities that by reallocating wards to clinical services, a number of additional single service wards could be created (e.g., Oncology).

4. Nosocomial infection rate on the ward is a function of the number of times a patient has to be moved from bed to bed.

Limitations

1. Operating beds are not program beds which indicate funding levels from Health Services Command.

2. There are physical space constraints in certain areas of the hospital that prevent flexibility in the management of beds.

3. Testing time for the alternative is restricted to one quarter in order to meet graduate research report suspense date.

4. Beds will be managed only by the Deputy Commander for Clinical Services, PAD (centrally), or Clinical Department Chiefs, Day or Evening Supervisor (decentralized).

5. At least five percent of beds must be kept free to insure flexibility to meet emergencies.

Definitions

1. Beds

Operating:	Beds set up, staffed, and equipped for use.
Inactive:	Beds set up and equipped (includes Medical Hold).
Converted:	Bed space converted to offices, exam rooms, supply rooms, dayrooms, and other uses.
Special Use:	Recovery beds.

2. Bassinets

Operating:	Set up, staffed, and equipped.
Inactive:	Set up and equipped.
Capacity:	Space for bassinets.

3. Actual beds & Bassinets — Sum of operating beds, inactive beds, operating bassinets and inactive bassinets as reported on BAMC Form 144NS.

Occupied: A bed assigned to a patient as of midnight to include a patient on pass not in excess of 72 hours, and any bassinet assigned to a newborn.

Review of the Literature

Bed management encompases a two-tiered system of preadmission (or early) testing programs, and admission scheduling (includes census control function).

A considerable volume of literature on the development, use, and evaluation of admissions scheduling systems, and preadmission testing programs has been produced. However, this literature has not addressed the organizational level which should manage the integration of these two technologies. This section reviews the existing literature, highlighting: (1) the characteristics, or factors, which determine the ultimate applicability and effectiveness of the technology; (2) the effect of the technology on basic bed management variables: number of admissions, average length of stay (ALOS), operating room scheduling, and average occupancy. It will then review Army and local medical center regulations and policies to ascertain if beds are currently being managed centrally by the Deputy Commander for Clinical Services, or PAD; or decentrally, by the Clinical Service Chiefs or the Day/Evening/Night Nursing Supervisor. Encompassed within this review will be the analysis of these levels of management upon HCCUs or similar productivity measurements, occupancy levels, patient management problems, and teaching program accreditation.

Preadmission Testing Literature Review

Preadmission Testing (PAT) is the process of conducting tests and examinations on an outpatient basis prior to the scheduled date of admission for elective patients. Preadmission tests and exams are typically done several days before the scheduled admission date so that results are available at the time of admission, enabling treatment to commence immediately. The potential for PAT to affect bed management variables favorably lies in its two-fold ability: (1) to produce more timely knowledge of test results, thereby speeding the process of diagnosis and potentially reducing LOS, and (2) to eliminate admissions determined to be inappropriate on the basis of preadmission test results. The literature generally indicates that PAT can successfully accomplish both LOS reductions and reductions

in unnecessary admissions. Varying degrees of success have been reported, with many documented results more descriptive than quantitative in nature. The review presented here focuses on the changes in bed management variables resulting from the implementation of PAT programs, rather than on the general nature of such programs. In addition, those variables affecting the extent to which PAT programs can be effectively utilized are discussed.[1]

Various studies support a reduction in LOS associated with PAT, with the amount of reduction ranging up to 2.0 days. The most extensive study to date is that of Coffey, who reported only a marginal reduction in stay for PAT patients as compared to early tested patients. Early tested patients are those who arrive at the hospital early in the morning of their scheduled admission date. Upon arrival, they are given routine tests, are subsequently admitted, and often have surgery later the same day.[2] Warner reported a reduction of .6-day in average length of stay for early tested patients compared with other elective admissions.[3] Coffey suggests that reduction in total stay is a function of preoperative LOS for PAT-eligible patients, and that a significant reduction can be expected when preoperative stay is two days or more. Minimal reduction in stay by a PAT program can be expected when average preoperative stay is less than one day, unless other changes are made simultaneously, such as admission on the day of surgery.[4]

Waller reports a .5-day reduction in LOS for 1665 patients matched partially on age, diagnosis, race, sex, operative status, and single versus multiple diagnoses recorded. For 909 patients matched on all characteristics, he observed no significant difference in stay between PAT and non-PAT patients. Since this study included both medical and surgical patients, the relevance of these findings with respect to a PAT program for elective surgical patients only is not clear.[5]

Six additional studies, much less detailed than those of Coffey and Waller,

report reductions in total stay for PAT patients. Reductions of 1.04 days; 1.1 days; 1.2 days; 1.94 days; and 2.0 days have been cited. Several of these studies, however, had small samples or provided little supporting data.[6]

A second potential effect of PAT in management of acute care hospital beds is in reducing unnecessary admissions. Coffey estimates that approximately two percent of PAT patient admissions will be cancelled due to changes in treatment plans made on the basis of the test results.[7]

Other benefits of PAT which have been suggested but not quantified in the literature include improved quality of care, due to the greater probability that complete information will be available at the time of surgery; fewer voluntary cancellations of scheduled admissions; and earlier certification of admission for federally funded patients. It has also been suggested, but not supported, that PAT should lead to workload leveling in the ancillary departments which perform the tests and exams, thereby enabling those departments to increase their efficiency.

Three patient and hospital characteristics have been cited as important in determining the potential for successful implementation of a PAT program. The first of these is occupancy rate, which affects a hospital's incentives to reduce length of stay and eliminate unnecessary admissions. Coffey suggested that hospitals with total occupancy rates of 75-85 percent, or medical/surgical occupancy of 85-95 percent, have good potential for PAT programs. The upper limit of 95 percent on medical/surgical occupancy is suggested because successful PAT programs require a low probability of involuntary admission cancellation. Cancellation of scheduled admissions because of high pressure on bed availability could necessitate repeat testing, since most test results are valid only for limited periods of time.[8]

The second characteristic cited as influential in the determination of the potential for successful PAT implementation is the type of patient admission -

medical or surgical. Most studies of PAT have focused on elective surgical patients only. Coffey noted that the one hospital in his study with a PAT program open to medical patients had negligible utilization by that group. In addition, the only study which indicated no reduction in LOS included both medical and surgical patients. In attempting to explain this difference, Coffey suggested that PAT will be more effective when the tests performed lie on the critical path of treatment. Such criticality is more likely for surgical patients, since they, more so than other patients, face a clear critical decision time - surgery.[9] This concept has also been supported by Barero, et al, who found that PAT is ineffectual unless results of tests and examinations performed are on the critical path of events. This implies that, if concurrent activities of longer duration than the PAT-associated tests are on the critical path, no LOS reduction will be achieved.[10]

Travel distance has been suggested as a third factor relevant to potential success of a PAT program. As the distance a patient must travel to the hospital increases, the probability that the patient will be willing to participate in a PAT program decreases. Coffey showed that a higher proportion of patients living within a ten-mile radius of the hospital used PAT programs. Hospitals that draw the majority of their patients from very large service areas may, therefore, have difficulty implementing PAT successfully.[11]

The degree to which a hospital's staff views the balance between the long-term benefits and the short-term costs and inconveniences of PAT will also impact on the success of a PAT program. Financial incentives such as reimbursement policies of third-party payers are clearly relevant to hospital policy. The attitudes of administrators, physicians, and employees will be reflected in such decisions as whether eligible patients are referred to PAT routinely or upon

physician request only, thus affecting potential PAT volume. With the advent of a Medicare payment system that uses a Diagnosis Related Group (DRG) price per discharge, hospitals have an incentive to improve their Medicare revenues by increasing admissions and decreasing length of stay.

Admissions Scheduling (AS) Literature Review

Existing literature concerning AS spans a range from individual admitting departmental studies focusing on operational improvements, to theoretical mathematical models based on operations research techniques. It is important to note that many of the reported models have never been integrated into a working admissions system, and further, that many of these models never could be successfully implemented. This nonapplicability is due primarily to overly simplifying assumptions. For example, many models make assumptions about major system parameters, approximating LOS, census, and arrival patterns with theoretical distributions which statistically do not correspond to empirical data. Milsum, et al, have analyzed most of these models and have found that, although many of them provide some sort of analytic tool for admissions control, they lack the ability to describe and forecast the complex operation of an admissions system accurately. They conclude that these models are useful only insofar as they help develop a framework for a systems approach to admissions control. Consequently, this review of admissions scheduling literature makes little mention of these studies.[12]

The potential of an admission scheduling system to affect the basic bed management variables lies primarily in its ability to achieve higher and less variable occupancy levels. This ability is affected by a number of factors, including the percentage of emergent patients, bed size, OR scheduling, and the ability to control elective admissions.[13]

Work performed at the University of Michigan's Department of Hospital Administration has resulted in the development of several algorithms which determine the maximum average attainable occupancy of a hospital unit when given certain information about the unit. Integral to each of these algorithms is the assumption that the Admissions Scheduling and Control System (ASCS) as developed by Hancock, et al, is functioning for the hospital unit. The ASCS is a comprehensive, realistic, well-defined, and validated admissions system designed to reduce census variation and raise occupancy. Proper implementation and operation of the ASCS, which is operating successfully in more than a dozen hospitals nationally, leads to higher maximum average occupancies than can be obtained with any other presently documented admissions systems. As a representative sample, none of the models proposed by Shonick, Young, or Robinson, Wing, and Davis, are as comprehensive as the ASCS, or results in comparable achievable occupancies. The ASCS also produces significantly higher occupancies than do the occupancy guidelines of the Hill-Burton Act, as well as those which result from the assumption that daily census is Poisson distributed.[14]

As implied by its name, the ASCS serves both a scheduling and a census control function. As an admissions system, the ASCS recognizes three input streams: emergent, scheduled, and call-in patients. Emergent patients are considered to be those for whom admission is immediately necessary. Scheduled patients include all those whose condition would allow them to be scheduled for admission on some future date. Call-in patients are those who, at their own consent, have been placed on a waiting list to be admitted on short notice. At their request, patients can both be given a scheduled date of admission and be placed on the waiting list. Thus, scheduled patients may become call-ins if, prior to their scheduled date of admission, they are selected for admission from the waiting

list. Failure to admit scheduled or emergent patients results in cancellations and emergency turnaways, respectively. Cancellations occur when all empty beds must remain available for emergent patients who might arrive prior to the discharge of patients currently occupying beds. Turnaways occur when emergency patients cannot be accommodated in the usual manner because unit censuses have reached capacity. Such patients are often admitted to overflow or standby areas rather than, as suggested by the name, turned away from the hospital.[15]

As a control system, the ASCS utilizes several allowances to guarantee specific levels. These allowances, which are based both on desired performance levels and on patient demand parameters, aid admitting personnel in making daily decisions about admissions, cancellations, and turnaways. Performance measures include the average occupancy level and average number of both cancellations and turnaways per month.[16]

Hancock, Martin, and Storer have demonstrated that the key principle allowing the ASCS to achieve high average occupancies is the call-in mechanism. This mechanism's effectiveness is heavily influenced by the patient characteristics of the hospital's admissions. Those characteristics found to be important in whether patients are willing to be called in include: (1) the distance from which the patient comes to the hospital, (2) the patient's age, and (3) the patient's relative physical condition. As the distance a patient must travel to the hospital increases, the likelihood that the patient will be able to respond to the admissions summons on short notice decreases. Clearly, some patients will be unable to drive themselves to the hospital due to their age or physical condition. Thus, an additional person must be summoned on short notice to provide transportation for the call-in patient. Needless to say, work schedules and other home conditions operate in a way to make this a problem. It should be noted, however, that the

call-in function has been successfully implemented in all hospitals currently using the ASCS.[17]

Hancock, Martin, and Storer also discuss the tradeoffs between scheduling admissions and the calling in of patients. They report that increases from 50 to 80 percent in scheduled elective patients caused a 2 to 3 percent loss in occupancy. They also point out that such an occupancy decrease represents a significant increase in cost per patient day, which may or may not be counterbalanced by a reduction in length of stay through the use of preadmission testing (PAT) for scheduled patients. Of course, the tradeoff between occupancy and scheduling varies between hospitals. If all patients were to be called in, maximum occupancy would be achieved. However, the advantages (e.g., PAT, patient convenience, and physician convenience) of scheduling must be balanced against the costs of the associated occupancy decrease.[18] Determination of the economic factors associated with scheduling was made in a study by Magerlein, et al, who found a cost of one dollar per patient day for a one percent decrease in occupancy on a 200-bed medical/surgical unit.[19]

Magerlein performed a comprehensive analysis of the maximum average occupancy that can be attained through use of the ASCS. In this analysis, the effects of four different factors on maximum achievable occupancy were investigated: (1) the hospital, or hospital unit, bed size, (2) the percentage of arrivals to the hospital who are emergent, (3) the percentage of arrivals who are schedulable, and (4) length of stay characteristics. The results of Magerlein's analysis include two detailed regression equations which can be used to predict the occupancy levels achievable through use of the ASCS as a function of these four variables. That is, if values for these four variables for a particular hospital or hospital unit are known, then the maximum achievable occupancy for this hospital or hospital

unit, given that the ASCS is being used, can be determined.[20]

With the use of the ASCS, average occupancies as high as 94.1 percent have been reached for medical/surgical units in several hospitals. Given the 74.4 percent average occupancy of short-term general hospitals in the United States in 1980, the potential for savings is clear. The use of a contemporary admissions system such as the ASCS allows sigificant improvements in hospital operating systems. These improvements are reflected by high average occupancies, low variance in average daily census (ADC), and reductions in surgical cancellations and emergency turnaways.[21]

Review of Army/Local Medical Center Bed Management Policies/Procedures

The Department of Defense currently has no bed management policy or procedures outlined in any of its regulations. It has developed an automated bed control system with some of the similar aspects of the ASCS model under the Tri-PAD system of Tri-Service Medical Information System (TRIMIS). The services (Army, Navy, and Air Force), however, have not been interested in adopting the system. The Tri-PAD project officer (LTC Hammond) indicated that Wilford Hall Medical Center tested the system but declined to implement it.[22] A follow-up visit with the Wilford Hall Assistant Administrator for Patient Affairs, validated that the system was tested. The test identified one major problem. The deficiency rested within the medical center operation concerning the organizational level which would manage the TRIMIS system. It was ascertained that the Patient Affairs Office had a large ongoing problem with bed management which included admission scheduling, bed control, and operating room scheduling. Patients were being told to report to the hospital for admission and being turned away by the admission desk. They were told to go home or required to stay in a local motel for periods of up to

four days until a bed was available, while OR time was already scheduled. Because of this situation, the Assistant Administrator for the Department of Surgery took over the admission scheduling and bed control of all surgery beds. He was so successful that the other clinical departments were coming to him to manage their beds on an ad-hoc basis. The Patient Affairs officer was relinquishing his responsibility and authority to the Assistant Administrator for the Department of Surgery who did not have the resources to accomplish effective and efficient admission scheduling and bed control for the entire hospital. As a result, the medical center has initiated an internal study to see what organizational level should manage beds. Then, it will assign the appropriate resources to coordinate and operate an effective overall bed management program. As of this writing, this is still an ongoing study which encompasses much internal turf fighting between the clinical and administrative divisions.[23]

In reviewing Army and local medical center bed management regulations and policies, it was ascertained that no hospital had completely implemented a total bed management program that encompassed preadmission testing and admission scheduling. One Army medical center has implemented a manual bed and admission control system, while the local civilian medical centers have implemented an automated admission scheduling system (including bed control). The Army medical centers have little or no written policies concerning any aspects of bed management including which organizational level should operate the system; while the local civilian medical centers have placed the responsibility with their admission office.

The research of regulations and policies revealed that beds were either being managed centrally by the admissions office (PAD) or decentrally by clinical department chiefs. The following two sections will review these two levels of management and their impact on productivity (HCUs or revenue), occupancy levels,

patient management problems, and teaching program accreditation. A review will be conducted of the Bexar County Medical Center Hospital system, which manages their beds centrally by the admissions office, and Walter Reed Army Medical Center (WRAMC) system, which manages beds decentrally by clinical department chiefs.

Centrally Managed by Admission Office (PAD)

At the Medical Center Hospital, which is the primary acute care health facility for the Bexar County Hospital District (BCHD), bed management is being accomplished by the Admission Office. The hospital's program only encompasses an automated admission scheduling system (includes census control function).[24]

Under the existing admissions system, there are two primary ways an admission can be generated:

(1) Clinic Elective Admissions. At Medical Center Hospital (MCH), an elective admission is defined as any admission scheduled by a physician having admitting privileges. The outpatient clinics for MCH are located at Bradley Green Community Health Center approximately eight miles from MCH in the downtown district of San Antonio. Upon determination by a physician that the condition of a patient warrants inpatient care, the physician schedules an entry date for the patient. In the case of the Surgery Department, the entry date is selected based upon operating room availability, while in the Medicine Department, the entry date is selected based on prognosis of the patient. Once an admission date is determined by the physician, the patient is sent to the preadmissions section where the administrative admissions process is begun. Bed assignment is accomplished on the date of hospitalization.[25]

(2) Emergency Admissions. Emergency admissions are generated from the Emergency Center at MCH. The decision to admit is made by the attending physician and the patient is assigned a bed based on the primary care service required by

the patient and the availability of beds within that service.[26]

A few inpatients are also generated through same-day outpatient surgeries. Outpatient surgeries occasionally become inpatients due to complications or other unknown events. The decision to admit is made by the attending physician and bed assignment occurs in the same manner as an emergency admission.[27]

Appendix A is an organizational chart for the Admissions Department and Appendix B is a flow chart which depicts the Admissions Management System.

It is important to note that admissions management is essentially a two-phase system. The decision to admit and the scheduled date of that admission are determined by a member of the medical staff. However, the decision to admit is also based upon administrative decisions concerning residency requirements, availability of required services, and the availability of beds. This dicotomy of management has the potential for generating many problems unless superior coordination is achieved.

Of the two primary modes of admission to the Surgical and Medicine Services, elective admissions account for roughly 40 percent of total admissions while 60 percent are attributable to emergency admissions. Thus, the majority of inpatients for these two services are generated from the Emergency Center.[28]

While it is indisputable that the majority of patients come into the hospital from the emergency center, there is little planning for the accommodation of emergency admissions. The 120-bed Surgery Department adheres to a stated policy of maintaining a buffer of ten empty surgical beds for the admission of all types of surgical emergency cases. Yet there is no data determining the efficacy of this policy. The 60-bed Medicine Department has no stated policy to accommodate emergency admissions. Thus, the number of beds available in Medicine for emergency cases varies according to the current workload in Medicine and seat-of-

Decentralized by Clinical Department Chief

Walter Reed Army Medical Center (WRAMC), which is the largest medical center within the Department of Army, decentralized their bed management to the clinical department level effective 25 August 1983. The center's program also only encompasses an admissions scheduling and census control function but it is manual. Appendix D is an update of the WRAMC bed control policy and bed complement. Under the system, there are three primary ways an admission can be generated: (1) clinic elective admission, (2) emergency admissions, and (3) air evacuation admissions. The clinic department chiefs have further decentralized their responsibility and authority for bed management to the Chief of Service level. Appendix E is a flow chart which depicts their admission management system.[31]

Services are responsible for finding beds for all of their patients. Emergencies and air evacuation patients continue to have priority over all other admissions. If for any reason a bed is not available, written permission must be obtained from another service in order to utilize one of its beds. This written approval must contain the physician's name, as well as the name of the individual given the approval and must accompany the patient to the admissions office. The admission office functions merely as an administrative clearing house to verify eligibility for care and account for patient location. Beds for air evacuation patients must be found even if it means obtaining permission to place them temporarily on another service. When medically necessary, patients may be placed in isolation rooms with only verbal concurrence of the services involved. As long as a service has a patient in a room not allocated to it, no more admissions will be made to that service until arrangements are made to transfer the patient to that service's room. This system insures that no patients are placed in beds allocated to another service without the other service's approval.

the-pants judgments on the part of the medical staff. There obviously is no data determining the efficacy of this unwritten policy.[29] Appendix C depicts the official bed complement for MCH.

With little policy and no evident planning to accommodate emergency admissions, the Surgical staff tends to base their level of elective admissions on the availability of operating room time without consideration to bed availability. The Medicine staff tends to base their level of elective admissions on the total Medicine bed complement without adequately adjusting for the impact of emergency admissions.

The end result and real problem in either case is the mismanagement of admissions to MCH with the following consequences:[30]

* nonavailability of beds for scheduled elective admissions
* increased health risk to elective patients rescheduled to a later date
* reduced bed census in the Medicine and Surgery Departments for elective admissions
* loss of inpatient revenues from elective admissions
* elective admission patient dissatisfaction
* increase in patient management problems
* insufficient patients in certain surgery categories to keep an accredited teaching program.
* inappropriate resource utilization of nursing staff

The Medical Center is currently studying its admission management policies and the feasibility of instituting a preadmission testing program.

A service's control of workload and prior planning is essential.[32]

The services have been monitoring the historical demand records on emergency and air evacuations to facilitate better planning for elective admissions and OR scheduling. Each service has begun to initiate a call-in patient roster. This mechanism allows patients, at their own consent, to be placed on a waiting list to be admitted on short notice. The unit clerical personnel manually run the bed control function and communicate any changes to the admission office.[33]

The end result between 1 September 1983 and 1 January 1984 has been an improvement in management of admissions at WRAMC in the following areas:[34]

* better availability of beds for scheduled elective admissions
* reduced patient moves between wards which increases patient satisfaction and reduces nosocomial infection
* decreased patient management problems
* sufficient occupancy to maintain a viable accredited teaching program
* facilitated improved resource utilization of nursing staff and supportive personnel.

However, this has had no affect on increasing bed census.

There have also been some drawbacks. The three primary disadvantages are: (1) an increase in the LOS, (2) some inappropriate admissions, and (3) a small increase in administrative staff. The increase in LOS and some mismanagement of admissions are a direct result of no preadmission testing program. The increase in clerical staff is a direct function of running a nonautomated system that requires much coordination. The unit administrators assist the service chiefs in these functions.[35]

Summary of Literature Review

In summary, a review of the literature demonstrates a number of factors which necessitate bed management within health care facilities. But, there has

been a lack of integration of the two technologies of bed management (admission scheduling and preadmission testing programs) into the management of acute beds at the appropriate organizational level. Over time, a number of commonly accepted approaches to bed management have been developed. Some of these approaches have been applied to admission scheduling problems within hospitals.

Medical centers (MEDCENs) must not ignore these external trends and must be proactive by adopting new management techniques to evaluate and manage the utilization of beds. Automated admission scheduling and preadmission testing programs are a proven and effective management tool which should be adopted immediately by Army MEDCEN command groups and internal managers.

Research Methodology

The intent of this section is to provide the details of how the objectives of the study will be accomplished. Each objective of the study will be addressed in sequential order and intermediate tasks to achievement of the objective will be outlined.

Study of the Current Literature

The first objective was to accomplish a review of the literature which included a review of Army and other local medical center regulations and policies to ascertain if beds can be managed:

a. Centrally by the Deputy Commander for Clinical Services

b. Centrally by PAD

c. Decentrally, by the Clinical Service Chiefs

d. Decentrally, by the Day/Evening/Night Supervisors.

Encompassed within the review will be an analysis of these levels of management upon productivity measures (HCUs/revenue), occupancy levels, patient management problems, and teaching program accreditation. The impetus for this review is present in the external DOD environment, several methods have been applied to teaching hospital settings and deficiences have been found and studies are being done to take corrective actions. The literature and external forces reflect a need for each Army MEDCEN to address bed management processes in its day-to-day operations. The literature is only void in information as to the appropriate level of management to successfully operate a bed management program (admission scheduling/control and preadmission testing).

Analysis of the Current Bed Management System

The second objective is to define the current organizational framework exist-

ing within BAMC which addresses some of the aspects of bed management. The study will involve assessing the formal organization and its related information system. Existing management tools, measures, and reports which can be of assistance will also be assessed.

Selection of Optimal Alternative by Churchman-Ackoff Method

The third objective will determine the organizational level at which inpatient beds should be managed. The four alternatives to be evaluated are the management by beds: (1) centrally by the DCCS; (2) centrally by PAD; (3) decentrally by the Clinical Service Chiefs; and (4) decentrally by the Day/Evening/Night Nursing Supervisors. Their evaluation will be based upon the following established standards: (1) generate sufficient HCUs to increase the current funding level; (2) target occupancy to minimize patient moves between wards to reduce patient complaints and nosocomial infections; (3) target occupancy to be 80-85 percent to facilitate resource utilization; (4) reduce patient management problems (medication errors and patient falls); and (5) generate sufficient occupancy to maintain a viable accredited teaching program (each speciality requires a different mix and quantity of cases). The methodolgy to be used to evaluate the four alternatives of the study will be the Churchman-Ackoff Method, because it is an objective technique for relatively subjective criteria.

The following staff members will be asked to weigh independently each of the five standards with a value of 1-20: DCCS, PAD, Chief of Nursing service, Day and Evening Nursing Supervisors, and Departments of Medicine/Surgery chiefs. Next each staff member will be asked to independently rate each of the four alternatives against the five standards for probability of attainment. They will be asked to rate it on a scale of .00 to 1, with .00 being the least important. The

average weighted value of the standards and the average importance of attainment for each alternative will be calculated. A numerical value will then be obtained for each alternative under each standard by multiplying the average weighted values of the standard by the average importance of standard attainment. Finally, a resultant numerical value will be obtained for each alternative by adding up the products of the average weighted values of the standards and the average importance of attainment values for each alternative. The alternative with the highest total value will be picked as the desired method of management. (See Appendix F.)

Evaluation Phase

The fourth objective will be the evaluation phase. This will be a qualitative evaluation because only a minimum amount of data can be compared between single quarters. The selected alternative will be tested in one specific clinic service for one quarter. A descriptive analysis of hospital records will then be done comparing the second quarter 1982 to the second quarter 1984 with no attempt made to make statistical inferences, to see if HCUs improved by 10 percent; patient complaints, nosocomial infections, and patient management problems decreased by 10 percent; and occupancy level was achieved at the 80-85 percent level and an appropriate mix and quantity of cases to keep teaching program accreditation. Fiscal year 1982 will be used for comparison because that time period was the most stable in regard to bed numbers by wards throughout the hospital (during 1983 many of the wards underwent renovation). Consideration will also be given to any changes in admitting staff numbers. Also, the key staff members who participated in the Churchman-Ackoff study will be interviewed to see if they noticed any improvements from previous quarters. (See Appendix I.)

Implementation

Review methods that were successful will be recommended for integration into the organizational framework by capitalizing on the results of the literature review and expert opinion.

CHAPTER II

Discussion

The literature review, accomplished in Chapter 1, clearly reflected a need for Army MEDCENs to adopt the current available administrative technologies of bed management (automated admission scheduling/control and a preadmission testing program). The only unanswered question is what organizational level should manage the integration of these technologies. This chapter will summarize the implementation of the approved research methodology for this graduate research project.

Analysis of the Current Method of Bed Management Within BAMC

Brooke Army Medical Center (BAMC) is a 698-bed multiple specialty facility located at Fort Sam Houston, Texas. BAMC provides primary, secondary, and tertiary care and is the regional referral center for military hospitals throughout the south central region of the United States.

The functional inpatient elements at BAMC include the three following facilities: Beach Pavilion, Main Hospital, and Chambers Pavilion. These facilities are physically separated from one another by a distance of one to two miles. Chambers Pavilion is the psychiatric inpatient and outpatient treatment center. Main Hospital and Beach Pavilion contain the remaining clinic and inpatient elements. The distribution of beds is 64, 199, and 398 respectively, with the Institute of Surgical Research (ISR), a tenant organization, occupying 37 beds within the Main Hospital. These inpatient care elements are necessarily interdependent upon one another and directed by the same headquarters (with the exception of ISR).

Contained within these facilities are a total of 35 wards. These wards are

categorized by primary clinical service(s). For example, Ward 16A within the Main Hospital is the obstetrics ward and 42G in Beach Pavilion is principally utilized for oncology and cardiology patients. Few of the wards support a single clinical service or department and most support at least two such services. The wards are further differentiated by the level of nursing care provided to include intensive care, normal level care, and minimal care. They are also distinguished by male and female areas. Some are medical, others surgical, and still others Med-Surg or a combination of patients receiving care from either a surgical or a medical specialty.

These differentiating factors are attempts to insure that patients admitted to each area have available to them the clinical services (nursing care, etc.) which they require. It also suggests that placing patients into an appropriate ward location is a complex process, i.e., a female patient with a diagnosis of upper GI bleeding with an admitting service of gastroenterology; this patient must be placed on a female medicine ward, preferably one which routinely cares for patients with similar diagnoses.

Table 1 on the following page depicts the current configuration of wards by type, principal clinical service, operating bed capacity, and by inpatient facility. Also included are the current accurate ward operating bed capacities. These revised capacities were obtained with the assistance of nursing personnel.

Currently, BAMC's bed management system does not include either an admission scheduling system or a preadmission testing program. Physicians are currently admitting without regard to bed vacancies or historical experiences with emergency room admissions. There are three methods by which patients can be admitted: (1) emergency (or emergent), (2) elective, and (3) air evacuation. These methods are identical to WRAMC. Emergency and air evacs take priority.

TABLE 1

BAMC Wards and Operating Capacities

	Ward	Type	Current Operating Bed Capacity
MAIN			
	12A	Urology	23
	12B	Female General Surgery	27
	13A (ICU)	Surgical Intensive Care	9
	13B	Male General Surgery	24
	14A	Burn Unit (ISR)	20
	14B	Burn Unit (ISR)	17
	15A	Gynecology	36
	15B	Gastroenterology	31
	16A	Obstetrics	19
	16B	Newborn Nursery	22
	16C	Neonatal Intensive Care	8
BEACH			
	41I	General Medicine, Cardiology	26
	42A	Intensive Care Post Coronary Bypass	3
	42A (ICU)	Surgical Intensive Care	4
	42B	Thoracic Surgery	27
	42C	Pediatric Intensive Care	7
	42D	Pediatrics	25
	42E	Med-Surg	30
	42G	Male Surgical	35
	42H	Male Med-Surg (Neuro)	33
	42H (ICU)	Neuro Intensive Care	4
	43B	Minimal Care Orthopedics	26
	43C	Male Orthopedic	38
	43D	Female Orthopedic	24
	43E	Coronary Care Unit	6
	43F	Medical Intensive Care	11
	43G	Female Oncology, Cardiology	24
	43H	Male Oncology, Cardiology	35
	43N	Telemetry	12
	43S	General Medicine	29
CHAMBERS			
	52A	Psychiatric	18
	52B	Psychiatric	18
	53A	Psychiatric	7
	51B	Med Hold	21

PAD and Nursing Service are responsible for the control and allocation of beds. PAD is faced with the problem of locating an empty bed for a patient without knowing what patients will be arriving for elective admissions or being discharged. BAMC policy is that no eligible beneficiary will be turned away if a physician determines that hospitalization is necessary, even if it is only an elective admission. Thus, PAD personnel are placed in a position where they must call the appropriate ward indicated by the admitting diagnosis to see if there is a vacant bed because their current bed census data is 48 hours old. Their current method for verifying whether a ward has a vacancy is to call the day/evening/night supervisors to make the necessary assessment. The nursing supervisors usually have to locate an empty bed on an associated ward or service until a transfer can be made. There can be up to five transfers made on one patient. This often results in certain patients receiving less than optimal care because the nurses assigned to that ward are not proficient in caring for these patients. It also often results in elective patients waiting up to 8 hours for a bed. Occasionally, patients are moved prematurely from ICU beds to ward beds where staffing is inadequate for their condition in order to make room for emergency patients. Because there is no preadmission testing program, elective patients are having extended LOS. There is currently a 1-week wait for elective inpatient Cat Scans. Also, the current BAMC LOS for orthopedic patients is twice as long as that at any other Army MEDCEN.

As indicated previously, these problems are highlighted because there is no information system to provide the PAD/Nursing office with the information necessary to insure a proper match between the demand for beds by diagnostic group and the supply of beds of a particular type. Each day at midnight, nursing personnel on each ward prepare and submit to the Department of Nursing the census of their particular ward. This data is summarized daily by that

department on BAMC Form 144 NS (Consolidation of Occupied Beds). An example of this form is inclosed as Appendix G. The data is also provided to the Uniformed Chart of Accounts (UCA) section of the Comptroller Division. There it is further consolidated as the Monthly Hospital Census Report (example inclosed as Appendix H). This report provides the average daily occupancy of each ward and the average length of stay per ward. A trend in the occupancy of a given ward over a period of time cannot be easily obtained from this report since only the previous month's average occupancy is included. These reports are distributed to the Commander, Deputy Commander for Clinical Services, the Chief of Staff, and selected clinical departments.

As a distinct and separate process, ward personnel daily review each inpatient on every ward and identify the primary clinical service responsible for his care. This data is consolidated per ward and submitted monthly to the UCA section of the Comptroller Division. There the data is further consolidated into a center-wide report (Appendix I), and utilized in allocating costs by clinical service. Currently, this information is not utilized for any other purpose or distributed to the center's managers.

The clinical services represented by the UCA codes on this form represent distinct diagnostic related groups, i.e., all patients with metastatic disorders are grouped together since all receive care from the Hematology/Oncology Service. The data depicted on this UCA report represents the overall demand for inpatient beds and the demand for beds by patients in 21 relatively distinct diagnosis related groups. These 21 groups are identified in Table 2. A review of these and other center reports over the last 12 months (February 83-February 84) reveals the following facts:

1. Average ward occupancy ranges from 57-100 percent.

TABLE 2

Clinical Services/Diagnostic Related Groups

	Clinical Service	UCA Code
1.	Internal Medicine	AAAA
2.	Cardiology	AAAB
3.	Dermatology	AAD
4.	Endocrinology	AAE
5.	Gastroenterology	AAF
6.	Hematology/Oncology	AAG
7.	Nephrology	AAI
8.	Neurology	AAJ
9.	General Surgery	ABA
10.	Thoracic Surgery	ABB
11.	Neurosurgery	ABD
12.	Ophthalmology	ABE
13.	Oral Surgery	ABF
14.	Otorhinolaryngology	ABG
15.	Plastic Surgery	ABI
16.	Urology	ABK
17.	Gynecology	ACA
18.	Obstetrics	ACB
19.	Pediatrics	ADA
20.	Orthopedics	AEA
21.	Podiatry	AEB

2. Several of the wards are significantly underutilized while others are functioning at near maximum capacity.

3. A number of clinical services utilize beds on many different wards. This infers that either nursing personnel on all these wards are proficient in care for these patients or that the patients assigned to certain wards are receiving less than optimal care.

4. The substantial daily variance in ward census coupled with the relative inflexibility of nursing personnel ward assignments suggests that certain wards are frequently either under or over staffed.

5. A backlog in elective surgery of 660 cases.

Thus, the end result and real problem is the lack of a bed management process at BAMC with the following consequences:

* nonavailability of beds for scheduled elective admissions.
* lost Hospitalization Composite Units (HCUs).
* increased health risk to elective patients being placed on inappropriate wards.
* elective admission patient dissatisfaction.
* reduced bed census in Surgery Department for elective admission.
* increased patient management problems.
* inappropriate resource utilization (under or overstaffing of wards).
* increase in nosocomial infections on Medicine wards.
* insufficient patients in certain surgery categories resulting in a reduction in residency training programs.

Churchman-Ackoff Analysis

The literature clearly indicated the availability of the appropriate administrative technologies to implement an effective and efficient bed management system, but failed to address which organizational level within the hospital could optimally manage the integration of these technologies. Since these technologies deal with a wide range and mix of health manpower and patient management issues, the researcher narrowed down the alternatives to the four previously discussed levels which will continue to play a key role in any bed management program.

Since the decision was not purely objective in nature and required qualitative judgments, the Churchman-Ackoff technique was well suited to this decision making process. The judgments which were required necessitated knowledge of clinical

procedures, resource management, patient management, and staff acceptance. Therefore, input was obtained from DCCS, PAD, Chief of Nursing Service, Chiefs of Department of Medicine and Surgery, and Day/Evening supervisors of Beach and Main.

A one-hour interview was scheduled with each of these nine individuals. During the first 40 minutes, each received a briefing which included a description of the problem, the administrative technologies available, an explanation of the alternatives, and the methodology. All those providing input were given the same briefing regardless of their previous knowledge of the system. In addition, every effort was made to avoid making statements or interpretations which could potentially bias the input. Once the briefing was concluded, the individual was given the following list of standards. The numerical value preceding each standard refers to the number of the standard and will be utilized in the Churchman-Ackoff Analysis table below. Each was asked to assign weighted values to each standard utilizing numeric values of 0 to 20.

S-1) generate sufficient HCUs to increase the current funding level

S-2) target occupancy to minimize patient moves between wards to reduce patient complaints and nosocomial infections

S-3) target occupancy to be 80-85 percent to facilitate resource utilization

S-4) reduce patient management problems (medication errors and patient falls)

S-5) generate sufficient occupancy to maintain a viable accredited teaching program

Once these weighted values had been obtained and recorded, the individual was asked to disregard the weights he had previously assigned and determine the probability of attaining these standards in each of the available alternatives. They were asked to assign a numeric value from .00 to 1.00. The .00 value was to be assigned if they established that there was absolutely no chance of attaining

a given standard and the value 1.00 used if they felt certain the standards would be attained.

A mean value was then determined for each standard weight. Likewise, a mean was calculated for each probability utilizing each of the nine input values. These values are depicted in Table 3, below.

Table 3

Churchman-Ackoff Analysis

Alternatives	Standards and Weighted Values					Total
	S-1 [11.44]	S-2 [14.22]	S-3 [12.11]	S-4 [11.11]	S-5 [8.77]	
A_1	(.50) 5.72	(.05) .71	(.39) 4.72	(.08) .89	(.14) 1.23	13.27
A_2	(.48) 5.49	(.24) 3.41	(.61) 7.39	(.17) 1.89	(.59) 5.17	23.35
A_3	(.67) 7.66	(.89) 12.66	(.81) 9.81	(.71) 7.89	(.89) 7.81	45.83
A_4	(.11) 1.26	(.47) 6.68	(.26) 3.15	(.83) 9.22	(.12) 1.05	21.36

A_1 Centrally by DCCS

A_2 Centrally by PAD

A_3 Decentrally by the Clinical Service Chiefs

A_4 Decentrally by the Day/Evening/Night Nursing Supervisors

[ ] Mean Weighted Values of Standards

( ) Mean Probability of Criteria Attainment

S-1, S-2.. Specific Criteria

This technique indicates that the optimal organizational level at which inpatient beds should be managed is decentrally by the clinical service chiefs.

In analyzing the probabilities of standards attainment, it should be noted that this alternative was determined to have a significantly higher probability of attaining four standards. Those standards indicated for attainment were: (1) generate sufficient HCUs to increase the current funding level, (2) target occupancy to minimize patient moves between wards to reduce patient complaints and nosocomial infection, (3) target occupancy to be 80-85 percent to facilitate resource utilization, and (4) to generate sufficient occupancy to maintain a viable accredited teaching program. Three of these four standards also had the highest mean weighted values.

Evaluation Phase

The last phase is the testing of alterative #3 (bed management by Clinical Service chiefs) for a three-month period. Upon completion, a qualitative evaluation by descriptive analysis of hospital records will be done comparing the second quarter 1982 to the second quarter 1984, with no attempt to make statistical inferences. This will be followed by a survey of Churchman-Ackoff participants to see if they noticed any improvements in bed management from previous quarters.

The Urology Service of the Department of Surgery was selected as the service to test alternative #3. This service was chosen because it was one of the few services that has an autonomous ward (12A) to support its inpatient demands and already had its service chief involved in some limited aspects of admission scheduling and preadmission testing. The service chief, because of the test, instituted a manual admission scheduling/control system which included emergency (air evacs), scheduled, and call-in patients. Emergencies were considered to be those for whom admission was immediately necessary. There was one bed set aside for emergency or air evac, which is five percent of capacity. Scheduled patients

included all those whose condition would allow them to be scheduled for admission on some future date. Call-in patients are those who, at their own consent, have been placed on a waiting list to be admitted on short notice. These patients were the penile implant cases which had a two-month wait for surgery. Upon selection for surgery, these patients were required to sign an agreement to be available for call-in for surgery with little notice. As a result, the scheduled penile implants may become call-ins, if, prior to their scheduled date of admission, they are selected for admission from the waiting list. Thus, if there are any elective cancellations by other urology members, then these patients can fill in the vacancies. The service chief, with the support of his staff, also implemented a viable preadmission testing program which insured that all necessary lab and X-ray tests and examinations were conducted prior to the scheduled date of admission for elective patients. See BAMC's flow chart of the PAT test and AS systems at Appendix J.

The Admission Office merely functioned as an administrative clearing house to verify eligibility for care and account for patient location. Urology Service was responsible for finding beds for all their patients. Emergencies and air evacuation patients continued to have priority. If for any reason a bed was not available, written permission was obtained from General Surgery or the Dermatology Service in order to utilize one of its beds. This written approval contained the physician's name, as well as the name of the individual given the approval from General Surgery or Dermatology Service, and accompanied the patient to the Admission Office. The administrative duties of the system were shared among the service chief, secretary, and the ward clerk.

The results of the descriptive analysis of hospital records comparing the second quarter 1982 to the second quarter 1984 are revealed in the following information, Table 4.

TABLE 4

Descriptive Analysis of Hospital Records

	2nd Quarter FY 82	2nd Quarter FY 84	Percent
Admissions	258	279	+8%
Ave. Percent Occupancy	84.9%	84.4%	(.5%)
Ave. LOS	6.6	6.1	(7.5%)
HCU	48	51	+6.2%
Noscomial Infections	5	3	(40%)
Patient Management Problems (Falls & Medication Errors)	9	0	(100%)
Patient Complaints	2	0	(100%)
Staff Physician	3	3	0
Residents	8	7	(12%)
Training Cases	130	145	+11

\+ Increase
( ) Decrease
HCU Daily AVE Occupancy X 1 + Daily AVE Admission X 10

The descriptive analysis reveals that with the decentralization of bed management (AS and PAT) to the clinic service level and even a decrease of one physician resident, there was an 8 percent increase in admissions and 6.2 percent increase in HCUs with LOS reduction of 7.5 percent. This was 3.8 percent short of the 10 percent target increase projected for HCUs. This LOS impact could become a key factor if the military moves toward the DRG base productivity system which it is currently studying. This DRG system rewards decreasing length of stays with

financial incentives. The average percent of occupancy for the quarter stayed at around 84 percent, which would facilitate resource utilization. This level of management had no real overall effect on this standard because the decrease in LOS cancelled out the increase in admissions. The largest impact was a decrease of 40 percent in nosocomial infections and a 100 percent decrease in patient complaints and management problems associated with patient falls and medication errors. This far exceeded the 10 percent target. The smallest impact was on the training, although there was an increase of 11 percent of training cases which exceeded the target set for accreditation. It had no effect on attracting more pediatric patients, in which the program has been deficient since the last accredition survey in 1982.

In summary, this level of management fell short of improving HCUs by 3.8 percent, kept occupancy level between 80-85 percent to facilitate resource utilization, decreased patient complaints, nosocomial infections, and patient management problems far greater than the 10 percent target, and improved by 11 percent quantity of cases for accredition but failed to affect the appropriate mix in the area of pediatric patients.

The final step of the analysis involved a survey questionnaire of the same nine key staff members who participated in the Churchman-Ackoff study to analyze their perceptions of the test. The survey was independent of the preceding qualitative hospital record analysis. The survey questionnaire (Appendix J) revealed the following information (Table 5).

TABLE 5

Key Hospital Staff Response to Questionnaire

	Improved	Same	Declined
1. Ability to Locate an Empty Bed	8	1	0
2. Quality of Patient Care	7	2	0
3. Adequate Qualified Staff to Meet Changing Patient Needs	7	2	0
4. Staff Coordination to Find a Bed	8	1	0
	Increase	**Same**	**Decrease**
5. Patient Complaints	0	2	7
6. Hospital Staff Complaints	0	2	7

The survey revealed that 89 percent of the key staff who participated in the Churchman-Ackoff study thought the ability to coordinate and locate an empty bed for a patient had improved, while 78 percent of the key staff thought quality of patient care improved and the qualified staff to handle and meet changing patients' needs improved. In addition, 78 percent of the staff surveyed thought both patient and hospital staff complaints decreased. In summary, the key staff observed that the decentralization of bed management to the Urology Service improved bed coordination and location, quality patient care, and insured adequate qualified staff to meet the changing patient needs. They also observed that patient and hospital staff complaints decreased.

CHAPTER III

Conclusions

The literature review and the current congressional budget emphasis on increasing health care productivity and minimizing costs, while increasing quality patient care, points to a need for including bed management as an integral part of a hospital's operation. To implement a viable bed management program, there needs to be an integration of the two current technologies of admission scheduling/bed control and preadmission testing programs. The most successful AS system has been ASCS. This allows for significant improvement in a hospital's operating system. These improvements are reflected by higher average occupancies, lower variance in ADC, and reductions in surgical cancellations and emergency turnaways. This system's success is based upon a complementary, ongoing preadmission testing program.

Over time, a number of commonly accepted approaches to bed management technologies have been adopted by local civilian hospitals but have been unsuccessful because they have not adopted PAT; failed to set a policy concerning emergency and call-in admissions; and failed to address the organizational level to appropriately integrate these advancements. A new technology developed by TRIMIS for bed control was tested at an Air Force medical center and failed because they had not integrated it at the appropriate organizational level. WRAMC, however, has had some success in bed management by decentralizing their admission scheduling system and bed control to the clinical service chief level but they have failed to complement it with a PAT system.

This study indicates that a decentralized level of management by the clinical service chief is the appropriate level of management, which would enhance the integration of current technologies and facilitate increased productivity, stable

occupancy levels, decreased patient complaints and management problems, improved quality care, and increase the total teaching case ceiling. It proved to have no effect on the appropriate mix of patients. With the service chief responsible for managing a given number of beds, the impetus for a successful preadmission testing program and continuous patient care assessment is centered on the physician. The service chief must insure that his staff is aware of the demands of emergency and elective patients for hospitalized time; make a continuous evaluation of current in-house patients to insure timely triage or disposition; do appropriate preadmission testing, and keep a continuous dialogue and coordination with the nursing staff and administrative support staff within the service and admission office.

The researcher realizes that all the services have not been interested in bed management because the current system of MCCUs does not reward a hospital commander if he manages admissions and beds, and is also highly political because it affects physician practice patterns. A case can be made to the contrary, LOS increases provide for greater MCCUs and lengthy elective surgical backlogs provide justification for construction of more hospital beds and larger facilities. This system of rewards is going to be short lived. With the current congressional budget interests in defense costs and health care, a system of productivity similar to DRGs is inevitable. The Veterans Administration hospitals are already on a modified DRG system. While Health Services Command has already undertaken a major productivity study to change the current system to a system that encompasses DRGs, it is imperative that the Army Medical Department become proactive and implement bed management at the appropriate organizational level.

Recommendations

1. Recommend that a study of the current admission scheduling technologies

which are being offered by TRIMIS and ASCS be done to ascertain which better meets management needs within current resource level constraints of Brooke Army Medical Center.

2. Recommend that BAMC adopt a preadmission testing program at the clinical service level.

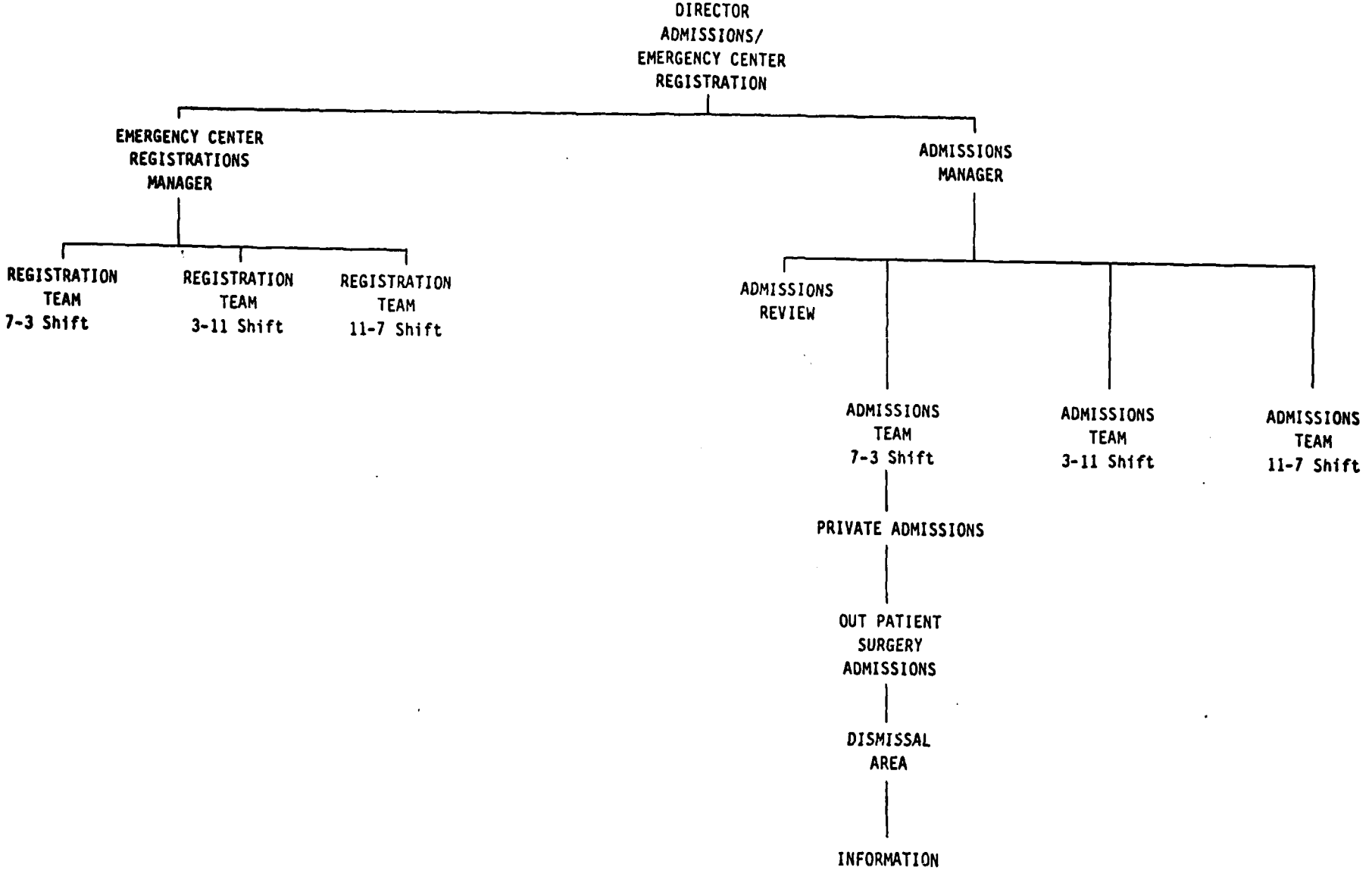
3. Recommend BAMC assign each service a fixed number of beds based on a 12-month analysis of the monthly census report.

4. Recommend that BAMC decentralize their responsibilities for management of beds to the clinical service level and adopt an integrated bed management program (Admission Scheduling and Preadmission Testing Program).

APPENDIX A

MCH ORGANIZATION CHART FOR THE ADMISSIONS DEPARTMENT

ADMISSIONS DEPARTMENT



APPENDIX B

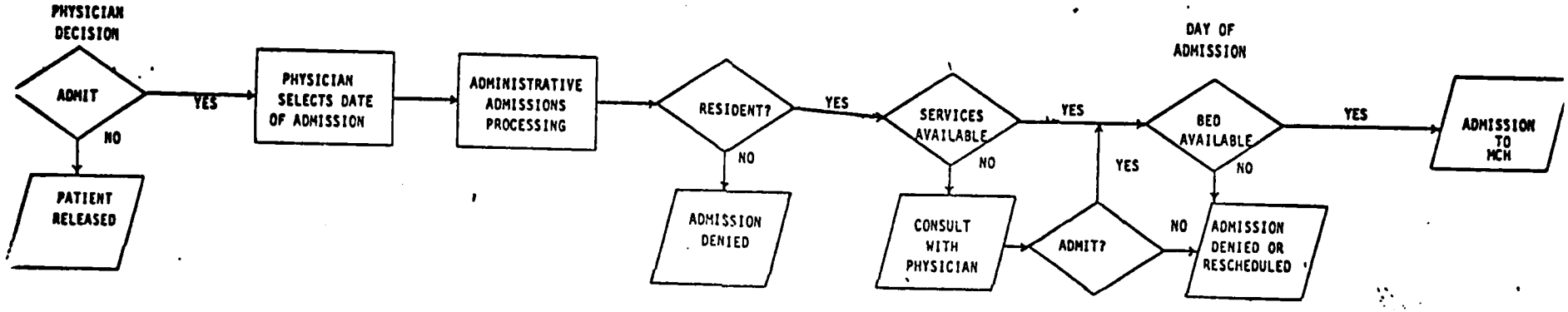
MCH ADMISSION MANAGEMENT FLOW CHART

APPENDIX C

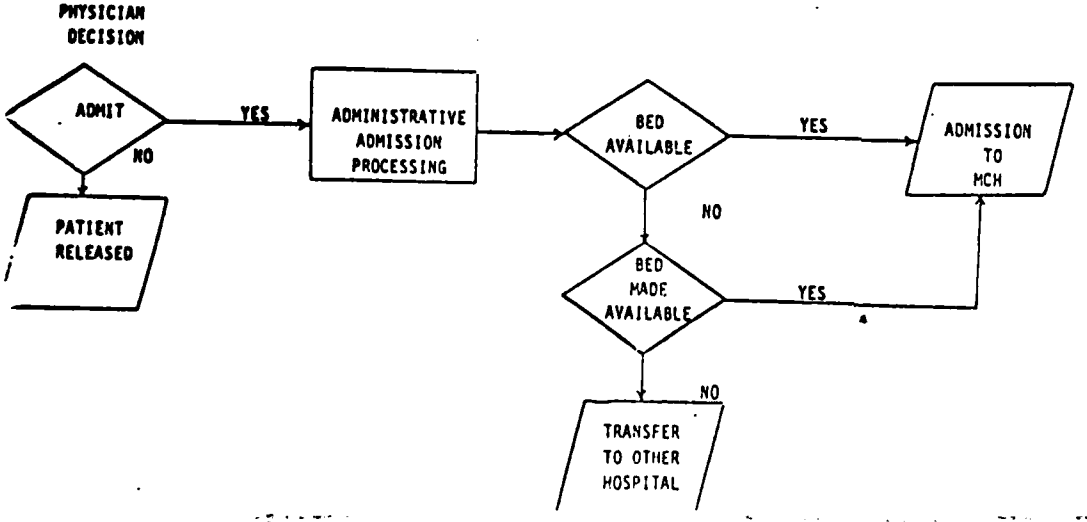
MCH BED COMPLEMENT

ADMISSIONS MANAGEMENT SYSTEM

ELECTIVE ADMISSIONS



EMERGENCY ADMISSIONS



APPENDIX D

WRAMC BED CONTROL POLICY AND BED COMPLEMENT

OFFICIAL BED COMPLEMENT
FOR MEDICAL CENTER HOSPITAL

Floor		Number of Beds		
		Mixed		Private
2	Surgery Intensive Care	13		
4	Obstetrics	58		2 (425)
4	Neonatal Level I	20		
	II	18		
	III	10		
5	General/Surgical Pediatrics	58		6 (518, 519, 520)
5	Pediatric Intensive Care	8		
6	Gynecology	30		6 (622, 624, 625)
6	Private, General			14 (630-641)
7	Special Surgery	60		
8	General Surgery	60		
9	General Medicine	60		
9	Cardiac Care Unit	6		
10	Neurology	12		
10	Isolation	6		
10	PM&R	6		
10	Med/Surg Overflow	6		
10	Medical Intensive Care Unit	6		
11	Psychiatry	22		5 (1138, 1152, 1153)
12	Private Med/Surg			53 (All Rooms)
	Bed Complement	459		86
	Total Bed Complement		545	

	Bassinets
Routine Nursery	52

DISPOSITION FORM

For use of this form, see AR 340-15; the proponent agency is TAGO.

REFERENCE OR OFFICE SYMBOL	SUBJECT
HSHL-PAD	Update on Bed Control Policy

TO C, Dept of Surgery
C, Ophthalmology Svc
C, ENT Service
C, Dept of Medicine
C, Dept of Psychiatry
C, Dept of Pediatrics
C, Dept of OB/GYN
C, Dept of Neurology

FROM Dep CDR

DATE 25 Aug 83

CMT 1

MAJ White/csc/6-1134

1. In order to best manage our inpatient census and admission workload, each department chief will have total control of the beds allocated to his department effective 28 March 1981. No admission will be made to another department unless the admitting department obtains approval from that department.

2. Department chiefs have complete responsibility for finding beds for all patients admitted to their departments including air evac patients. If a department cannot find a bed within its own resources, coordination must be made as stated in paragraph 1.

Daniel B Kimball

DANIEL B. KIMBALL, JR., MD
COL, MC
Deputy Commander

40	9	3	5		
41	19	15	1		
42A	6	4	2		4
42B	12	10	2	1	
42C	10	9	1		
42D	12	6	6		
44	30	25	0		
45	15	10	4	5	
46	27	21	6		4
47	16	10	6		
48T	12	6	6		
43	17	9	3	7	2
SUB TOTAL	177	131	46	13	10

61	24	23	1	0	2
64	48	41	7	0	0
65	48	41	7	0	2
66	48	34	14	1	1
67	45	37	8	0	1
68	45	39	9	0	1
SUB TOTAL	307	215	46	1	1

71	49	41	7	1	1
72	7	2	5		
73	63	55	1	1	6
74	48	42	6		
SUB TOTAL	167	140	19	2	7

51	48	44	4	1	0
52	43	36	12	0	0
53	41	32	9	0	0
54	45	38	7	0	0
55	45	36	9	0	0
56	48	46	2	3	0
57	48	35	12	1	0
58	40	39	1	1	2
SUB TOTAL	358	296	62	6	3

4[illegible]	172	131	34	4	4
[illegible]	348	296	62	6	3
[illegible]	201	215	46	1	1
7[illegible]	359	140	19	2	7
TOTAL	559	782	161	22	15

MISCELLANEOUS (Not In-Patient Census)		
WD 43 (ESD)	6	
Recovery Room	27	
WD 48D	4	
GI Clinic	4	
Allergy Clinic	2	
Medical Hold	77	
ASC Ward (6SD)		
WD 75	4	
TOTAL	126	

Comments:

Ward 44 is 1 men cap acity

0700 - 0700 CENSUS AND BED REPORT		DEPARTMENT OF NURSING WALTER REED ARMY MEDICAL CENTER		DATE: 27 Sep. 83	
WARD	CAPACITY	CENSUS	EMPTY BEDS	SI	VSI
40	8	4	4	3	1
41	19	18	1		
42A	6	4	2		4
42B	12	8	4		
42C	10	6	4		
42D	12	12	0		
44	24	28	0		
45	14	6 (3)	8	3	
46	27	22	5		3
47	16	12 (1)	4		
48T	12	8	4		
49	12	10	2	9	1
SUB TOTAL	172	138	38	15	9

WARD	CAPACITY	CENSUS	EMPTY BEDS	SI	VSI
61	24	23	1		
64	48	40	8		
65	48	40	8		
66	48	35	13	1	
67	45	40	5		1
68	48	35	13		
SUB TOTAL	261	213	48	1	1

71	48	47	1	2	1
72	7	2	5	0	0
73	56	51	5	4	1
74	48	44	4	4	1
SUB TOTAL	159	144	15	10	3

51	48	46	2	1	
52	43	30	13		1
53	41	29	12		
54	45	40	5		
55	45	36	9		
56	48	45	3	3	
57	48	36	12	1	
58	40	40		2	2
SUB TOTAL	358	302	56	7	3

ALL FLOORS RECAP					
4FLR	172	138	38	15	9
5FLR	358	302	56	7	3
6FLR	261	213	48	1	1
7FLR	159	144	15	10	3
TOTAL	950	797	157	33	16

MISCELLANEOUS (Not In-Patient Census)		
WD 43 (L&D)	6	
Recovery Room	27	
WD 48D	8	
GI Clinic	4	
Allergy Clinic	2	
Medical Hold	77	
ASC Ward (400)	8	
WD 75	4	
TOTAL	136	

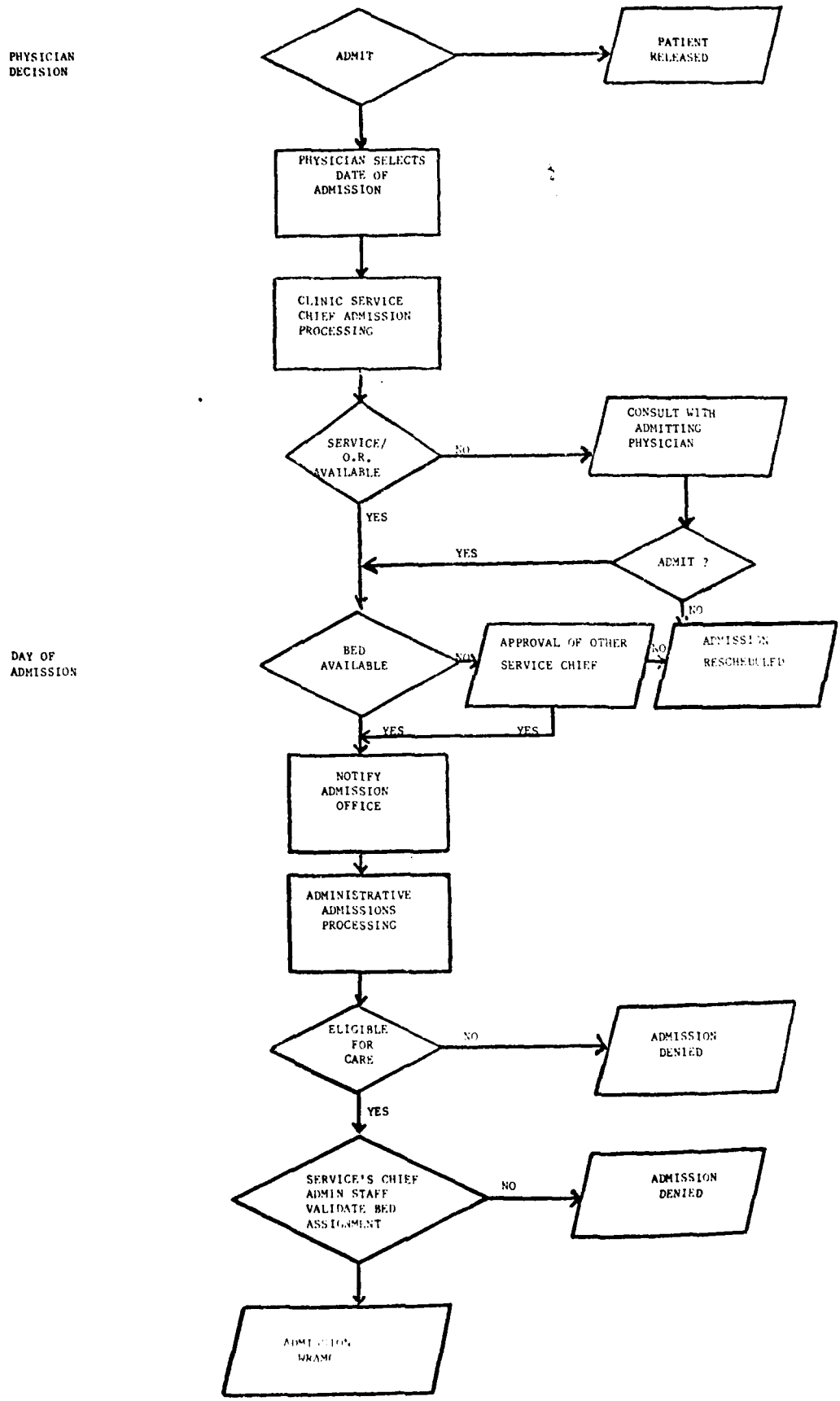
REMARKS:

WARD 44 is 4 over capacity

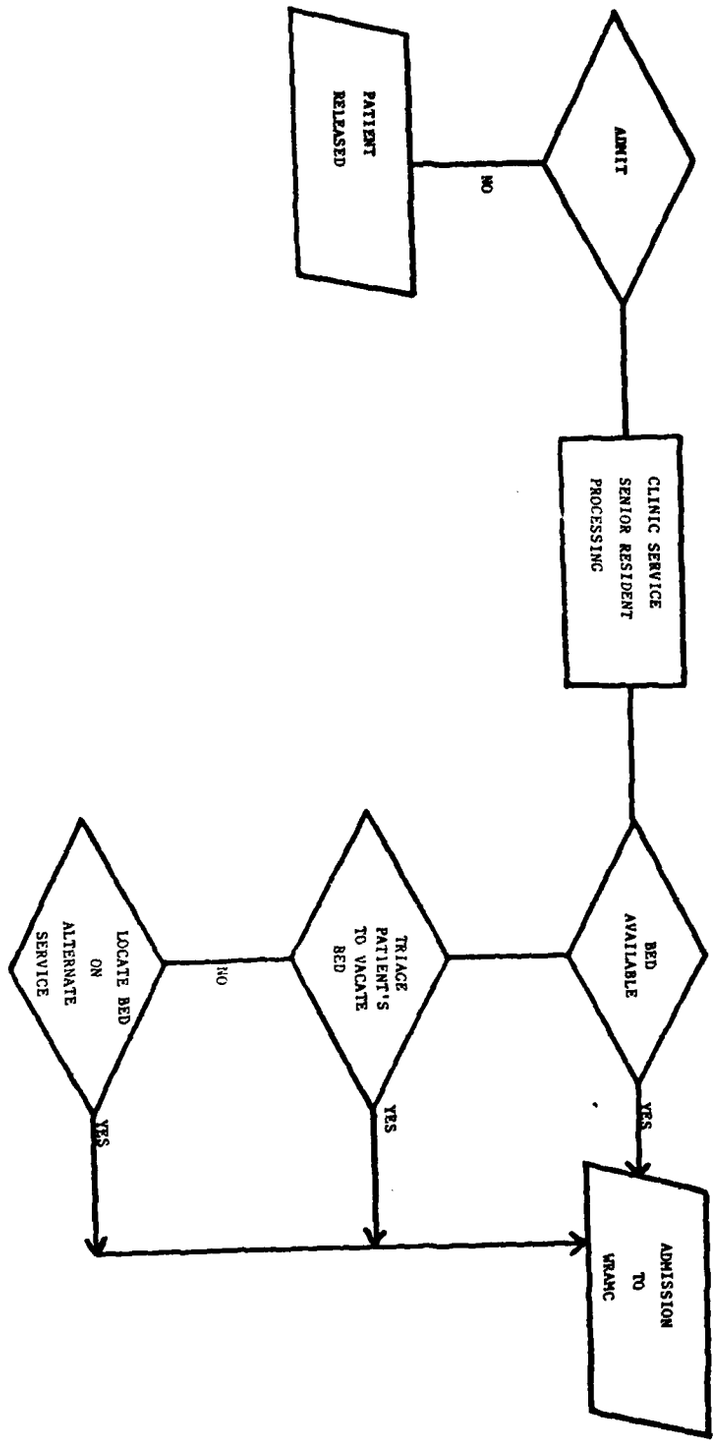
APPENDIX E

WRAMC ELECTIVE, EMERGENCY, AND AIR-EVAC ADMISSION MANAGEMENT FLOW CHART

ELECTIVE ADMISSIONS MANAGEMENT SYSTEM



EMERGENCY/AIR-EVAC ADMISSIONS MANAGEMENT SYSTEM



APPENDIX F

CHURCHMAN-ACKOFF ANALYSIS TABLE

APPENDIX F

CHURCHMAN-ACKOFF ANALYSIS TABLE

Standards and Weighted Values

Alternatives	S_1 [ ]	S_2 [ ]	S_3 [ ]	S_4 [ ]	S_5 [ ]	Total
A_1	( ) X_{A_1}	( ) X_{A_1}	( ) X_{A_1}	( ) X_{A_1}	( ) X_{A_1}	$\cong X_{A_1}$
A_2	( ) X_{A_2}	( ) X_{A_2}	( ) X_{A_2}	( ) X_{A_2}	( ) X_{A_2}	$\cong X_{A_2}$
A_3	( ) X_{A_3}	( ) X_{A_3}	( ) X_{A_3}	( ) X_{A_3}	( ) X_{A_3}	$\cong X_{A_3}$
A_4	( ) X_{A_4}	( ) X_{A_4}	( ) X_{A_4}	( ) X_{A_4}	( ) X_{A_4}	$\cong X_{A_4}$

A_1 Centralized bed management by PAD.

A_2 Centralized bed management by DCCS.

A_3 Decentralized bed management by Clinical Service Chief.

A_4 Decentralized bed management by Day/Evening/Night Supervisors.

[ ] Average weighted values of Standards.

( ) Average importance of Standards attainment values.

$X_{A_{1-4}}$ Product of [ ] times ( ).

$S_1, S_2, S_3 \ldots$ Specific Standard.

A resultant numerical value ($\cong X_A$) will be obtained for each alternative.

APPENDIX G

CONSOLIDATION OF OCCUPIED BEDS

CONSOLIDATION OF OCCUPIED BEDS

Department of Nursing
Brooke Army Medical Center

0001 to 2400 HRS _____ 19 _____

NURSING UNIT CARD A	1-15 16-18 OP BEDS	19-21 PREV CENSUS	22-24 TOTAL IN	25-27 TOTAL OUT	28-30 CURR CENSUS	31-33 SI	34-36 VSI	37-39 DEATHS	40-42 OVER 60	43-45 OUTPATIENTS	46-48 ICU DAYS	CATEGORIZATION OF PATIENTS 49-51 I	52-54 II	55-57 III	58-61 IV	62-73 REMARKS
12A	23															
12B	27															
13A SICU	9															
13B	24															
15A	36															
15B	31															
16A	19															
16B	22															
16C NBICU	8															
MAIN TOTAL	199															
14A/14B ISR	30															
41I	26															
42A Open Heart	3															
42A SICU	4															
42B	27															
42C PICU	7															
42D	25															
42E	30															
42G	35															
42H	33															
42H NICU	4															
43B	26															
43C	38															
43D	24															
43E CCU	6															
43E MICU	11															
43G	24															
43H	35															
43N TELEMETRY	12															
43S	29															
BEACH TOTAL	398															
CHAMBERS	43															
51B Med Hold	21															
HOSPITAL TOTAL	691															
(13A Recovery)	(6)															
(42A Recovery)	(10)															

BAMC Form 144
1 Mar 84

Edition of 1 Oct 83 may be used

EMERGENCY CLINIC	PATIENTS SEEN	PATIENTS ADMITTED	AMIC CLINIC	PATIENTS SEEN	PHONE CONSULTS	OBSTETRIC DELIVERIES		DATE Y Y M M D D	CODE
DAY	1-3	10-12	DAY	19-21	25-26	DAY	29-30	74 75 76 77 78 79	B
EVENING	4-6	13-15	EVENING	22-24	27-28	EVENING	31-32		
NIGHT	7-9	16-18	TOTAL			NIGHT	32-34		
TOTAL			TOTAL ER/AMIC			MONTHLY TOTAL			

PATIENT INFORMATION LIST

MAIN HOSPITAL

BEACH PAVILION

CHAMBERS PAVILION

DEATHS

SIGNATURE _____

APPENDIX H

MONTHLY HOSPITAL CENSUS REPORT

PREPARED: 12 SEP 83

MONTHLY HOSPITAL CENSUS REPORT
BROOKE army MEDICAL CENTER

PCN: RAD-M02 AS OF 31 AUG 83

CONSOLIDATED CENSUS - DAILY AVERAGES

NURSING UNIT	OPER BEDS	PREV CENSUS	TOTAL IN	PTNS OUT	CURRENT CENSUS	LENGTH OF STAY	PERCENT OCCUPIED	SI	VSI	DEATHS	OVER 60	OUT-PNTS	ICU DAYS	CATEGORY CAT 1	CAT 2	OF PATIENTS CAT 3	CAT 4
12A	23	16.7	3.0	2.8	16.8	5.6	73.0	.0	.0	.0	3.1	.0	.0	4.3	5.4	5.7	1.5
12B	27	21.8	3.9	3.8	22.0	5.6	81.5	1.5	.0	.0	3.9	.0	.0	10.9	9.1	1.9	1.0
13AICU	9	6.7	2.8	2.6	6.8	2.4	75.6	3.7	3.1	.2	6.0	.0	9.6	6.8	.0	.0	.0
13B	24	22.7	4.1	4.4	22.5	5.5	93.8	.7	.0	.0	11.8	.0	.0	10.5	8.7	2.2	1.2
15A	36	21.3	5.4	5.2	21.5	4.0	59.7	.0	.0	.0	2.5	1.7	.0	16.6	2.9	.9	1.1
15B	31	20.8	4.7	4.6	20.9	4.4	67.4	.3	.3	.0	7.4	.7	.0	9.0	6.3	3.5	2.2
16A	19	8.3	2.9	3.0	8.2	2.8	43.2	.0	.0	.0	.0	6.2	.0	3.2	2.2	2.3	.4
16B	22	8.1	2.4	2.4	8.1	3.4	36.8	2.0	.0	.0	.0	.0	.0	3.1	.0	.0	.0
16C	8	5.6	.3	.3	5.6	18.7	77.0	.3	5.4	.1	.0	.0	8.1	5.6	.0	.0	.0
PAIN **	199	131.9	29.5	29.2	132.3	4.5	66.5	8.6	8.7	.3	45.7	8.6	17.7	73.0	33.5	16.5	7.4
14A/14BISR	30	19.3	.7	.7	19.3	27.6	64.3	3.9	4.5	.2	.9	.0	.0	13.8	4.2	.8	.5
41 I	26	22.5	2.6	2.6	22.5	8.7	86.5	1.5	.5	.0	11.1	.0	.0	5.6	6.9	7.3	2.7
42AOPN HRT	3	2.3	1.5	1.5	2.3	1.5	78.7	2.3	.0	.0	1.2	.0	3.9	2.3	.0	.0	.0
42AICU	4	4.2	1.3	1.2	4.2	3.2	105.0	3.9	.2	.0	2.2	.0	8.1	4.2	.0	.0	.0
42B	27	20.2	3.2	3.1	20.4	6.4	75.6	3.2	.0	.0	10.8	.0	.0	2.3	3.8	13.6	.6
42C	7	4.0	1.3	1.3	4.0	3.1	57.1	1.8	1.5	.0	.1	.0	5.9	4.0	.0	.0	.0
42D	25	15.6	5.2	5.0	15.8	3.0	63.2	1.5	.1	.0	.0	.0	.0	14.6	.1	.0	1.1
42E	30	25.1	3.0	3.1	25.0	8.3	83.3	.0	.4	.0	7.9	.0	.0	8.9	10.2	5.8	.1
42G	35	22.6	3.0	3.1	22.5	7.5	64.3	.0	.0	.0	7.7	.0	.0	3.4	4.3	10.5	4.3
42MNEURO	33	26.9	2.7	2.7	26.9	10.0	81.5	.4	.3	.1	5.3	.0	.0	5.7	6.8	7.6	6.8
42NICU	4	3.9	.4	.4	3.9	9.8	97.5	2.3	1.3	.0	1.0	.0	3.7	3.9	.0	.0	.0
43B	26	22.3	2.1	1.9	22.5	10.7	86.5	.0	.0	.0	.0	.0	.0	.0	.0	.2	22.4
43C	38	32.0	3.4	3.3	32.2	9.5	84.7	.0	.0	.0	4.2	.0	.0	10.1	9.0	7.9	5.2
43D	24	19.4	2.9	2.9	19.4	6.7	80.8	.0	.0	.0	6.8	.0	.0	6.3	7.0	3.1	3.0
43E/CCU	6	4.8	2.5	2.4	5.0	2.0	83.3	4.5	.4	.2	2.5	.0	6.6	5.0	.0	.0	.0
43E/NICU	11	6.5	3.0	2.9	6.6	2.2	60.0	3.4	3.0	.2	4.0	.0	8.0	6.6	.0	.0	.0
43G	24	19.9	2.5	2.3	20.2	8.1	84.2	1.3	.3	.0	14.7	.0	.0	5.9	9.1	4.7	.5
43H	35	31.6	3.6	3.5	31.7	8.8	90.6	3.3	1.3	.2	12.9	.0	.0	10.5	9.3	7.6	4.4
43N	40	33.1	3.5	3.5	33.1	9.5	82.8	1.8	1.3	.1	17.5	.0	.0	6.9	10.0	5.6	1.6
BEACH **	398	317.0	48.0	46.8	318.2	6.6	79.9	31.1	10.2	.8	107.9	.0	36.2	106.1	85.5	73.9	52.7
CHAMBERS	63	19.1	.7	.7	19.2	27.4	44.7	.0	.0	.0	.0	.0	.0	5.7	8.3	2.3	2.9
9AD	18	12.9	.4	.2	13.1	32.8	72.8	.0	.0	.0	.0	.0	.0	.0	.0	.0	13.1
51B	30	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
HOSPITAL**	718	500.3	79.4	77.6	502.1	6.5	69.9	43.6	23.5	1.3	152.4	8.6	54.0	290.6	131.4	93.4	76.6
13AREC	6	.0	8.9	8.9	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
42AREC	10	.0	10.4	10.4	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0

END PAGE 1

PREPARED: 12 SEP 83

MONTHLY HOSPITAL CENSUS REPORT
BROOKE ARMY MEDICAL CENTER

PCN: RBD-NO3 AS OF 31 AUG 83

DAILY AVERAGES

EMERGENCY CLINIC PATIENTS SEEN			
TOTAL	DAY	EVE	NIGHT
3368	39.3	42.4	77.0

EMERGENCY CLINIC PATIENTS ADMITTED			
TOTAL	DAY	EVE	NIGHT
345	3.3	4.8	3.3

AMIC PATIENTS SEEN		
TOTAL	DAY	EVE
4405	86.7	55.4

CLINIC PHONE CONSULTS		
TOTAL	DAY	EVE
167	3.0	2.4

TOTAL ER/AMIC PATIENTS SEEN
7773

DIALYSIS TREATMENTS	
TOTAL	DAILY
249	8.0

DELIVERIES

TOTAL	DAY	EVE	NIGHT
71	24	29	18

INTENSIVE CARE UNIT DAYS

NURSING UNIT	TOTAL	DAILY
13AICU	299	9.6
16C	251	8.1
42A OPN HRT	121	3.9
42AICU	251	8.1
42C	182	5.9
42HICU	115	3.7
43E/CCU	205	6.6
43E/MICU	249	8.0
TOTAL ICU	1673	54.0

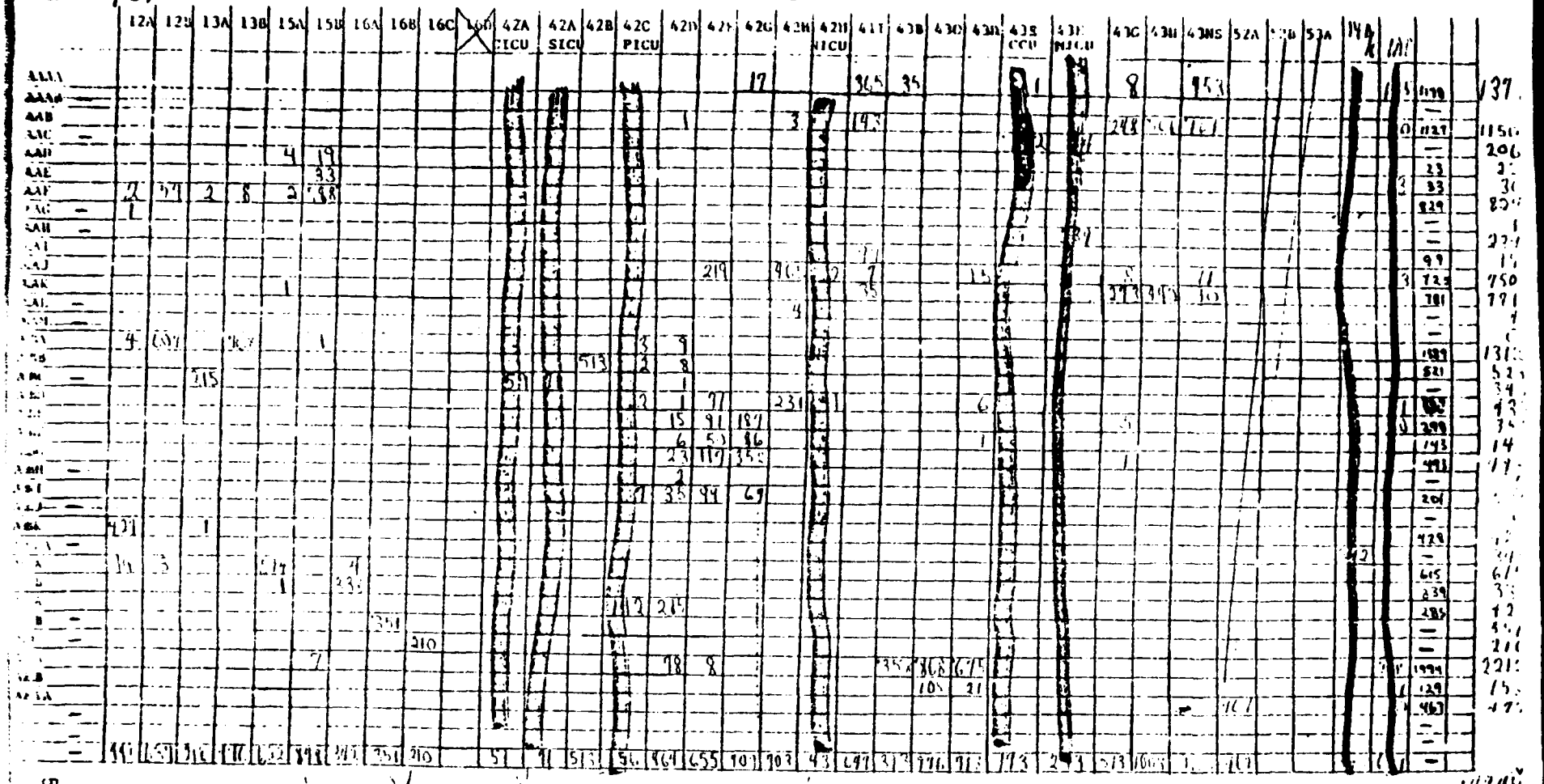
END PAGE 1

APPENDIX I

UCA CODES BY CLINICAL SERVICES

January 84

APPENDIX I



APPENDIX J

QUESTIONNAIRE

APPENDIX J

Questionnaire

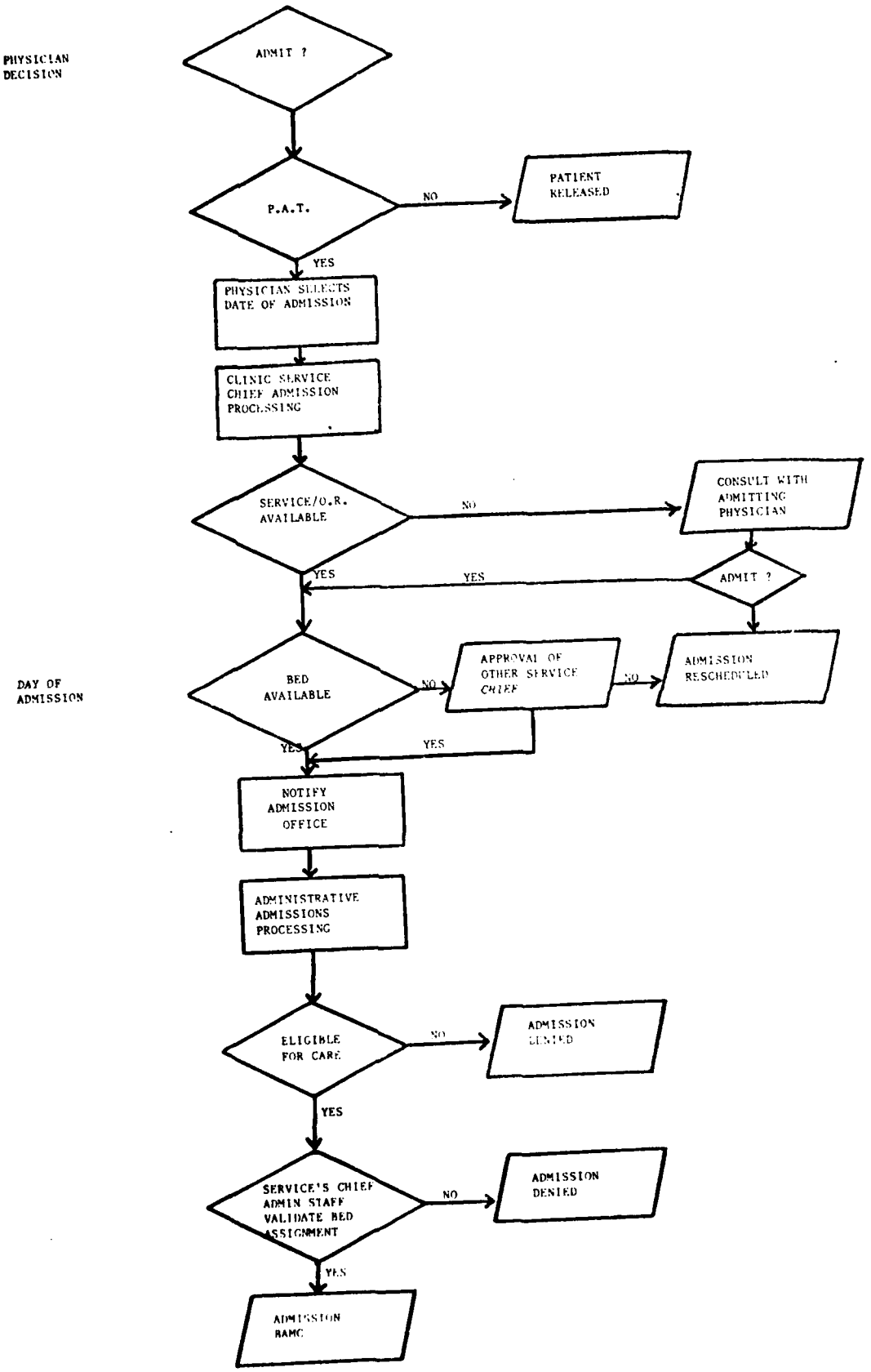
Please circle response.

1. The ability to locate an empty bed for a patient improved, stayed the same, or declined?
2. The quality of patient care improved, stayed the same, or declined?
3. Adequate qualified personnel staffing to meet the changing patient needs improved, stayed the same, or declined?
4. The coordination to find an empty bed improved, stayed the same, or decreased?
5. Patient complaints increased, stayed the same, or decreased?
6. Hospital staff complaints dealing with locating beds increased, stayed the same, or decreased?

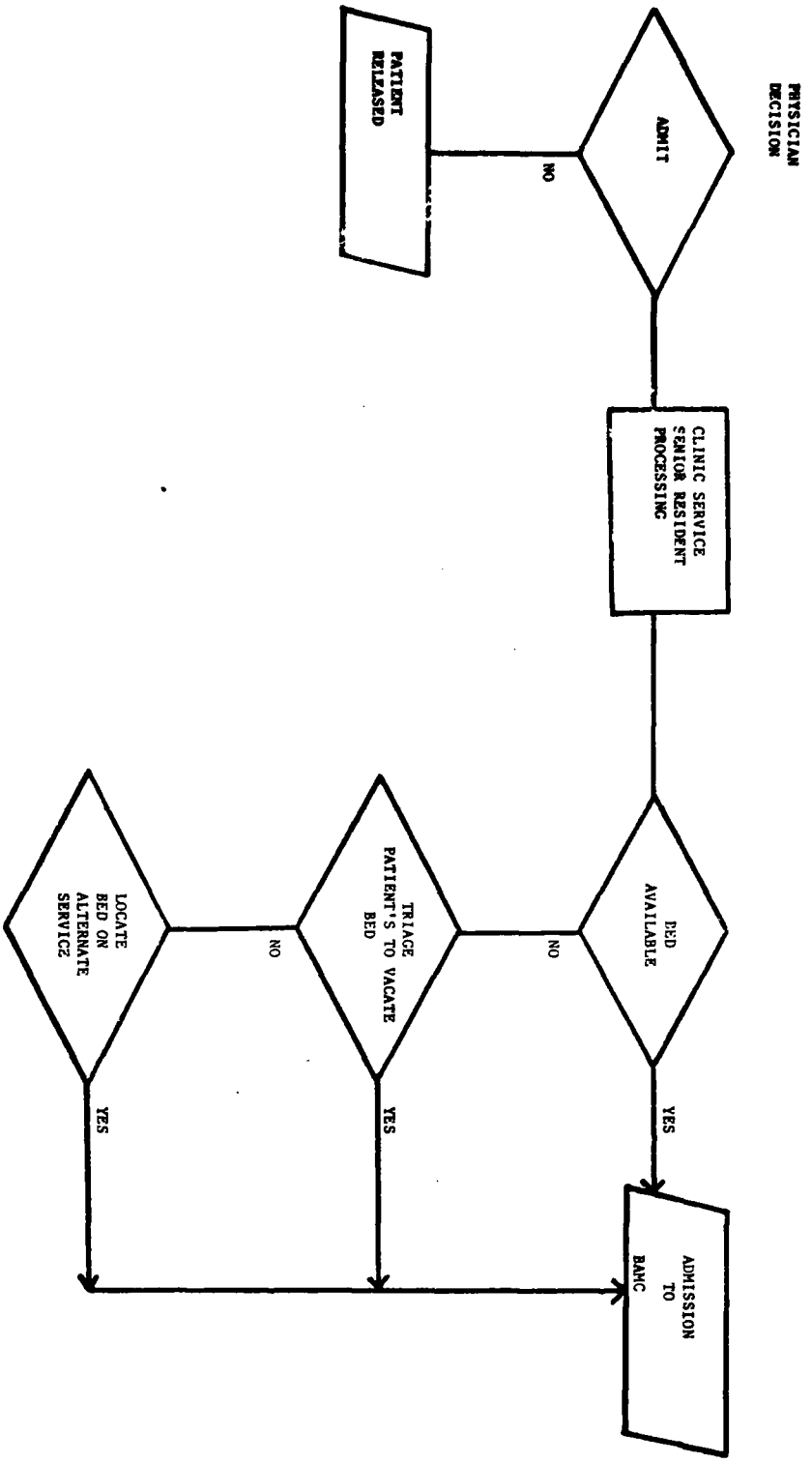
APPENDIX K

BAMC TEST ADMISSION MANAGEMENT AND PREADMISSION PROGRAM FLOW CHART

ELECTIVE ADMISSIONS MANAGEMENT SYSTEM



EMERGENCY/AIR-EVAC ADMISSIONS MANAGEMENT SYSTEM



FOOTNOTES

[1]Richard J. Coffey, "Preadmission Testing of Hospitalized Surgical Patients and Its Relationship to Length of Stay," doctoral dissertation, Department of Industrial and Operations Engineering, University of Michigan, Ann Arbor, Michigan, June 4, 1979 (Ann Arbor, Michigan: Office of Dean, 1979), p 22.

[2]Ibid, p. 26.

[3]David M. Warner, *Preliminary Analysis of Pre-Admission Tested (PAT) Patients,"* unpublished paper, the University of Michigan, Ann Arbor, Michigan, September 1978 (Ann Arbor, Michigan: Office of Dean, 1978), p. 33.

[4]Coffey, p. 27.

[5]James Waller, "The Effects of an Admitting Center on Various Components of a Health Care Delivery System," Report to Methodist Hospital of Gary, Inc., Gary, Indiana, April 17, 1979 (Gary, Indiana: Commission on Professional and Hospital Activities, 1979), p. 17.

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[7]Coffey, p. 29.

[8]Ibid, p. 30.

[9]Ibid, p. 30.

[10]D.M. Barbero, L. Shuman, and R. Swinkole, "An Evaluation of Various Pre-surgical Testing Procedures," Blue Cross of Western Pennsylvania Research Series 16, 15 January, 1979. (Pittsburgh, Pennsylvania: Blue Cross Office, 1979), p. 8.

[11]Coffey, p. 31.

[12]J. H. Milsum, E. Turban, and I. Vertinsky, "Hospital Admission Systems: Their Evaluation and Management," Management Science, Vol 19 (February, 1973): 6.

[13]David B. Magerlein, "Potential Cost Savings Due to the Use of Contemporary Technology in a Hospital Setting," Hospital Financial Management, Vol 5 (May, 1978), p. 29.

[14]W.M. Hancock, D.M. Warner, S. Hade, and P.A. Fuchs, "Admission Scheduling and Control Systems," in Cost Control in Hospitals, J.R. Griffith, W.M. Hancock, and F.C. Munsen, (Ann Arbor, Michigan: Health Administrative Press, 1976), p. 150-85.

[15]Ibid.

[16]Ibid.

[17]W.M. Hancock, J.B. Martin, and R.H. Storer, "Simulation - Based Occupancy Recommendations for Adult Medical/Surgical Units Using Admission Scheduling Systems," Inquiry, Vol XV (March 1978): p. 5.

[18]Ibid, p. 27-32.

[19]Magerlein, p. 32.

[20]Ibid, P. 34.

[21]P.F. Yannitelli and W.M. Hancock, "Implementation of the Admission Scheduling and Control System into Charles Hospital," Report Number 79-3, June 3, 1979. (Ann Arbor, Michigan: Bureau of Hospital Administration, School of Public Health, 1979), p. 17.

[22]Interview with LTC John Hammond, TRIMIS Program Office, Bethesda, Maryland, September, 1983.

[23]Interview with CPT James R. Tipton, Wilford Hall Medical Center, San Antonio, Texas, October 5, 1983.

[24]Interview with Mr. Jim Brooks, Director of Admissions, Bexar County Medical center, San Antonio, Texas, August 17, 1983.

[25]Interview with Ms. Elia Peres, Admissions Manager, Bexar County Medical Center, San Antonio, Texas, August 18, 1983.

[26]Ibid.

[27]Ibid.

[28]Ibid.

[29]Brooks, August 19, 1983.

[30]Ibid.

[31]Interview with MAJ Larry White, Walter Reed Army Medical Center, Washington, D.C., January 12, 1984.

[32]Ibid.

[33]Ibid.

[34]Ibid.

[35]Ibid.

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