

IS 47-00

U.S. ARMY - BAYLOR UNIVERSITY GRADUATE PROGRAM
IN HEALTH CARE ADMINISTRATION

A STATISTICAL ANALYSIS OF THE
RELATIONSHIP OF DISTANCE AND MODE OF TRANSPORTATION
ON LENGTH OF STAY
AT BROOKE ARMY MEDICAL CENTER

GRADUATE MANAGEMENT PROJECT
SUBMITTED TO THE FACULTY OF BAYLOR UNIVERSITY
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF
MASTER OF HEALTHCARE ADMINISTRATION

BY

MAJOR JOHN P. HAGEN

FORT SAM HOUSTON, TEXAS

JULY 1997

ACKNOWLEDGMENTS

I give special thanks to the many individuals who made this project possible especially the wonderful staff at Brooke Army Medical Center who were always willing to provide assistance. I would also like to thank my preceptor, COL Joseph Gonzales, for the opportunity to pursue this project and his assistance and guidance in completing it. A debt of gratitude is owed to LTC Sandra White for her assistance in the statistical analysis portion of this paper and her unending support and guidance throughout. To my wonderful wife and family who, as always, aided in motivating me to complete this study.

ABSTRACT

This retrospective quantitative study examined the relationship of distance, measured based on catchment area status, and mode of transportation, measured based on the use of the U.S. Transportation Command's (TRANSCOM) aeromedical evacuation system, to determine their influence on length of hospital stay at Brooke Army Medical Center in FY96 in order to better understand the impact these patients have on utilization management.

Based on criteria driven selection of four discharge Diagnosis Related Groups (DRGs), patient records (n=657) were selected for review. Based on statistical analysis this study determined that increases in LOS for patients using the aeromedical evacuation system were statistically significant when compared to patients arriving at BAMC by other means. These results were expected. This study also determined that LOS for patients coming from outside the local catchment area did not have statistically significant increases in LOS when compared to those from within the local catchment area. Based on the literature review and subjective observations these results were not anticipated.

This study recommends establishing a preadmission assessment process for all inpatient transfers coming to BAMC via the aeromedical evacuation system to determine the need for admission based on physician assessment. In addition continued use of the Remain Overnight (RON) service as a means to reduce LOS in aeromedical evacuation patients is highly recommended. No recommendations for change were made regarding out-of-catchment area patient management. Based on the results of this study out-of-catchment area patients appear to have similar utilization patterns based on the LOS as patients from within the catchment area.

TABLE OF CONTENTS

ACKNOWLEDGMENT	ii
ABSTRACT	iii
TABLE OF CONTENTS	iv
LIST OF TABLES	v
LIST OF FIGURES	vi
CHAPTER	
1. INTRODUCTION	1
The Military Health Service System	2
Transition to Utilization Management	4
Conditions Which Prompted the Study	6
Statement of the Problem	8
Literature Review	8
Purpose	17
2. METHODS AND PROCEDURES	19
Data Collection	19
3. RESULTS	23
4. DISCUSSION	35
5. CONCLUSIONS AND RECOMMENDATIONS	42
APPENDIX	
A. LIST OF ABBREVIATIONS	45
B. DEFINITION OF TERMS	47
C. SOP FOR THE REMAIN OVERNIGHT SERVICE	49
D. SOP FOR ELIGIBILITY FOR REMAIN OVERNIGHT SERVICE	54
E. REMAIN OVERNIGHT SERVICE STATISTICS	57
REFERENCE LIST	58

LIST OF TABLES

Tables	Page
1. Summary age data for total sample of patients used in study	25
2. Summary table of ANOVA analysis of the ALOS for DRG 106 based on catchment area origin	27
3. Summary table of ANOVA analysis of the ALOS for DRG 106 based on mode of transportation	28
4. Summary table of ANOVA analysis of the ALOS for DRG 125 based on catchment area origin	29
5. Summary table of ANOVA analysis of the ALOS for DRG 125 based on mode of transportation	29
6. Summary table of ANOVA analysis of the ALOS for DRG 209 based on catchment area origin	30
7. Summary table of ANOVA analysis of the ALOS for DRG 209 based on mode of transportation	31
8. Summary table of ANOVA analysis of the ALOS for DRG 215 based on catchment area origin	32
9. Summary table of ANOVA analysis of the ALOS for DRG 215 based on mode of transportation	32
10. Summary of research question, hypotheses and statistical analysis for each DRG in the study sample	33
11. Comparison of ALOS and the difference by DRG for aeromedically evacuated patients versus patients not transported by aeromedical evacuation	35
12. Comparison of ALOS and the difference by DRG for in-catchment and out-of-catchment area patients	40

LIST OF FIGURES

Figure		Page
1.	Great Plains Regional Medical Command area of responsibility	7
2.	Numbers of discharge by specific DRG	23
3.	Ratios of discharge by specific DRG	23
4.	Discharge by gender for each DRG	24
5.	Racial composition for the total sample	26

CHAPTER 1

INTRODUCTION

Health care costs in the United States continue to grow at an alarming rate. The combination of a growing and aging population, new and expensive technologies, questionable utilization of resources, and an over consumption of health care by providers and patients alike have all contributed to increased health care costs. Aggregate health care spending more than doubled during the 1980s, from \$251.1 billion in 1980 to \$696.6 billion in 1990 (Levit 1994). This equates to roughly \$2,566 for every American citizen (Angell 1993). Although the rate of increase moderated during the early 1990s, health care spending still managed to increase to \$884.2 billion by 1993 (Prospective Payment Assessment Commission, 1995; Ginsburg 1996). A recent General Accounting Office (GAO) report noted that Medicare costs alone have risen on average more than 10 percent per year (GAO 1996). This trend is expected to continue to the year 2000 with a growth rate of 10.2% annually (NIHCM 1995). It is also estimated that by the year 2000 health care will account for more than 16 percent of the gross national product meaning other needs such as transportation, education and defense will receive a smaller percentage of federal dollars (Sonnefeld, 1991).

Additionally, the aging population impacts on the rising cost of health care. This population is increasing simply because people are living longer. Since 1900 there has been an eight fold increase in the number of Americans over the age of 65 years and those over 85 years are 21 times as numerous, as well as being the fastest growing age group in the country (Jecker

and Schneidermann 1992). In 1988, the average life expectancy had increased to 74.9 years and the roughly 75 million people born between 1946 and 1964 constituted nearly one-third of the U.S. population. As this population ages and life expectancy continues to rise, more and more people face chronic medical conditions and an ever increasing use of health care resources. This, combined with the American health care system which is organized structurally and functionally to provide acute care, has resulted in ever increasing health care costs and an inefficient use of resources (Freidman 1991). In an attempt to change these trends in today's cost-conscious economic environment, managed care has evolved to address these issues.

The Military Health Services System

The Military Health Services System (MHSS) faces similar challenges and is undergoing adjustments similar to those of the civilian sector in dealing with rising costs and maintaining access for its beneficiaries. The MHSS, which consumes 5.6% of the total Department of Defense (DoD) budget, comprises a vast complex of 148 hospitals and over 800 medical and dental clinics worldwide (Lanier 1993). Even though the number of facilities and personnel within the MHSS is decreasing, the system is still facing significant fiscal problems. Historically constrained by legislative budgeting, the system is now experiencing similar constraints as those in the civilian sector with demands by Congress and the Office of the Assistant Secretary of Defense for Health Affairs (OASD(HA)) to reduce health care operating costs. This is made more challenging by the fact that a reduction in military forces, to include medical personnel, has not lead to similar reductions in beneficiaries since many transitioned to retiree status with continued eligibility for health care. (McGee 1995).

To understand this transition for the MHSS it's important to understand how the MHSS functioned in the past and how it has evolved over time. Since the 1950s, the MHSS used weighted workload units to describe the outputs of the health care system. Under this arrangement the MHSS was resourced based on workload production. This system evolved into Medical Work Units (MWU) which used inputs such as personnel, supplies and facilities and outputs which included such things as bed days and visits as units of measure for workload. The MWU was developed to provide a weighted work unit that allowed comparison of radically different measures of work such as bed days and clinic visits (Williams 1994). The economic incentives behind this type of fee-for-service system is workload production since the Medical Treatment Facility (MTF) is paid for each output produced. By increasing such things as length of stay, bed days per thousand, the number of ancillary procedures performed, or holding patients for social reasons, such as awaiting aeromedical evacuation, an MTF could receive a corresponding increase in its budget. This resulted in a perverse economic incentive for military health care facilities to do more in order to maximize their budget.

Since the mid-1980s, the MHSS recognized the need to change from the traditional fee-for-service health care delivery system with its emphasis on acute and inpatient care. It undertook a number of demonstration projects such as the Civilian Health and Medical Program of the Uniformed Services (CHAMPUS) Reform Initiative, the Catchment Area Management Model, and the Tidewater initiative in an attempt to show that the MHSS can function in a capitated managed care environment. These demonstration projects resulted in the MHSS managed care program known today as TRICARE (McGee 1995). The TRICARE program is based on a regional health care network responsible for its own planning and execution and is intended to

increase the tri-service cooperation within each region. This MHSS program creates a cooperative effort in which a direct care system using military treatment facilities and a managed care support contractor utilizing civilian medical treatment sources provide coordinated medical care to military beneficiaries.

Another important aspect of the transition to managed care is how funds are distributed within the MHSS. In 1994 the DoD began allocating health care resources to the individual services using a modified capitation budget formula. This meant that under this prospective type of payment plan MTFs would receive a finite amount of funding based on the number of beneficiaries within the catchment area. For MTFs this meant finding new methods to reduce marginal costs, methods of resource sharing, eliminating duplicative services, and initiating programs such as utilization management, quality improvement and case management (McGee 1995).

Transition to Utilization Management

In November 1994 in an effort to ensure necessary measures were implemented to reduce costs, ensure quality, and maintain access within the MHSS, the OASD(HA) issued a memorandum providing guidance on utilization management. This DoD Utilization Management (UM) Policy for the Direct Care System under TRICARE noted that the establishment of regional health delivery systems moved the DoD further in the development of a single standard of care for all military beneficiaries and would maintain its progress toward a “seamless” system of care. Central to this seamless system was the concept that UM practices would hold the MHSS annual rate of growth levels below the national norm, and by using InterQual criteria,

would allow a sound basis for comparing UM patterns across MTFs, regions and between the services (Joseph 1994).

In May 1996 the Defense Health Program Resource Management Steering Committee formed a "UM Tiger Team". Its purpose was two fold. First, it was to recommend an approach to OASD(HA) which would equitably distribute a proposed fiscal year 1997 (FY97) UM decrement among the services, and secondly, to recommend an approach to increase the level of UM in the direct care system. Although the team did not come to a consensus on how to equitably apportion the FY97 UM reduction among the services the OASD(HA) opted for a "rate adjusted" approach using the most complete year of data in the Retrospective Case-Mix Analysis System (RCMAS) and compared services by discharge rate. The distribution of \$150 million (M) for the FY97 UM decrement recommended by the Tiger Team was as follows: Army-45% or \$68M; Navy-25% or \$37M; and Air Force-30% or \$45M (Maddy 1996). This resulted in decrements of 1.0%, 1.5% and 2.0%, for the Navy, Air Force and Army, respectively (McMann 1997).

In addition, the U.S. Army Medical Command (MEDCOM) implemented its own methods for UM reductions on MTFs in an effort to improve utilization within the U.S. Army Medical Department (AMEDD). Using FY95 RCMAS data, the MEDCOM reviewed discharge rates/1000 beneficiaries, medical treatment days/1000 beneficiaries and potential outpatient procedures, excluding one day admissions, for patients falling under Catchment Area Patient Origin Category II in the RCMAS system. This category includes patients from within the catchment area of the MTF and those from within the local catchment area treated at other MHSS MTFs. Each Army MTF was decremented based on the results of the MEDCOM review (Hanna

1997). As a result of these decrements Brooke Army Medical Center (BAMC) experienced a 5.36% reduction in its FY97 Operations and Maintenance budget which equates to a total UM decrement of \$3.56M (Loader 1997).

Conditions Which Prompted the Study

In an effort to identify potential areas for UM improvement BAMC utilizes its managed care support contractor, Foundation Health Federal Services (FHFS), to perform utilization review and track certain areas of concern. In this process FHFS identified out-of-catchment area patients to include those using the United States Transportation Command's (TRANSCOM) aeromedical evacuation system as significant contributors to length of stay (LOS) at BAMC. In November 1996 BAMC received a list of nine factors associated with increased total bed days at BAMC for the month of September 1996 (UM Committee Meeting Minutes 1996).- The findings noted that 32 patients added 170 bed days for nonmedical reasons. These bed days were attributable to patients from outside BAMC's catchment area, most notably those arriving via aeromedical evacuation in an inpatient status. The catchment area for BAMC includes a geographic area encompassing a forty mile radius from the facility to include 137 zip codes within in that area. Of the nine constraints identified by FHFS affecting bed days at BAMC, the conclusion was that these out-of-catchment area patients were the most significant cause of increased bed days. This trend continued each month through the first quarter of FY97.

As the main referral center for the Great Plains Regional Medical Command (GPRMC), BAMC is responsible for much of the tertiary care within this fourteen state region and Panama (see Figure 1). Transport of patients from outside the local catchment area is generally

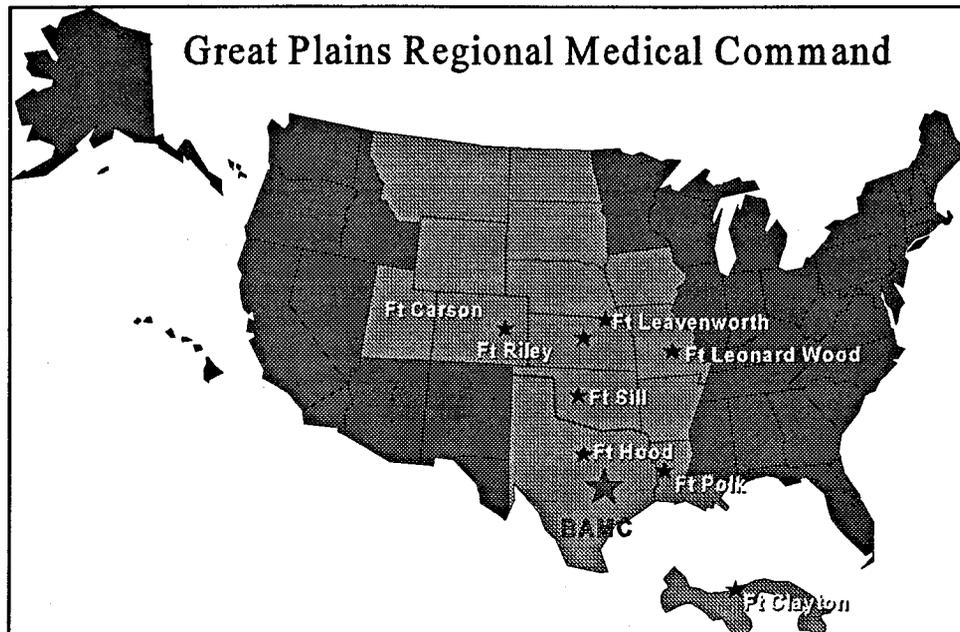


Figure 1 Great Plains Regional Medical Command's fourteen state and Panama area of responsibility, with BAMC as the main referral center

accomplished through patient self-transport or through the use of the TRANSCOM aeromedical evacuation system. The aeromedical evacuation system was responsible for the transfer of 1,641 patients to BAMC in FY96 (Global Patient Movement Requirements Center 1996). Both the aeromedical evacuation system and self-transport play an integral role in providing access to BAMC for patients from outside the local catchment area. However, the effect that these out-of-catchment patients have on UM at BAMC is not well understood. Since BAMC will be faced with possible UM decrements in the foreseeable future it is important to gain an understanding of the effect these patients from outside the catchment area have on utilization management.

Statement of the Problem

With a UM decrement of \$3.56M for FY97 it is important to understand the impact that various sectors of the population have on health care utilization within BAMC. To determine what effect various patient groups have on UM at BAMC, this study attempts to answer a number of questions: 1) Does distance and mode of transportation influence how patients are managed at BAMC? 2) What issues are involved with the transport of patients to BAMC from outside the local catchment area? 3) Is there a need for better management of out-of-catchment area patients, and if so, how can this be accomplished in a more efficient manner?

Literature Review

Physical accessibility to medical care has long been an issue of interest to health care planners and managers. How distance and accessibility is managed and how it effects the health care organization is the focus of this review. This literature review focuses on two broad areas in particular: 1) the distance patients travel to receive care at a medical facility and its effect on medical utilization, to include how the military deals with the issue, and 2) a review of measures previously used to evaluate distance and medical utilization.

Distance and Medical Utilization

It has long been observed that the location of people and their social activities are to a great extent spatially ordered (McGuirk and Porell 1984). Therefore, it stands to reason that the issue of distance and the utilization of medical care would be of a significant magnitude to warrant active research, however, very little *recent* literature was found on this topic. The reasons for this are not known but the literature sighted below offers relevant theory and information adaptable to

the issue at hand in today's environment.

A review of the literature notes two major theories that underlie distance and the demand for medical services. These are the central place theory and distance decay theory. According to Shannon, Bashshur, and Metzner (1969) many of the studies relating to distance and medical utilization are based on the major theoretical work of Von Thunen in the late 1800s. Von Thunen asserted that, given an open expanse of land, a city will be located in the center of it and all activities will be located in competitive relationship to the center. This central place theory recognizes a hierarchy of centers with differing varieties of services. The lowest level centers offer basic services and are numerous while the higher level centers offer basic services along with a wide range of specialized services. The underlying belief is that consumers will only travel as far as necessary to acquire needed services (Shannon, Bashshur, and Metzner 1969).

Shannon and Dever (1974) note that under the central place model the spatial pattern of medical facilities in a given region would, theoretically, range from the upper and lower level limits in which the upper level of the hierarchy is the medical center providing the entire range of possible services centrally located with the lower level of individual physicians providing their services from a home-based practice. In addition, according to McGuirk and Porell (1984), the observation that as third-party insurance coverage increases and alleviates out-of-pocket costs, travel time and waiting time become the chief determinants of demand and choice of medical facility.

The second theory is distance decay which seems to augment the central place theory with the added dimension of diagnosis. Some of the more recent studies done by Mayer (1983) and Stock (1983) both observed that health care utilization falls or "decays" with distance, and most

importantly, the magnitude of that decay has been observed to be influenced by diagnosis, so the impact of distance decreases as the seriousness of the diagnosis increases.

Other studies support the distance decay theory. Welch, Larson, and Welch (1993) hypothesize that distance may serve as a proxy for severity of illness. In their research the authors define severity of illness in terms of the resources used and the charges for those resources. Using data from the three largest cities in the state of Washington and based on selected Diagnosis-Related Groups (DRGs), Welch et al found patients who came from a distance have more complex case mixes and higher charges than local patients. The authors note that barring any “statewide pricing discrimination” it appears that patients coming from a distance are more costly to treat, and therefore, have a greater severity of illness. Welch et al also remarks that DRGs for which distant patients are particularly expensive are those DRGs in which physician or patient discretion may play an important role.

Based on these findings it would appear that patients who travel greater distances would be more costly or have a greater severity of illness, but the findings of Jencks and Bobula (1988) appear to conflict with these findings. This retrospective study using zip codes as a measure of distance from tertiary care facilities notes that those hospitals that receive transfers and referrals are more costly per patient than other hospitals, but transferred patients account for only a small fraction of the increased cost and referred patients account for none. Jencks and Bobula hypothesize that tertiary care hospitals use their special capabilities and skills not only on patients with critical illnesses and exotic disorders but also use them for the rest of their patients, which adds to the overall per capita cost. As a caveat, Gordon et al. (1995) note that although tertiary care hospitals appear more expensive they may actually achieve superior outcomes at a lower cost

when it comes to high-risk surgical procedures or high-volume procedures.

Mayer (1983) adds another dimension to the issue of distance and choice of medical facility. He suggests that the application of the central place theory to the analysis of patient travel should look at the “bundle of services” the institution provides and not the facility itself. He hypothesizes that each procedure or diagnosis has its own catchment area and when viewing the issue of distance it must be based on the procedures or diagnoses, not the facility. This thought process adds credence to the distance decay theory since diagnosis is an important element in that theory.

Most of the distance and medical utilization research reviewed by this author dealt with the impact of distance on those traveling from rural settings and seems to establish the fact that distance demonstrates a significant impact on patient decision-making. However, research conducted by Studnicki (1975) in one metropolitan area indicates that other factors besides distance are more important. Using a study population of over 16,000 live births in a large metropolitan area with 16 different hospitals Studnicki found that a large portion (20 percent) of the study population exhibited *extreme* spatial inefficiency by traveling to four of the 16 hospitals which were farthest from their residence requiring them to bypass the other 12 hospitals. This indicates, at least in large metropolitan areas, that when given a choice, other factors besides distance or catchment area may play a more significant role in a patient’s choice of medical care.

In searching for direct applications of these theories to the MHSS there was no literature found. It can be assumed that many of the factors described above are applicable to MHSS patients with their own cultural and socio-economic factors affecting their decision to use the MHSS. There is, however, one exception to this. The TRANSCOM’s aeromedical evacuation

system attenuates many of the factors associated with distance and medical utilization and in many cases removes the free choice a patient may have in selecting a treatment facility based on requirements to be evacuated and treated at a military facility based on cost savings and training requirements of the government. According to Wade, et al (1996) the aeromedical evacuation system minimizes concerns over distance and describes the system as

the most sophisticated program ever conceived to eliminate financial and logistics barriers to patient referral and transport and thus allow the DoD to offer nearly seamless medical support to patients around the world.

The aeromedical evacuation system originated in 1942 when the War Department officially began development and operations of an aeromedical evacuation system and in 1993 DoD Directive 5154.6 made the commander of TRANSCOM the single manager for the DoD (Kennedy 1996). The CONUS based portion of aeromedical evacuation operates a hub-spoke system with Scott Air Force Base serving as the hub, with patient movement coordination conducted through the Global Patient Movement Requirements Center (GPMRC) at Scott. This high-volume, long-range system transports approximately 70,000 patients annually at an operating cost of approximately \$2,700 per hour, excluding landing and service fees, with an average mission length of ten hours (Connors and Lyons 1995).

Measures to Evaluate Distance and Medical Utilization

Griffith (1995) notes that one judges the acceptability of a measure by its value and its cost. He states that value is indicated by the extent to which the monitor is able to improve performance using the measure, and cost is a combination of the resources consumed to obtain the measure and the cost of incorrect reports. In this review of numerous measures which

evaluate distance and its relationship to medical utilization one common method emerged. The comparison of LOS for either a particular DRG or a mix of DRGs in relationship to the distance of the patient from the facility was the most common method used. The next portion of the literature review will look at the use of DRGs and LOS as units of measure to identify the pros and cons of using these measures in analyzing distance and medical utilization.

Diagnosis-Related Groups as a Unit of Measure

DRGs were developed by a team at Yale University between 1967 and 1982 as a means of defining hospital output (Fetter 1992). They were initially intended to be used in that capacity as a management tool but later became the reimbursement mechanism of the Medicare Prospective Payment System (PPS). Under the PPS some patients are DRG “winners” while others are “losers” based on a given hospital’s efficiency for a particular DRG. The goal of the hospital is to maximize that efficiency (Rhodes, Sharkey and Horn 1995). Since their inception DRGs have become almost universally accepted by the government, the medical field, and the insurance industry as the best available tool for health care analysis and reimbursement (Glick 1989).

Even with this wide acceptance of DRGs it is important to be aware of potential shortcomings. Restuccia (1995) notes that even though DRGs provide incentives to reduce length of stay and provision of ancillary services they still encourage admissions to hospitals. And a recent article in the Wall Street Journal (Lagnando 1997) identifies another problem, that of “upcoding” to maximize reimbursement, in which the practice of upgrading the seriousness of a medical malady is used to obtain the highest reimbursement possible. These particular cases represent more of an ethical dilemma than a systematic problem with DRGs.

Early on, one of the main system concerns noted in using DRGs was that of variability. Horn et al (1985) state that although DRGs help categorize resource consumption and may be the likely measure of efficiency they only explain a small portion of the variance in hospital resource use. If their use is to improve efficiency, better methods to explain this variance must be uncovered. Glick (1989) notes that in research conducted at the Research Department of the Naval School of Health Sciences DRGs accounted for 40.9% of the variation in LOS. In more recent work Horn et al (1991) found only 27% of the variation in LOS predicted by DRGs but this involved the use of grouped or near common DRGs.

When looking at the ability of DRGs to account for the variation in such things as resource utilization and LOS there are numerous references which address the need for improvement (Welch, Larson and Welch 1993, Horn et al 1991, Berman et al 1986, Horn et al 1985). These references note that the clinical severity of illness of patients assigned to the same DRG can result in differences in cost and outcomes. Efforts to address this variation have not resulted in any significant improvement. Up to its time of publishing Jencks and Dobson (1987) note that the use of Disease Staging and the Patient Management Categories, which are computerized systems for measuring and assigning patients to disease categories, show no significant improvement over DRGs. Horn et al (1991) used the Computerized Severity Index (CSI) developed at John Hopkins University in an attempt to explain variations in LOS. Of the 25 DRGs assessed, the DRGs alone predicted 27% of the variation while DRGs with Admission CSI were able to predict 38% and those adjusted for maximum CSI predicted 54% of the variation. Horn et al (1991) propose the use of this system as an adjustment to the existing DRG system but at present it is not in place for routine use. Fetter (1991) notes that for determining payment, no

systems presently available offers a major improvement or substitute for DRGs and implementation of these systems would require more concurrent and aggressive retrospective review. Fetter adds that current work is underway to refine the DRG definitions to better account for differences in severity of illness.

Length of Stay as a Unit of Measure

Length of stay (LOS) is the second variable analyzed as a unit of measure in this review. In Ash's (1995) review of designing hospital utilization studies she notes that when the focus is on detecting inappropriate days, the natural unit of measure is individual days of care, or length of stay. Many of the studies identified in this review use LOS as a unit of measure in evaluating the efficiency of a health care facility. It is important, however, to identify in which capacity LOS is being used. For example, Payne et al (1992), caution using average LOS even though its one of the most commonly used measures in UM programs. They believe that as a UM program matures its increased effectiveness will divert some of its shorter lengths of stay patients to outpatient status resulting in an increased average length of stay (ALOS).

For others, such as utilization management firm Meridian Managed Care (MMC), LOS is used as a benchmark (Nelson and Christenson 1995). MMC identifies benchmark performance from a state-wide public database on inpatient claims, identifies the physician or facility achieving efficient performance, evaluates the performance characteristics that allow achievement of the benchmark and educate their client staff and other facilities on methods to attain that benchmark.

For the military, Glick (1989) notes that LOS is a widely accepted measure of hospital resource consumption. As a measure of performance and point of reference Glick reports that

between 1983 and 1986 the Army and Air Force reduced LOS by 44% but with prospective payment system incentives driving civilian hospitals, LOS in nonfederal hospitals was still 30 to 50% shorter than DoD hospitals.

Literature Summary

Physical accessibility to health care and its impact on patients and health care resources has long been an area of interest. This literature review identified two major theories applicable to distance and physical accessibility to medical care. Both the central place theory and the distance decay theory support the idea that distance does have an impact on the utilization of health care resources and the demand for those resources. The research cited here generally supports that finding but the actual cause and effect relationship may lie well beyond that simple explanation or the scope of this paper. For the military, the MHSS is able to attenuate many of the effects associated with distance through the use of the TRANSCOM's aeromedical evacuation system.

This literature review also looked at methods to measure health care utilization. The literature noted that when detecting inappropriate hospital days or the utilization of inpatient medical resources LOS is generally an appropriate and accepted unit of measure. DRGs, on the hand, appear fraught with controversy. DRGs are a common classification system used to identify a medical disorder for reimbursement purposes but their ability to adequately account for the variation in resource utilization and LOS remains a point of contention. However, no system at present offers any major improvement over the use of DRGs as a measure for reimbursement and DRGs continue to be a common means of classification.

Purpose

BAMC is presently experiencing a UM decrement of \$3.56M for FY97. In light of the potential for continued budget reductions it is imperative that the utilization management process be evaluated and factors which impact UM be identified. One factor universally considered a measure of a successful UM process is length of stay. Therefore, it is necessary to understand which factors are related to extending LOS. The purpose of this study is to identify those factors related to a patient's mode of transportation and the distance traveled by patients that may be associated with excessive LOS.

Research Question #1

Is there a relationship between one mode of patient transportation to BAMC and LOS for inpatient care? Mode of transport is defined as whether the patient utilizes aeromedical evacuation or another form of transportation.

H_0 - There is no relationship between mode of transportation and LOS for inpatients treated at BAMC.

H_a - There is a relationship between mode of transportation and LOS for inpatients treated at BAMC.

Research Question #2

Is there a relationship between the distance a patient travels to receive inpatient care at BAMC and LOS for that patient care? Distance is defined as forty miles or less for those patients from within the MTF's catchment area and as greater than forty miles for patients from outside the

catchment area.

H_0 - There is no relationship between the distance a patient travels to receive inpatient care at BAMC and LOS for inpatients treated at BAMC.

H_a - There is a relationship between the distance a patient travels to receive inpatient care at BAMC and LOS for inpatients treated at BAMC.

CHAPTER 2

METHODS AND PROCEDURES

Data Collection

This retrospective quantitative analysis studied whether there is a correlation between distance traveled by a patient and the mode of transportation a patient used and its possible impact on length of stay (LOS) at Brooke Army Medical Center. Since BAMC is a tertiary referral center with a Graduate Medical Education (GME) mission, as well as other training programs, and also functions as a community hospital, there is the potential for variations in workload. To compensate for these variations in workload a 12 month period, FY 96, was selected as the time frame for data analysis. The first step in the analysis was the identification of the most restrictive variable listed within the hypotheses. Since the number of aeromedical evacuation patients transferred to BAMC was considered the most likely variable to render a small sample size, initial efforts concentrated on this group. To acquire the necessary data, the Defense Medical Regulating Information System (DMRIS) was used. This database, located at Scott Air Force Base, provides the only automated system for tracking aeromedical evacuation information on patients evacuated through the aeromedical evacuation system. For this study, DMRIS generated a list of the 523 inpatient transfers to BAMC occurring in FY96 (GPMRC, 1996).

Medical records for each of the 523 inpatient transfers were reviewed using the Composite

Health Care System (CHCS) to determine the patient's discharge DRG and total LOS. Of the 523 inpatient records reviewed for discharge DRG, 101 records were eliminated from the list for various reasons. These exclusions included burn patients (49) transferred via BAMC to the Institute of Surgical Research (commonly known as the burn unit) since these patients technically are not BAMC inpatients; obstetrical patients (9), since BAMC no longer provides inpatient obstetrical care; and patients listed on DMRIS for which no inpatient records were found (43) in CHCS. Patients in this last category were considered to be inappropriately labeled in DMRIS as inpatient, and were more likely diverted to an outpatient status upon arrival at BAMC based on medical necessity. This change in status would not appear in DMRIS. The exclusion of these patients resulted in a total of 422 discharge DRGs for aeromedical evacuation patients suitable for this study.

Totals were tabulated for each distinct DRG (e.g. DRG 410) from the 422 DRGs provided by DMRIS. There was no effort to group DRGs. A distinct DRG was selected for further analysis if it met the following criteria. The first requirement was that there were at least 5 patients within that specific DRG and each of the patients in that DRG was admitted for only a single hospital stay under that DRG in the time period of this study. This process excluded patients that were admitted multiple times for the same treatment or procedure such as chemotherapy. The second criteria was that the LOS for any admission had to be greater than one day to exclude admissions for diagnostic testing or social reasons. DRGs meeting these criteria included DRG 106, coronary bypass with cardiac catheterization; DRG 125, circulatory disorders excluding acute myocardial infarction (AMI) with cardiac catheterization without complex diagnosis; DRG 209, major joint and limb reattachment procedures of the lower

extremity; and DRG 215, back and neck procedures without complications.

The Patient Administration System and Biostatistical Activity II (PASBA II) database was used to access information regarding patients discharged from BAMC and coded as one of the four selected DRGs, less one day admissions. PASBA II is the second generation inpatient data retrieval program which contains the standard inpatient data record. Using this system, and FY96 data, all patients discharged under the four DRGs meeting the selection criteria were identified. This resulted in a total of 657 patients. Additional data provided by PASBA II included patient demographics, length of hospital stay, and patient in-catchment or out-of-catchment area status. Ten percent of the patients records were physically checked to ensure the reliability of the data provided by PASBA II correctly corresponded to the patient record. No discrepancies were noted.

The unit of analysis in this study is the episode of hospitalization. The dependent variable is LOS. LOS is defined as the duration, in days, of a hospital stay, excluding the day of discharge. The independent variables for this study are catchment area origin and aeromedical evacuation status. The catchment area for BAMC encompasses a 40 mile radius from the facility and includes 137 zip codes. Other analysis included an assessment of demographic variables such as gender, age and race.

Due to the lack of compatibility between DMRIS and CHCS it was necessary to acquire individual patient information from DMRIS in order to cross reference it with CHCS. Once this was accomplished all patient information was coded to restrict its access. In addition all information gathered using PASBA II involved the use of the register number with no identifying patient information.

The data collected from DMRIS, CHCS, and PASBA II was be analyzed utilizing the Statistical Package for the Social Sciences (SPSS) program and guidance by Norusis (1994) in analyzing that data. After each portion of the data was entered into SPSS a review of the frequency distribution for all variables was completed to ensure the data were coded and entered correctly.

The second step in this analysis involved the evaluation of all univariate summary statistics appropriate to the level of measurement for each variable. For nominal and ordinal values, measures of central tendency, such as mode and median, were calculated. In the case of the one interval variable, age, measures of central tendency, mean, median, mode, as well as measures of dispersion such as range, variance, and standard deviation were computed within each DRG. Each of the hypotheses was tested separately for differences of means using a one-way analysis of variance (ANOVA). For all analyses $p < 0.05$ was considered statistically significant.

CHAPTER 3

RESULTS

This chapter provides a statistical summary of the DRGs evaluated in this study. These results cover an analysis of the DRGs as a total group which reviews gender, age, and racial composition. This is followed by an analysis of each individual DRG within the study. This includes a review of the demographic information within each DRG and an inferential analysis of the influence of catchment area origin and the mode of transportation for each DRG.

Of the total sample of 657 discharge DRGs in this study, 10.7% or 70 of the discharges were categorized as DRG 106, coronary bypass with cardiac catheterization. There were 330

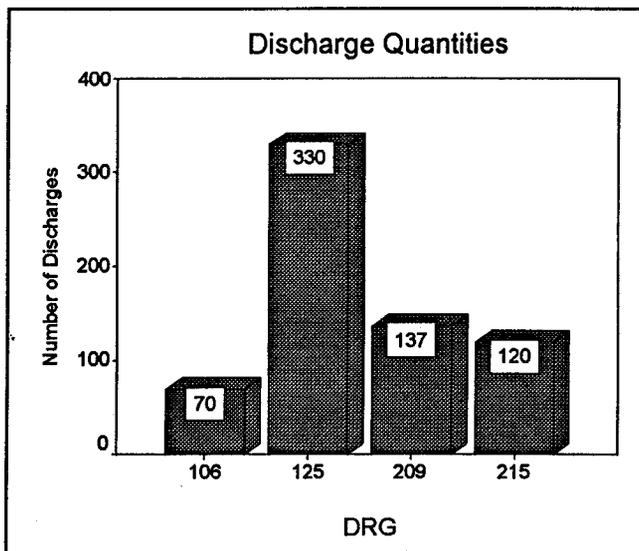


Figure 2 Numbers of discharges by specific DRG (n=657)

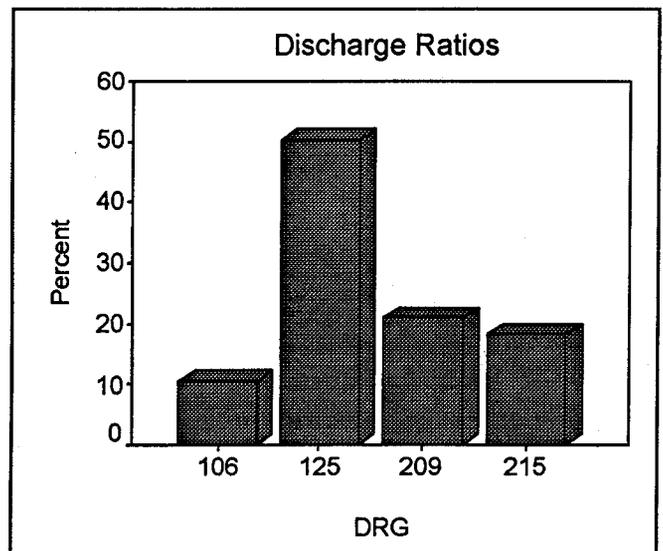


Figure 3 Ratios of discharges by specific DRG (n=657)

discharges, or 50.2% of the cases categorized as DRG 125, circulatory disorders excluding acute myocardial infarction (AMI) with cardiac catheterization without complex diagnosis. DRG 209, major joint and limb reattachment procedures of the lower extremity, comprised 20.9% or 137 of the discharges, and DRG 215, back and neck procedures without complications, consisted of 120 discharges or 18.3% of the cases. Figures 2 and 3 provide a graphic representation of the frequency distributions.

Males accounted for 61.8% of the total sample, while females comprised 38.2% of the sample. DRG 125 had a greater percentages of females than males, while the other three DRGs had a greater ratio of males to females. Figure 4 provides a graphical representation of the frequency distribution by gender for each DRG.

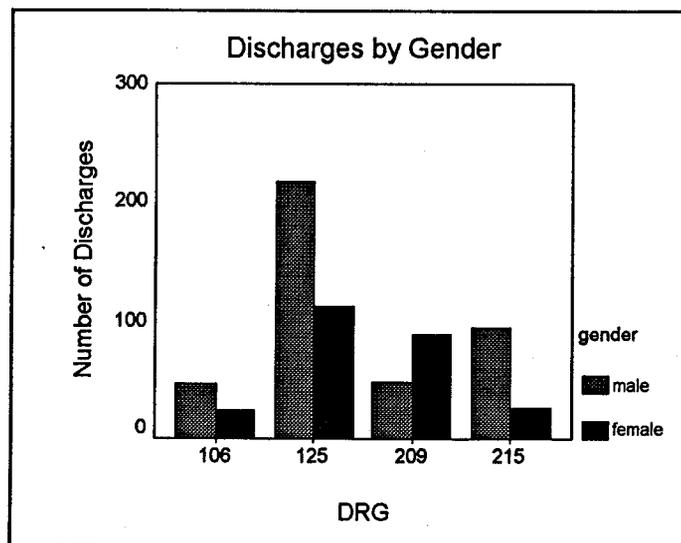


Figure 4 Discharges by gender for each DRG

The mean age for the total group was 56.28 years with a standard deviation of 15.17 years and a range of 71 years. The median age was 59 years with a mode of 64 years. The mean age

for females was 59.3 with a standard deviation of 14.49. Age range for females was 68 years with the oldest being 91 years of age while the youngest was 21 years old. Males had a mean age of 54.37 years with a standard deviation of 15.30 years. Age range was 71 with the oldest male being 91 years of age and the youngest being 20 years of age. Table 1 summarizes this data.

Age Composition			
	Male	Female	Total
Mean	54.3793	59.3506	56.2785
N	406	251	657
Std. Deviation	15.3024	14.4681	15.1718
Max	91	89	91
Min	20	21	20
Range	71	68	71

Table 1 Summary age data for total sample

Analysis of the ethnic and racial composition for the total sample yielded the following results. Caucasians comprised the greater portion of the study group at 79%. African-Americans accounted for 12% of the total sample while Hispanics made up 6.4%. The remaining 2.6% were categorized as Other. See Figure 5 for the frequency distribution based on ethnic and racial composition.

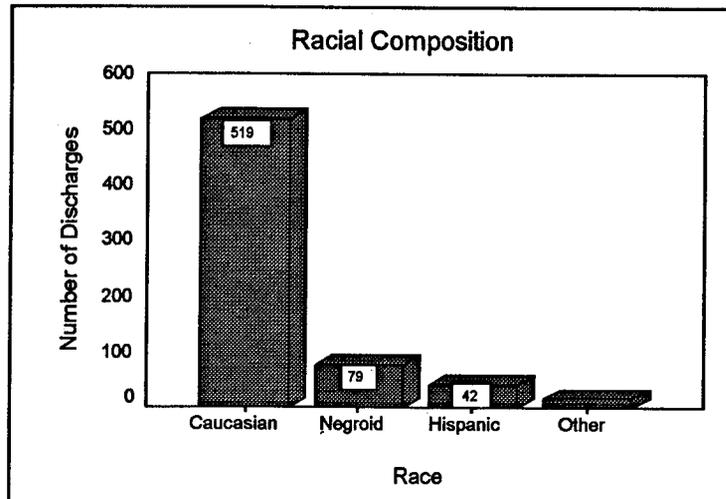


Figure 5 Racial composition for the total sample

The remainder of this chapter is devoted to a review of the descriptive and inferential statistics for each specific DRG. The statistical analysis conducted below for each DRG includes outliers. For the purposes of this paper outliers were defined as those LOS outside the 90th percentile as determined by SPSS. An analysis was also conducted with these outliers removed. Even with these outliers removed the results of the statistical significance was unchanged.

DRG 106

Seventy discharges were categorized as DRG 106, coronary bypass with cardiac catheterization. Gender distribution consisted of 46 males (65.7%) and 24 females (34.3%). The mean age of the group was 63.68 years with a standard deviation of 10.96 years. The range was 45 years (40-84 years of age). The mode was 64 years and the median was 63.5 years. Ethnic composition for this DRG consisted of 59 Caucasians (84.3%), 5 African-Americans (7.1%), 4 Hispanics (5.7%), and 2 (2.9%) categorized as Other.

The average length of stay (ALOS) for DRG 106 was 16.8 days with a standard deviation of 8.28 days and a range of 47 days. For patients originating within the catchment area the ALOS

was 16.41 days with a standard deviation of 7.12. For patients originating outside the catchment area the ALOS was 17.46 days with a standard deviation of 10.07 days. A one-way ANOVA of means within these two groups indicates that the difference in ALOS is not significant with $F(1,69) = .261$ and $p = .611$. Table 2 provides a summary of the statistical analysis.

Source	Sum of Squares	df	Mean Square	F	p
Between Groups	18.102	1	18.102	0.261	0.611
Within Groups	4715.098	68	69.340		
Total	4733.200	69			

Table 2 Summary table of ANOVA analysis of the ALOS for DRG 106 based on catchment area origin (n=70)

For patients discharged under DRG 106 using the aeromedical evacuation system the ALOS was 27.4 days with a standard deviation of 12.7 days. The ALOS for patients using other forms of transportation to BAMC was 15.98 days with a standard deviation of 7.37 days. A one-way ANOVA of the means within these two groups indicates that the difference in ALOS is significant with $F(1, 69) = 9.96$ and $p = .002$. Table 3 provides a summary of the ANOVA based on mode of transportation.

Source	Sum of Squares	df	Mean Square	F	p
Between Groups	605.015	1	605.015	9.966	0.002
Within Groups	4128.185	68	60.709		
Total	4733.200	69			

Table 3 Summary table of ANOVA analysis of the ALOS for DRG 106 based on mode of transportation (n=70)

DRG 125

There were 330 discharges categorized as DRG 125, circulatory disorders except AMI, with cardiac catheterization without complex diagnosis. Gender distribution consisted of 218 males (66.1%) and 112 females (33.9%) of the discharges. The mean age of the group was 58.43 years with a standard deviation of 12.31 years. The range was 65 years, from age 21 years to 86 years. The mode was 64 years and the median was 60 years. Ethnic composition for this DRG consisted of 251 Caucasians (76.1%), 49 African-Americans (14.8%), 22 Hispanics (6.7%), and 8 (2.4%) categorized as Other.

The ALOS for this DRG was 3.6 days with a standard deviation of 2.62 days and a range of 29 days. The mode was 2 days. For those patients originating from within the catchment area the ALOS 3.6 days with a standard deviation of 2.6 days. For those patients originating from outside the catchment area the ALOS was 3.58 days with a standard deviation of 3.04 days. A one-way ANOVA among the means within these two groups indicated that the difference in ALOS was not significant with $F(1, 329) = .005$ and $p = .944$. See Table 4 for an ANOVA summary.

Source	Sum of Squares	df	Mean Square	F	p
Between Groups	.034	1	.034	0.005	0.944
Within Groups	2267.363	328	6.913		
Total	2267.397	329			

Table 4 Summary table of ANOVA analysis of the ALOS for DRG 125 based on catchment area origin (n=330)

For patients discharged under DRG 125 the ALOS for those using the aeromedical evacuation system was 6.4 days with a standard deviation of 1.82 days. The ALOS for patients using other forms of transportation to BAMC was 3.55 days with a standard deviation of 2.61 days. A one-way ANOVA between means for these two groups indicates that the difference in ALOS is significant with $F(1, 329) = 5.874$ and $p = .016$. Table 5 provides a summary of the statistical analysis.

Source	Sum of Squares	df	Mean Square	F	p
Between Groups	39.889	1	39.889	5.874	0.016
Within Groups	2227.508	328	6.791		
Total	2267.397	329			

Table 5 Summary table of ANOVA analysis of the ALOS for DRG 125 based on mode of transportation (n=330)

DRG 209

For DRG 209, major joint and limb reattachment procedures of the lower extremity, there were 137 cases within this group. Gender distribution consisted of 89 females (65%) and 48

(35%) males. The mean age of the group was 63.42 years with a standard deviation of 13.57 years. The range was 70 years (21 - 91 years of age). The mode was 61 years and the median was 64 years. Ethnic composition for this DRG consisted of 117 Caucasians (85.4%), 9 African-Americans (6.6%), 7 Hispanics (5.1%), and 4 (2.9%) categorized as Other.

The ALOS for DRG 209 was 10.1 days with a standard deviation of 5.05 days and a range of 46 days. The mode for this group was 8 days. For those patients originating from within the catchment area the ALOS 9.71 days with a standard deviation of 5.91. For those patients originating from outside the catchment area the ALOS was 10.58 days with a standard deviation of 3.76 days. A one-way ANOVA among the means within these two groups indicates that the difference in ALOS is not significant with $F(1,136) = 1.01$ and $p = .316$. Table 6 provides a summary of the statistical analysis.

Source	Sum of Squares	df	Mean Square	F	p
Between Groups	25.926	1	25.926	1.014	0.316
Within Groups	3450.643	135	25.560		
Total	3476.569	136			

Table 6 Summary table of ANOVA analysis of the ALOS for DRG 209 based on catchment area origin (n=137)

For patients discharged under DRG 209 who used the aeromedical evacuation system the ALOS was 14.86 days with a standard deviation of 3.08 days. The ALOS for patients using other forms of transportation to BAMC discharged under DRG 209 was 9.85 days with a standard deviation of 5.02 days. A one-way ANOVA between these two groups indicates that the difference in ALOS is significant with $F(1, 136) = 6.803$ and $p = .010$. Table 7 provides a

summary of the ANOVA.

Source	Sum of Squares	df	Mean Square	F	p
Between Groups	166.789	1	166.789	6.803	.010
Within Groups	3309.780	135	24.517		
Total	3476.569	136			

Table 7 Summary table of ANOVA analysis of the ALOS for DRG 209 based on mode of transportation (n=137)

DRG 215

DRG 215, back and neck procedures without complications, was comprised of 120 discharges. Gender distribution consisted of 94 males (78.3%) and 26 females (21.7%). The mean age of the group was 37.88 years with a standard deviation of 11.17 years. The range was 53 years (20 - 73 years of age). The mode was 36 years and the median was 36 years. Ethnic composition for this DRG consisted of 92 Caucasians (76.7%), 16 African-Americans (13.3%), 9 Hispanics (7.57%), and 3 (2.5%) categorized as Other.

The ALOS for this DRG was 4.81 days with a standard deviation of 3.03 days. The range was 20 days, the mode was 3 days and the median was 4 days. For those patients originating from within the catchment area the ALOS 4.18 days with a standard deviation of 2.75. For those patients originating from outside the catchment area the ALOS was 5.0 days with a standard deviation of 3.1 days. A one-way ANOVA among the means within these two groups indicates that the difference in ALOS was not significant with $F(1,119) = 1.582$ and $p = .211$. See Table 8 for a summary of the statistical analysis.

Source	Sum of Squares	df	Mean Square	F	p
Between Groups	14.485	1	14.485	1.5820	.211
Within Group	1080.107	118	9.153		
Total	1094.592	119			

Table 8 Summary table of ANOVA analysis of the ALOS for DRG 215 based on catchment area origin (n=120)

For patients discharged under DRG 215 using the aeromedical evacuation system the ALOS was 7.37 days with a standard deviation of 2.64 days. The ALOS for patients using other forms of transportation to BAMC was 4.63 days with a standard deviation of 2.64 days. A one-way ANOVA of the means within these two groups indicates that the difference in ALOS is significant with $F(1, 119) = 6.418$ and $p = .013$. Table 9 provides a summary of the statistical analysis.

Source	Sum of Squares	df	Mean Square	F	p
Between Groups	56.467	1	56.467	6.418	.013
Within Groups	1038.125	118	8.798		
Total	1094.592	119			

Table 9 Summary table of ANOVA analysis of the ALOS for DRG 215 based on mode of transportation (n=120)

The preceding chapter provided a statistical summary of the DRGs evaluated in this study. The chapter covered an analysis of the DRGs as a total sample followed by an analysis of each

individual DRG within this study. This included a review of the demographics of the patients within each DRG and an inferential analysis of the possible influence of catchment area origin and the mode of transportation for each DRG. Table 10 provides a summary of the research questions, hypotheses, and findings of the data analysis.

Research Question	Hypotheses	Data Analysis Findings
#1 Is there a relationship between the distance a patient travels based on catchment area status and LOS at BAMC for inpatient care under DRG 106?	H ₀ - There is no relationship between distance traveled and LOS H _a - There is a relationship between distance traveled and LOS	Accept the null hypothesis. There appears to be no relationship between distance traveled based on catchment area status and LOS for DRG 106.
#2 Is there a relationship between mode of transportation and LOS at BAMC for inpatient care under DRG 106?	H ₀ - There is no relationship between mode of transportation and LOS H _a - There is a relationship between mode of transportation and LOS	Reject the null hypothesis. Accept the alternate hypothesis. There appears to be a relationship between mode of transportation and LOS at BAMC for DRG 106.
#3 Is there a relationship between the distance a patient travels based on catchment area status and LOS AT BAMC for inpatient care under DRG 125?	H ₀ - There is no relationship between distance traveled and LOS H _a - There is a relationship between distance traveled and LOS	Accept the null hypothesis. There appears to be no relationship between distance traveled based on catchment area status and LOS for DRG 125.
#4 Is there a relationship between mode of transportation and LOS at BAMC for inpatient care under DRG 125?	H ₀ - There is no relationship between mode of transportation and LOS H _a - There is a relationship between mode of transportation and LOS	Reject the null hypothesis. Accept the alternate hypothesis. There appears to be a relationship between distance traveled based on catchment area status and LOS at BAMC for DRG 125.

Research Question	Hypotheses	Data Analysis Findings
#5 Is there a relationship between the distance a patient travels based on catchment area status and LOS AT BAMC for inpatient care under DRG 209?	H ₀ - There is no relationship between distance traveled and LOS H _a - There is a relationship between distance traveled and LOS	Accept the null hypothesis. There appears to be no relationship between distance traveled based on catchment area status and LOS for DRG 209.
#6 Is there a relationship between mode of transportation and LOS at BAMC for inpatient care under DRG 209?	H ₀ - There is no relationship between mode of transportation and LOS H _a - There is a relationship between mode of transportation and LOS	Reject the null hypothesis Accept the alternate hypothesis. There appears to be a relationship between distance traveled based on catchment area status and LOS at BAMC for DRG 209.
#7 Is there a relationship between the distance a patient travels based on catchment area status and LOS AT BAMC for inpatient care under DRG 215?	H ₀ - There is no relationship between distance traveled and LOS H _a - There is a relationship between distance traveled and LOS	Accept the null hypothesis. There appears to be no relationship between distance traveled based on catchment area status and LOS for DRG 215.
#8 Is there a relationship between mode of transportation and LOS at BAMC for inpatient care under DRG 215?	H ₀ - There is no relationship between mode of transportation and LOS H _a - There is a relationship between mode of transportation and LOS	Reject the null hypothesis Accept the alternate hypothesis. There appears to be a relationship between distance traveled based on catchment area status and LOS at BAMC for DRG 215.

Figure 10 Summary of research question, hypotheses and statistical analysis for each DRG in the study sample

CHAPTER 4

DISCUSSION

This chapter provides an interpretation of the results of this retrospective, quantitative study. It includes an evaluation of the influence that the mode of transportation which a patient chooses and the distance a patient travels has on LOS at Brooke Army Medical Center. This analysis reviews each of the independent variable's proposed influence on LOS and identifies ongoing issues and efforts related to the particular variable.

This study has two significant findings. The first finding is that patients who use the aeromedical evacuation system have a statistically significant increase in ALOS within the DRGs selected for study. This result was anticipated based on data provided by Foundation Health Federal Services (FHFS), as well as subjective findings noted by the author while researching this topic. Table 11 summarizes the ALOS for patients categorized by mode of transportation to include the differences in ALOS between groups.

DRG	ALOS for Aeromedical Evacuation Patients in Days	ALOS for Non-aeromedical Patients in Days	Difference in ALOS (Days)
106	27.40	15.98	11.42
125	6.40	3.55	2.85
209	14.86	9.85	5.01
215	7.38	4.63	2.75

Table 11 Comparison of ALOS and the difference by DRG for aeromedical evacuation patients versus patients not transported by aeromedical evacuation

It is important to note that the sample size within each DRG for patients aeromedically evacuated was small (5-8). However, the results were consistent and statistically significant within the four DRGs evaluated, and based on the results one could expect similar results for other discharge DRGs for aeromedical evacuation patients. With a total of 523 aeromedical inpatient transfers to BAMC in FY96, this could translate into a significant number of unnecessary bed days.

In researching the factors influencing this increase in LOS a key factor appeared to be inefficiencies in the way aeromedical evacuation patients are managed at the facility level. This includes both prior to admission and after all medically necessary treatment has been provided. When a patient arrives at BAMC through the aeromedical evacuation system as an inpatient transfer they are immediately admitted to an inpatient ward. Due to the fact that TRANSCOMs air assets transfer patients based on a regular flight schedule established in advance and approved based on available flight hours for a fiscal year, and one which does not correspond to any particular medical necessity, patients often arrive well in advance of their scheduled medical procedure or treatment to insure they arrive in time (Ledbetter, 1997). Under the old system of Medical Work Units (MWU) this system was ideal because it allowed the unit or ward to show an increase in MWUs based on the patient census even though the patient received little or no significant medical care. Today, using different metrics, this means additional bed days in which the patient essentially receives no significant therapy or medical treatment and which counts against the facility from a utilization management standpoint.

This same pattern persists when a patient is ready for discharge. The Global Patient

Movement Requirements Center (GPMRC) requires that all necessary care must be completed before a patient can be manifested for an aeromedical evacuation flight (Minter, 1997). This reduces the need to reschedule cancellations and ensures a full complement of patients with each flight. This requires the physician to complete all medically necessary care and then arrange for evacuation back to the referring facility. To accomplish this the patient is allowed to remain in an inpatient status until the day of the scheduled flight. Since most TRANSCOM flights are scheduled on a twice weekly basis to the most common referring facilities this could result in increases of 2-5 days in LOS if the patient is allowed to remain in an inpatient status (Minter, 1997). It may go as high as 7-10 days if a flight is canceled, inclement weather restricts air movement, or if a flight is already full. Based on the inherent nature of these types of conditions it is not surprising that increased LOS were noted for groups of aeromedical evacuation patients in this study. Since the aeromedical evacuation system is worldwide it is highly probable that these conditions exist at many of the referral centers using TRANSCOM's system.

A review of the data (see Table 11) reinforces this conclusion. When comparing DRG ALOS between aeromedical evacuation patients and those using other means of transportation to BAMC the increases fall into a range that would correspond with this observation. DRG 125, DRG 209 and DRG 215 all fall within a 2-5 day increase in ALOS over the ALOS of patients using other means of transportation. DRG 106, coronary bypass with cardiac catheterization, is the exception, with an average increase of 11.42 days. This significant increase in DRG 106 is not adequately explained solely on the basis of the aeromedical evacuation system but may be explained based on a combination of the requirements for DRG 106 and the aeromedical evacuation system. This DRG requires two procedures, the cardiac catheterization and the

coronary bypass graft. These are separate procedures done at separate times, unless they are performed in an emergent manner. Patients using the aeromedical evacuation system are seldom emergent patients. The requirement to arrive well in advance of the scheduled cardiac catheterization, in combination with a potential delay in discharge as described above, could result in an increase of 10-12 days.

During the course of this study the problem of increased LOS for aeromedical evacuation patients was actively addressed by the Utilization Management Branch of the Quality Improvement Service at BAMC. The UM decrement and pressure to improve UM statistics were a driving force in the decision to find ways to reduce LOS. In an effort to minimize LOS, there was a need to develop an alternate location at BAMC where formerly discharged patients could be lodged while awaiting aeromedical evacuation. An underutilized medical ward was converted into a Remain Overnight (RON) facility (see Appendix C for RON SOP). The RON provides a secure sleeping area with shower facilities that requires minimal management and supervision with no additional cost to BAMC or use of nursing services. The Department of Social Work was assigned the responsibility of managing admissions to the RON on a 24 hour basis (see Appendix D for eligibility requirements).

To date this program has been very effective in reducing excessive LOS. It allows physicians to discharge patients knowing adequate, no-cost facilities are available for their patients. Within the first 120 days of its inception the RON housed 89 individuals saving an estimated 733 bed days (Newborn, 1997). Appendix E provides a month-by-month summary and the estimated cost avoidance attributable to the RON. It is important to note that the RON is used for both preadmission and post admission patients but the only formal program established

for aeromedical evacuation patients is for post admission stays as part of the discharge planning process. To date no formal review system is in place to screen each aeromedical evacuation patient prior to admission to determine the medical necessity of the admission. The nursing bed manager attempts to accomplish this but it is done in an ad hoc manner and is accomplished on a time-available basis (Neely, 1997).

A secondary outcome as a result of the creation of the RON is a reduction in Temporary Duty (TDY) costs to a sending unit. Under normal circumstances, when a patient is sent to a medical referral center in an outpatient status, or if the patient is changed from an inpatient status to outpatient status, the soldier's military unit is required to pay all TDY costs associated with the out-of-hospital experience, such as lodging and meals. With the RON, soldiers are provided living quarters at no cost to the unit and meals are available within the dining facility at BAMC for meal card holders. This results in no cost to the military unit for those patients that qualify to use the RON service.

The second finding of the study is that the distance a patient travels to receive inpatient care does not appear to influence the LOS within the DRGs analyzed here. These results were not expected. Based on studies identified in the literature review and information provided by FHFS it was anticipated that an increase in length of stay for out-of-catchment area patients would be statistically significant. This study did not substantiate that belief and within one DRG actually showed an opposite influence. Table 12 summarizes in- and out-of-catchment area ALOS and displays the differences between these two groups. Based on the uniqueness of BAMC's patient population, with a large retiree population and the large geographic area from which they originate, it is difficult to determine if these results would be similar in other military medical

referral centers.

DRG	In-Catchment Area ALOS in Days	Out-of-catchment Area ALOS in Days	Difference in ALOS in Days
106	16.40	17.46	1.06
125	3.61	3.59	-.02
209	9.71	10.58	1.27
215	4.18	5.00	.82

Table 12 Comparison of ALOS and the difference by DRG for in-catchment and out-of-catchment area patients

If LOS can be used as a measure of resource utilization it can be concluded that there is no difference in the cost of providing care for both in-catchment and out-of-catchment area patients. This is an important finding in light of impending changes in the method for funding MTFs. Beginning in FY98 OASD(HA) will begin a new form of Defense Health Program Fund resource allocation called Enrollment Based Capitation (EBC). Under EBC, funding for each MTF will be based on the number of TRICARE Prime enrollees with a Primary Care Manager at that MTF. The intent of this budget methodology is to hold MTF commanders accountable for all resources used by the enrolled population and to provide an incentive to encourage the beneficiary population to enroll and receive high quality, appropriate, and cost-effective healthcare.

Under EBC any health care services delivered to an MTF's enrollee outside the MTF must be purchased by that MTF regardless of whether the organization providing the care is another MTF. For BAMC, this means out-of-catchment area referral and transfer patients who are enrolled under another MTF and receive care at BAMC will serve as potential revenue sources if BAMC is able to provide quality care at or below the established reimbursement price. On the other hand, referral and transfer patients not enrolled under TRICARE Prime would receive a

lower reimbursement rate and potentially serve as cost centers. This will result in a loss of revenue for BAMC and similar referral centers. The actual results of such a reimbursement system remains to be seen however, knowing that little difference in resource demands exist between out-of-catchment and in-catchment area patients will aid in the management of these patients and in the decision making process.

This chapter provided an interpretation of the results of this study. It determined that the influence of distance, based on catchment area status of the patient, was not significant based on the DRGs studied. Based on the sample analyzed this study was not able to extrapolate these results to other DRGs. This study also strongly indicates that patients using the aeromedical evacuation system do have significantly increased LOS and based on these results one could assume that if other DRGs were studied similar results would be found.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

The purpose of this study was two fold. First, it attempted to answer the question does mode of transportation, based on aeromedical evacuation status, increase the LOS at BAMC and second, does the distance a patient travels to receive treatment, based on catchment area status, increase the LOS at BAMC? Based on both objective data obtained through accepted research and statistical methods and subjective observations through personal observation, the conclusions of this study clearly indicate that patients who use the aeromedical evacuation system do have longer LOS than those using other means of transportation. This study also concludes based on statistical analysis of the DRGs researched in this study that catchment area status appears to have little or no influence on a patient's LOS at BAMC.

As mentioned in Chapter 4, formal efforts are already in place to address the increase in LOS associated with the aeromedical evacuation patient after they are admitted to the facility and have completed all necessary medical care. For these post-admission patients appropriate discharge planning and use of the RON is effectively reducing unnecessary bed days.

A recommendation of this study is that a formal preadmission screening process be implemented to reduce unnecessary or early admissions of aeromedical evacuation patients. This would involve a multi disciplinary approach requiring physician, nursing staff, and patient administration personnel to assess the medical necessity and the timeliness of all aeromedical

evacuation patient admissions. No recommendation for the actual delegation of responsibility is made in this paper but key points that must be addressed are as follows. A daily review of the patient manifest would be required to identify inpatient transfers. This would involve determining which patients arriving on a flight are slated as inpatients and determine who the admitting physician is. All patients manifested as inpatient transfers must have an admitting physician (Minter, 1997). The admitting physician would be notified of the patients scheduled arrival and would have to determine if the patient requires immediate admission or, based on the scheduled medical procedure or treatment, could be deferred to the RON until the appropriate time for treatment. Using this process would serve to effectively reduce LOS associated with unnecessary or early admissions, reduce TDY costs for military units, and provide an efficient, customer friendly method of screening and managing patients prior to their arrival.

In addition this study recommends that each incoming class of GME receive a formal inbrief regarding the use of the RON service and the proposed formal review process required for each aeromedical evacuation inpatient. This could effectively reduce resistance to the review process and inform physicians of an option for early discharge or deferred admission.

Based on the results of this study no recommendations are made regarding the management of patients arriving from outside the local catchment area. Since this study demonstrates no significant difference in LOS between in- and out-of-catchment area patients, methods of reimbursement based on future EBC requirements and the needs of GME programs will be the driving force in effectively managing these patients.

As the managed healthcare environment evolves and the Military Health Services System evolves with it, management decisions will be based on a balance of quality, access and cost. This

study attempted to address two issues associated with the cost aspect of that triad based on LOS. By better understanding the aspects of mode of transportation and the relationship of distance on LOS at Brooke Army Medical Center, healthcare managers can make better decisions based on maximizing returns on investment and finding optimal solutions.

APPENDIX A

LIST OF ABBREVIATIONS

ALOS	Average Length of Stay
AMEDD	U.S. Army Medical Department
AMI	Acute Myocardial Infarction
ANOVA	Analysis of Variance
BAMC	Brooke Army Medical Center
CHAMPUS	Civilian Health and Medical Program of the Uniformed Services
CHCS	Composite Health Care System
CSI	Computerized Severity Index
DMRIS	Defense Medical Regulating Information System
DRG	Diagnosis-Related Group
DoD	Department of Defense
FHFS	Foundation Health Federal Services
FY	Fiscal Year
GAO	Government Accounting Office
GME	Graduate Medical Education
GPMRC	Global Patient Movement Requirements Center
GPRMC	Great Plains Regional Medical Command

ICD-9	International Classification of Disease
LOS	Length of Stay
M	Million
MMC	Meridian Managed Care
MEDCOM	U. S. Army Medical Command
MHSS	Military Health Services System
MTF	Medical Treatment Facility
MWU	Medical Work Unit
NIHCM	National Institute for Health Care Management
OASD(HA)	Office of the Assistant Secretary of Defense for Health Affairs
PASBA	Patient Administration System and Biostatistical Activity
PPS	Prospective Payment System
RCMAS	Retrospective Case-Mix Analysis System
RON	Remain Overnight Service
SOP	Standard Operating Procedures
SPSS	Statistical Package for the Social Sciences
TDY	Temporary Duty
TRANSCOM	United States Transportation Command
UM	Utilization Management

APPENDIX B

DEFINITION OF TERMS

Average Length of Stay - total occupied bed days divided by total number of dispositions

CHAMPUS - a DoD administered insurance-like program for military service members and their families.

Catchment Area - a geographic area, usually within a 40 mile radius, which represents the area an MTF supports for medical care

Composite Health Care System - an inpatient database providing patient information

Defense Medical Regulating Information System - a database system used by GPMRC for tracking aeromedical evacuation on patients evacuated through the aeromedical evacuation system.

Diagnosis Related Groups (DRG) - a statistical system of classifying any inpatient stay into groups for the purpose of payment.

Enrollment Based Capitation(EBC) - a system in which the distribution of Defense Health Program Funds to military services is based primarily on the number of enrollees at each services' MTF, and creates incentives for decisions at every level for high quality, cost-effective, and clinically appropriate health care services.

Global Patient Movement Requirements Center (GPMRC) - a joint service agency located at Scott Air Force Base responsible for regulating the movement of patients within TRANSCOMs aeromedical evacuation system.

Length of Stay (LOS) - the duration, in days, of a hospital stay, excluding the day of discharge.

Medical Expense and Performance Reporting System (MEPRS) - a uniform expense and manpower reporting system in Department of Defense fixed military medical and dental treatment facilities that provides standardized expense and manpower data for management of health care resources.

Military Health Services System (MHSS) - the military health care system that provides health care to active duty service personnel in both peacetime and wartime settings. It also provides health care services to non-active duty beneficiaries through MTFs, clinics and CHAMPUS.

Patient Administration System and Biostatistical Activity II (PASBA II) - a second generation inpatient data retrieval program which contains the standard inpatient record

TRICARE - a DoD managed care program offering military beneficiaries a choice of three health care benefit packages that include TRICARE Prime (health maintenance organization), TRICARE Extra (preferred provider organization), and TRICARE Standard (point of service).

United States Transportation Command (TRANSCOM) - the DoD single manager for the implementation of policy and the standardization of procedures and information support systems for intertheater medical regulating of patients

APPENDIX C

SOP FOR REMAIN OVERNIGHT SERVICE

MCHE-ZX

9 December 1996

SUBJECT: Standing Operating Procedure (SOP) for the Remain Overnight Service (RON-Service)

1. **PURPOSE.** To establish procedures and policies regarding the operation and use of the RON Service.
2. **GENERAL.** The goal of the RON Service is to provide individuals (usually outpatients) with temporary lodging when appropriate. This determination will be made by a representative of the Department of Social Work (Depart of SW).

The goal should be accomplished by treating each individual in a caring fashion. This service is intended to promote and maintain the positive image of BAMC while considering individuals who are eligible for care at our facility.

3. **CONCEPT OF OPERATION.**

a. **Background.** The RON Service is intended to provide temporary lodging for those individuals who are in an outpatient status, just discharged, who are awaiting outpatient procedures, MEDEVAC, and who have been screened (using Dept of SW SOP) by a representative of Dept of SW to determine whether the patient meets the criteria for lodging (usually the main criteria will be financial hardship).

b. In most cases, assessment interviews will be conducted during normal duty hours: 0730-1630, Monday through Friday. In cases of weekends and after duty hours, assessment interviews will be conducted by the on-call social worker. During other than duty hour periods,

MCHE-ZX

SUBJECT: Standing Operating Procedure (SOP) for the Remain Overnight Service (RON Service)

the first point of contact will be the AOD who will in turn notify the on-call social worker.

c. The social worker will consult with the patient's primary physician as appropriate, and with Patient Administration Division (PAD) when necessary. In the case of a disagreement as to whether the individual should be lodged in the service or not and when there are no other reasonable alternatives, the individual will be housed for the night and the issue will be resolved the next day.

d. This service is intended to provide lodging only. Individuals who are provided lodging must be capable of taking care of themselves, to include food and transportation. The intent of this service is to house individuals who are eligible for care at BAMC, not family members or significant others who accompany the individuals.

e. This service will be filled on a first come, first served basis, after the patient has arrived on post and has been evaluated by the Dept of SW. A waiting list will not be established. Individuals will not be asked to leave the service in order to make room for another individual. Usually, reservations will not be made prior to the arrival of the individual and assessment by the social worker.

f. There will be no changes or modifications allowed to 6E or to equipment/property located on 6E that would prevent its return to use as an inpatient ward.

g. Length of Stay: Generally individuals will be on this service for a minimal time (less than 5 days). Individual situations that result in a person staying in excess of 5 days will be reviewed by the BAMC Utilization Management Committee for appropriateness.

h. Individuals who are assigned to the RON Service are responsible for security of their own personal effects to include any valuables.

4. RESPONSIBILITIES.

a. Commander, Troop Command

(1) The Commander, Troop Command, has responsibility for administrative (inn keeper issues) matters. This includes development of appropriate procedures in coordination with Chief, Dept of SW for registration of guests during duty hours, issuance of linens and hand receipts as appropriate, and staffing of the front desk during duty hours (0730-1630, Monday through Friday).

MCHE-ZX

SUBJECT: Standing Operating Procedure (SOP) for the Remain Overnight Service (RON service)

(2) Will identify an individual to be hand receipt holder for equipment and property that remains on 6E. Will identify procedures to be used during duty hours and other periods for the issuance of linens, hand receipts, and effect appropriate coordination for AOD/SDNCO instructions.

(3) Will coordinate with Chief, Dept of SW for the occupation of certain rooms on 6E by the Troop Command companies for the purpose of providing administrative support to BAMC military personnel. This support will include the ability to conduct routine business of processing leaves, TDY, etc., at the hospital and thereby saving time and hassle for BAMC personnel.

(4) Will provide front desk coverage for the RON Service during duty hours.

(5) Will make necessary coordination for a smooth transition of responsibility for administrative matters concerning the RON Service from duty hours to nonduty hours by developing and putting in place a simple procedure for AOD/SDNCO personnel.

(6) Even when there are no residents on the RON Service, the companies will have their offices staffed and services available during the scheduled hours. (Troop Command will establish and publish these hours. Some adjustments will be made to determine reasonable service hours for both staff and the company personnel.) The front desk will be staffed during duty hours (0730-1630, Monday through Friday).

b. Chief, Dept of SW.

(1) Is responsible for developing an internal SOP that the social workers will use to assess all individuals who are referred to them to determine if they should be housed in the RON Service.

(2) In most cases, assessment interviews will be conducted during normal duty hours. In the case of individuals who present during other than duty hours, the on-call social worker will be contacted by the AOD to conduct the necessary assessment.

(3) Will consult with clinical staff as appropriate to further refine the assessment process and to work on issues concerning individual patients. Will work with the Chief of PAD to provide feedback concerning issues resulting from MEDEVAC system.

(4) Will maintain logs of individuals assigned to the RON Service and will report on the use

MCHE-ZX

SUBJECT: Standing Operating Procedure (SOP) for the Remain Overnight Service (RON service)

of this service to the Utilization Management Committee.

c. Chief, Logistics Division.

(1) Will assist in expediting the turn in of equipment and property on 6E and the assignment of a new hand receipt to the representative from Troop Command.

(2) Will coordinate for the adjustment to the housekeeping schedule for 6E from inpatient standards to the appropriate standard.

(3) Will assist the Troop Command representative in setting up a process for handling and issuance of linen, hand receipts, etc.

(4) Will assist the Adjutant in relocation of the AOD sleep room from the present location to 6E.

d. Center JAG.

(1) Will develop form(s) as appropriate for residents to fill out reference liability, security, and responsibility.

(2) Will review SOP and the operation of the RON Service from a legal sufficiency standpoint and advise the Commanding General on any related matters.

e. Chief, PAD.

(1) Will coordinate as appropriate with clinical staff to include Chief, Dept of SW concerning MEDEVAC patients.

(2) Will provide feedback and education to regional hospitals concerning any inappropriate categorization of MEDEVAC patients.

f. Chief, Department of Nursing. Will ensure wide dissemination of information of the RON Service and its intended purpose among the nursing staff. This does not constitute a change in handling of patients who are being discharged.

g. Chief, Department of Clinical Operations. Will ensure wide dissemination of information of the RON Service and its intended purpose among the clinical staff. This does not constitute a change in the decision process to admit or discharge a patient, but it may allow BAMC clinical

MCHE-ZX

SUBJECT: Standing Operating Procedure (SOP) for the Remain Overnight Service (RON Service)

staff to give closer attention to Utilization Management concerns.

5. The RON Service is being provided on a trial basis starting on Monday, 9 December 1996. The trial will last approximately 90 days. The test phase will end on Monday, 10 March 1997, if not terminated sooner due to circumstances not currently known. At the end of the trial, the concept will be reviewed to determine if BAMC should continue with the RON Service or not.

6. Changes or recommendations for improvement of this SOP should be directed to the BAMC Chief of Staff. All personnel involved with the implementation of the RON Service should attempt to resolve issues at the lowest level possible and with the patient in mind.

JOSEPH P. GONZALES
Colonel, MS
Chief of Staff

APPENDIX D

SOP FOR ELIGIBILITY FOR RON

MCHE-SW (loo)

25 November 1996

SUBJECT: Standing Operating procedure: Eligibility for Remain Overnight Service

1. Purpose. To establish procedures and policies regarding eligibility for the Remain Overnight Service and the role of Department of Social Work with respect to patients requesting lodging.
2. Goal. The goal is to provide patients quality social work services to include temporary lodging that contributes positively to the patient's emotional well-being.
3. Types of Support. The Department of Social Work will provide the following types of support and services:
 - a. Screen patients for admission to Remain Overnight Service.
 - b. Provide counseling and support to patients while receiving outpatient care at BAMC.
 - c. Provide intervention and assistance in the event patient's status changes from outpatient to inpatient.
 - d. Provide assistance after duty hours through social work on-call services.
4. Referral Process for Lodging to Remain Overnight Service.

The Remain Overnight Service will accept BAMC outpatients only upon referral of a Department of Social Work staff member in consultation with the patient's primary physician or patient Administration Division. The staff member will complete an assessment interview to determine whether the patient meets the criteria for lodging. If the criteria are met, the social worker will ask the patient to complete an application form and sign a liability statement. The patient must be experiencing some emotional or financial hardship and not receiving reimbursement for travel expenses from the military or other sources. In most cases, assessment interviews will be

MCME-SW

SUBJECT: Standing Operating Procedure: Remain Overnight Service

conducted during normal duty hours: 0730 to 1630, Monday through Friday. In emergency cases on weekends and after duty hours, assessment interviews will be conducted by the on-call social worker. During the weekends and after duty hours, the first point of contact will be the AOD who, in turn, will notify the on-call worker.

5. Criteria for Lodging. Patients receiving TDY funds are not eligible to stay at the Remain Overnight Service. Although financial need is a primary consideration, eligibility of a patient will not be solely based on financial need. The Remain Overnight Service is open to all outpatients who have traveled over 75 miles and their appointment or surgery has been canceled at BAMC. All Department/services at BAMC can consider the Remain Overnight Service as an option for their patients. There will be no waiting list, and the Remain Overnight Service will be filled on a first come, first serve basis after the patient has arrived on post and has been evaluated by the Department of Social Work. Special consideration will be given to a parent of a patient if it is a minor child. The Remain Overnight Service is intended to provide a caring, emotionally supportive, and comfortable atmosphere for outpatients who are authorized care at BAMC. Eligibility for the Service will be based on the medical condition of the patient. Under no circumstances will a patient be asked to leave the Service in order to make room for another patient. Examples of eligibility for the Remain Overnight Service are listed as follows:

- a. Patients who arrive via the MEDEVAC system or who live more than 75 miles away from BAMC and have no resources in the San Antonio area and arrives as an inpatient and is discharged when they arrive at BAMC to an outpatient status.
- b. Patients who are waiting for their return MEDEVAC flight.
- c. HIV patients who are being staged and live more than 75 miles from BAMC and who have no resources in the San Antonio area.
- d. Cancer patients who live more than 75 miles away from BAMC and have no resources in the San Antonio area.
- e. Patients who live more than 75 miles away from BAMC and who have no resources in the San Antonio area and had their same day surgery appointment canceled.
- f. Heart transplant patients who live more than 75 miles away from BAMC and who have no resources in the San Antonio area.
- g. Single soldiers living in the barracks that are placed on quarters.

MCHE-SW

SUBJECT: Standing Operating Procedure: Remain Overnight Service

7. Length of Stay. Patients staying in excess of 5 days will be reviewed by the BAMC Utilization Manager for appropriateness. However, the NCOIC of the Remain Overnight Service reserves the right to ask violators of Service rules, to find other lodging. The Service is not available to outpatients' families and significant others.

8. Transportation to and from BAMC. Transportation to and from BAMC except for MEDEVAC is the responsibility of the patient.

JESSE P. NEWBORN
COL, MS
Chief, Department of Social Work

APPENDIX E

SUMMARY DATA FOR REMAIN OVERNIGHT SERVICE

Occupancy Rate First 30 Days (9 Dec 96- 7 Jan 97)	29 / 30 days = .96 /day
Occupancy Rate Second 30 Days (8 Jan - 6 Feb 97)	276 / 30 days = 9.2/day
Occupancy Rate Third 30 Days (7 Feb- 8 Mar 97)	220 / 30 days = 7.33/day
Occupancy Rate Fourth 30 Days (9 Mar -7 Apr 97)	208 / 30 days = 6.93/day
Average Occupancy/Day in First 120 Days	733 / 120 days = 6.11/day

Number of Remain Overnight Services Occupied Days	733
Number of Individuals Using Remain Overnight Service	89
Average Length of Stay	8.24 Days

The following information is based on the estimated cost of an occupied bed day provided by MEPRS using FY97 statistics through February 1997.

Computed Average Cost of One Inpatient Day	\$1315
Number of Remain Overnight Service Occupied Days	733
Total Cost of Inpatient Bed days Based on Average Bed day Cost	\$963,895
Remain Overnight Service Operating Cost Thru Apr 97	\$1000
Possible Cost Avoidance in First 120 Days	\$962,895

REFERENCES

- Angell, Marcia. "How Much Will Health Care Reform Cost." Journal of the American Medical Association 328 (1993): 1778-1781.
- Ash, Arlene. "The Design and Analysis of Hospital Utilization Studies." International Journal of Quality in Health Care 7 (September 1995): 245-52.
- Baigelman, Walter, Leisa Weld and John S. Coldiron. "Relationship Between Practice Characteristics of Primary Care Internists and Unnecessary Hospital Days." American Journal of Medical Quality 9 (Fall 1994): 122-8.
- Berman, R.A., D. Green, D. Kwo, K.F. Safian, and L. Botnick "Severity of Illness and the Teaching School." Journal of Medical Education 61 (January 1986): 1-9.
- Connor, Susan B. And Terence J. Lyons. "U.S. Air Force Aeromedical Evacuation of Obstetric Patients in Europe." Aviation, Space and Environmental Medicine 66 (November 1995): 1090-4.
- Fetter, Robert B. "Hospital Payment Based on Diagnosis-Related Groups." Journal of the Society for Health Systems 3 (1992): 4-15.
- _____ 1991. DRGs: Development and Application (Ann Arbor, Michigan: Health Administration Press)
- Friedman, E. "Health Care's Changing Face: The Demographics of the 21st Century." Hospitals 7 (1991): 36-40.
- General Accounting Office. "Federal Efforts to Enhance Patient Quality of Care." GAO/HEHS-96-20 (April 10, 1996): 1-16.
- Ginsburg, Paul B. and Jeremy D. Pickreign. "Tracking Health Care Costs." Health Affairs 15 (Fall 1996): 140-149.
- Glick, Dean F. "DRGs: From Development to Application in the Department of Defense." Military Medicine 154 (May 1989): 255-9.

Global Patient Movement Requirements Center, Scott Air Force Base, ad hoc report dated 18 Dec 1996.

Gordon, Toby A., Gregg P. Burleyson, James M. Tielsch, and John L. Cameron. "The Effects of Regionalization on Cost and Outcome for One General High-Risk Surgical Procedure." Annals of Surgery 221 (January 1995): 43-49.

Griffith, John R. 1995. The Well-Managed Health Care Organization (Ann Arbor, Michigan: AUPHA Press).

Hanna, Vera. Personal interview by author, 20 February 1997.

Horn, Susan D., Phoebe D. Sharkey, Angela F. Chambers and Roger A. Horn. "Severity of Illness Within DRGs: Impact of Prospective Payment." American Journal of Public Health 75 (1985): 1195-9.

Horn, Susan Dadakis, Phoebe D. Sharkey, June M. Buckle, Joanne E. Backofen, Richard F. Averill and Roger A. Horn. "The Relationship Between Severity of Illness and Hospital Length of Stay and Mortality." Medical Care 29 (1991): 305-17.

Jecker, N.S. and L.J. Schneiderman. "Futility and Rationing." The American Journal of Medicine 92 (1992): 189-196.

Jehlik, Paul J. And Robert L. McNamara. "The Relationship of Distance to the Differential Use of Certain Health Personnel and Facilities and to the Extent of Bed Illness." Rural Sociology 17 (1952): 261-265.

Jencks, Stephen F. and Joel D. Bobula. "Does Receiving Referral and Transfer Patients Make Hospitals Expensive?" Medical Care 26 (October 1988): 948-57.

Joseph, Stephen C. Memorandum from the Office of the Assistant Secretary of Defense for Health Affairs dated 23 November 1994. Subject: Utilization Management (UM) Activities in the Direct Care System under TRICARE.

Kennedy, Betty R. Point Paper SUBJECT: Aeromedical Evacuation Historical Precedents. Headquarters, Air Mobility Command, September 1996.

Lagnado, Lucette. "Hospitals Profit by 'Upcoding' Illnesses." Wall Street Journal (17 April 1997): B1.

- Lanier, J. and C. Boone. "Restructuring Military Health Care: The Winds of Change Blow Stronger." Hospital Health Services Administration 38 (1993): 121-132.
- Ledbetter, Brenda. Personal interview by author, 14 March 1997.
- Levit, K. "National Health Spending Trends, 1960-1993." Health Affairs 13 (Winter 1994): 14-31.
- Loader, Michael. Personal interview by author, 21 February 1997.
- Maddy, John L. Memorandum from the Office of the Assistant Secretary of Defense for Health Affairs, Chairman, Resource Management Steering Committee dated 6 Aug 1996.
Subject: Results of Utilization Management Tiger Team Findings/Recommendations.
- Mayer, John D. "The Distance Behavior of Hospital Patients: A Disaggregated Analysis." Social Science and Medicine 17 (1983):819-27.
- McGee, William M. and Ronald P. Hudak. "Reengineering Medical Treatment Facilities for TRICARE: The Medical Group Practice Model." Military Medicine 160 (May 1995): 235-9.
- McGuirk, Marjorie A. And Frank W. Powell. "Spatial Patterns and Hospital Utilization: The Impact of Distance and Time." Inquiry 21 (Spring 1984): 84-95.
- McMahan, Dortha. Personal interview by author, 18 February 1997.
- Minter, Kelly. Personal interview by author, 17 April 1997.
- National Institute for Health Care Management. "Medicaid Managed Care Facts." NIHCM Fact Sheet (February 1995).
- Neely, Constance. Personal interview by author, 21 May 1997.
- Nelson, Mary F. And Richard Christenson. "The Focused Review Process: A Utilization Management Firm's Experience With Length of Stay Guidelines." Journal on Quality Improvement 21 (Sep 1995): 477-87.
- Newborn, Jesse. Personal interview by author, 12 May 1997.
- Norusis, Marija J. 1995 SPSS 6.1 Guide to Statistical Analysis (Engelwood Cliffs, New Jersey: Prentice Hall, Inc.)

- Payne, Susan M., Deirdre Campbell, Barbara G. Penzias and Elinor Sochowitzky, "New Methods for Evaluating Utilization Management Programs." Quarterly Review Bulletin 18 (October 1992): 340-7.
- Prospective Payment Assessment Commission (PPAC). 1995. Medicare and the American Health Care System/Report to Congress Washington, D.C.:Government Printing Office.
- Restuccia, Joseph D. "The Evolution of Hospital Utilization Review Methods in the United States." International Journal of Quality in Health Care 7 (September 1995): 253-60.
- Rhodes, Robert S., Phoebe D. Sharkey and Susan D. Horn. "Effect of Patient Factors on Hospital Costs for Major Bowel Surgery: Implications for Managed Health Care." Surgery 117 (1995): 443-50.
- Shannon, Gary W., G.E. Alan Dever. 1974. Health Care Delivery: Spatial Perspectives (New York: McGraw-Hill, Inc.).
- Shannon, Gary W., Rashid L. Bashshur, and Charles A. Metzner. "The Concept of Distance as a Factor in the Accessibility and Utilization of Health Care." Medical Care Review 26 (1969): 143-161.
- Sonnefeld, Sally T. "Projections of National Health Expenditures Through the Year 2000." Health Care Finance Review 13 (1991): 1-15.
- Stock, R. "Distance and the Utilization of Health Facilities in Nigeria." Social Science and Medicine 17 (1983):563-70.
- Studnicki, James. "The Minimization of Travel Efforts As A Delineating Influence For Urban Hospital Service Areas." International Journal of Health Services 5 (1975): 679-693.
- Utilization Management Committee Meeting Minutes. 20 November 1996.
- Wade, Terence P., Issam A. Halaby, Diane R. Stapleton, Katherine S. Virgo and Frank E. Johnson. "Population-based analysis of treatment of pancreatic cancer and Whipple Resection: Department of Defense Hospitals 1889-1994." Surgery 120 (October 1996): 686-7.
- Welch, H. Gilbert, Eric B. Larson, and W. Pete Welch. "Could Distance Be a Proxy for Severity of Illness? A Comparison of Hospital Costs in Distant and Local Patients." Health Services Research 28 (Oct 1993): 441-58.

Williams, Duke R., William Cahill, D. Braendel and R. Mercer. "Unit Cost Resourcing in the Military Health Services System: Concepts and Realities. Armed Forces Comptroller (Winter 1994): 25-28.

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY <i>(Leave blank)</i>	2. REPORT DATE JULY 1997	3. REPORT TYPE AND DATES COVERED FINAL REPORT (7-96 TO 7-97)	
4. TITLE AND SUBTITLE A STATISTICAL ANALYSIS OF THE RELATIONSHIP OF DISTANCE AND MODE OF TRANSPORTATION ON LENGTH OF STAY AT BROOKE ARMY MEDICAL CENTER		5. FUNDING NUMBERS	
6. AUTHOR(S) MAJ JOHN P. HAGEN, MS			
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) BROOKE ARMY MEDICAL CENTER FORT SAM HOUSTON, TX		8. PERFORMING ORGANIZATION REPORT NUMBER 3 -97	
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) US ARMY MEDICAL DEPARTMENT CENTER AND SCHOOL BLDG 2841 MCCS-HRA (US ARMY-BAYLOR PROGRAM IN HCA) 3151 SCOTT RD SUITE 1411 FORT SAM HOUSTON TEXAS 78234-6135		10. SPONSORING / MONITORING AGENCY REPORT NUMBER	
11. SUPPLEMENTARY NOTES			
12a. DISTRIBUTION / AVAILABILITY STATEMENT APPROVED FOR PUBLIC RELEASE; DISTRIBUTION IS UNLIMITED		12b. DISTRIBUTION CODE	
13. ABSTRACT <i>(Maximum 200 words)</i> This retrospective quantitative study examined the relationship of distance, measured based on catchment area status, and mode of transportation, measured based on the use of the U.S. Transportation Command's (TRANSCOM) aeromedical evacuation system, to determine their influence on length of hospital stay at Brooke Army Medical Center in FY96 in order to better understand the impact these patients have on utilization management. Based on criteria driven selection of four discharge Diagnosis Related Groups (DRGs), patient records (n=657) were selected for review. Based on statistical analysis, this study determined that increases in LOS for patients using the aeromedical evacuation system were statistically significant when compared to patients arriving at BAMC by other means. These results were expected. This study also determined that LOS for patients coming from outside the local catchment area did not have statistically significant increases in LOS when compared to those from within the local catchment area. Based on the literature review and subjective observations, these results were not anticipated. This study recommends establishing a preadmission assessment process for all inpatient transfers coming to BAMC via the aeromedical evacuation system to determine the need for admission based on physician assessment. In addition, continued use of the Remain Overnight (RON) service as a means to reduce LOS in aeromedical evacuation patients is highly recommended. No recommendations for change were made regarding out-of-catchment area patient management. Based on the results of this study, out-of-catchment area patients appear to have similar utilization patterns based on the LOS as patients from within the catchment area.			
14. SUBJECT TERMS UTILIZATION MANAGEMENT, U.S. TRANSPORTATION COMMAND'S AEROMEDICAL EVACUATION SYSTEM; DIAGNOSIS RELATED GROUPS		15. NUMBER OF PAGES 62	16. PRICE CODE N/A
17. SECURITY CLASSIFICATION OF REPORT UNCLASSIFIED	18. SECURITY CLASSIFICATION OF THIS PAGE UNCLASSIFIED	19. SECURITY CLASSIFICATION OF ABSTRACT UNCLASSIFIED	20. LIMITATION OF ABSTRACT UNLIMITED