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This research analyzed the effects of Major Diagnostic Category Groups upon Total Sick Days associated with specific diagnoses for inpatients at Ireland Army Community Hospital. Data were collected from the Individual Patient Data System. Regression analysis was used to test the effects of MDCGs upon TSDs while controlling for the effects of time and gender. Results strongly suggest that MDCGs significantly affect TSDs (R squared = .57) while in the presence of time and gender controls, $F(15, 255) = 22.17$, p .001. These results indicate that MDCGs can be used to predict TSDs for an active duty military population with true validity and reliability. Military Treatment Facility Commanders can use this information to assess the current inpatient portion of health status for the military population the MTF serves. Additionally, Commanders can use the predictive power of this model in developing essential information for improving resource allocation decisions and organizational workload management.

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In Partial Fulfillment of the

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of

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by Captain Thomas C. Clines, MS

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Acknowledgments

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Abstract

Assessing the health status of an active duty military population is extremely difficult. One variable that contributes to a population's health status is the total number of sick days the population experiences. The purpose of this study is to determine what set of criteria Medical Treatment Facility (MTF) Commanders can use to estimate total sick days an active duty military population will accumulate over a given period of time. This problem is significant for development of possible improvements in the health of the population, more efficient health care delivery and resource allocation, and increased military and medical unit readiness.

This research analyzed the effects of Major Diagnostic Category Groups (MDCGs) upon Total Sick Days (TSDs) associated with specific diagnoses for inpatients at Ireland Army Community Hospital. Data were collected from the Individual Patient Data System (IPDS) maintained by the United States Army Patient Administration Systems and Biostatistics Activity, Fort Sam Houston, Texas. Regression analysis was used to test the effects of MDCGs on TSDs while controlling for the effects of time and gender.

Results strongly suggest that MDCGs significantly affect TSDs ($R^2 = .57$) while in the presence of time and gender controls, $F(15, 255) = 22.17$, $p < .001$. These results indicate that MDCGs can be used to predict TSDs for an active duty military population with true validity and reliability. MTF Commanders can use this information to assess the current inpatient TSD portion of health status for the military population the MTF serves. Additionally, Commanders can use the predictive power of this model in developing essential information for improving resource allocation decisions and organizational workload management.

CHAPTER 1

Introduction

Conditions Which Prompted the Study

The costs of providing health services to authorized beneficiaries by the Department of Defense (DOD) have experienced the same steep increases in the last decade as have been witnessed in civilian health care facilities. Decisions made by top DOD management executives relative to the allocation and utilization of scarce health care resources, must be predicated on timely and relevant information regarding the health status of the population served. Such sophisticated reliable health status information about active duty military populations is currently unavailable. If valid and reliable health status information pertinent to active duty military populations could be obtained it would prove valuable to health care administrators in a variety of ways.

Primarily, health status information should be utilized to better assess the overall health status of a population at any given point in time. Health care administrators can utilize such information to manage health care resources more efficiently and effectively. In addition, DOD Medical Treatment Facility (MTF) Commanders would possess an instrument to better predict a population's future health status and determine the appropriate amount of resources required to provide sufficient quality health care.

Efficient management of valuable health care resources alone is sufficient reason to warrant further investigation of the determinates of population health status indicators. However, additional incentive for identifying variables to predict a population's future health is established by the technological explosion health care delivery has experienced. According to Austin (1989) "information technology has just begun to influence the way we do business in the health services industry" (p. 159). Technological advances in information management experienced during the past decade demand that appropriate information use be undertaken. Research on the determinants of a population's health status using information heretofore unavailable, would represent an effort to proactively contribute to improved health care resource management and increased health care quality.

Statement of the Problem

The assessment of the general health status of an active duty military population is a primary responsibility of the MTF Commander. To accurately measure and evaluate the health status of any population is extremely difficult due to the lack of an acceptable definition of health status and the great number of individual variables which can effect the subject population's overall health. MTF Commanders are best positioned to assess the health status of an active duty military population given a standard set of acceptable criteria. Is there such a set of health status assessment factors which can assist MTF Commanders to validly and reliably measure and evaluate the health status of an active duty population?

One variable that contributes to a population's health status is the Total number of Sick Days (TSDs) the population experiences over a period of time. The problem of this study is to determine what standard set of criteria best reflects the TSDs experienced by an active duty military population. This problem is significant in light of possible improvements in the health of the active duty population, in increased efficiency of the health care delivery system, in more effective health care resource allocation, and in improved medical and military organizational readiness. If such a set of criteria exist, MTF Commanders will be better able to accurately describe, explain, predict and control the TSDs of the active duty military population they serve.

Literature Review

Mortality and morbidity as health status indicators

The feasibility and practicality of developing methods to quantify and describe the health status of a specific population has been addressed by a multitude of authors. Moriyama (1968) indicates that mortality rates have historically provided the only relevant and sensitive measure of health status. The vast changes in health care and health perception experienced in the United States during the 1960's, caused the sensitivity of mortality rates as a measure of health status to be questioned. During the same period refined measures of morbidity were developed and used to assess the health status of segments of our population. Mortality and morbidity rates concentrated exclusively on negative aspects of health and were used to construct a continuum model of health, with well-being at one end and death at the other (Moriyama, 1968). Difficulty in accepting this construct of measuring health status centered on the lack of "a conceptual definition of health capable of being translated into suitable operational definitions" (Moriyama, 1968).

Conceptual definition of health status

A sound conceptual definition for any subject is possible only when the elements of the subject can be amalgamated into an acceptable and understandable model. Health status suffers for want of a sound conceptual definition due to the inability to explicitly describe the many variables which contribute to the determination of health. Additionally, one acceptable conceptual definition of health which accounts for all contributing health status variables does not exist. The World Health Organization

(WHO) declared in 1958 that health was represented by "a state of complete physical, mental, and social well-being and not merely the absence of disease and infirmity" (WHO, 1958). According to Bergner (1985) the WHO definition of health distinguishes between the factors which effect health and factors which are inherent to health. Bergner expresses health status in terms of five dimensions: the genetic foundation; the biochemical, physiological, or anatomic condition; the functional condition; the mental condition; and the health potential of the individual (1985). In this construct, Bergner presents each health status element as an independent factor; yet, each element interacts with and is dependent on all others to describe overall health status (see Figure 1).

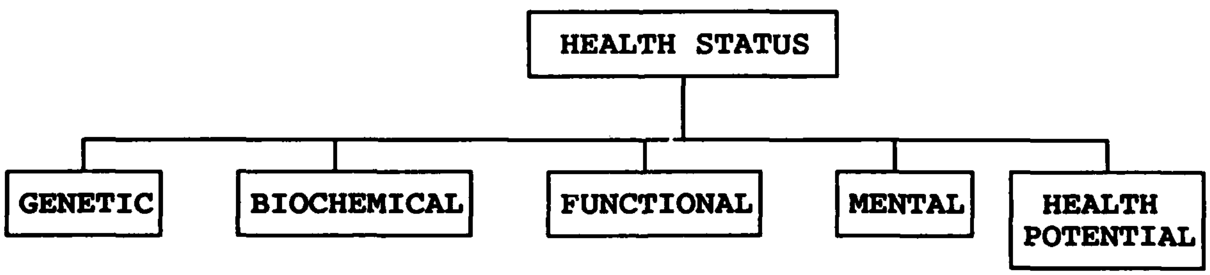

Figure 1. Conceptual model of health status.

The conceptual model of health status proposed by Bergner can be divided into two categories of health state: an actual disease, disability, or handicap state, and a variable health state. The actual health state represents the combination of genetic, biochemical, functional, mental, and health potential elements which are present and directly influence the health status of the individual. The variable health state is representative of the combination of genetic, biochemical, functional, mental, and health potential which have effected health status in the past or may effect future health status of the individual, but which are not currently diagnosed or otherwise identified. Simply stated, an individual in an actual disease, disability or handicap state is in a position where his health status has been negatively affected; therefore, he or she is sick. An individual who is in a variable health state is not presently experiencing a negative effect on his health status (see Figure 2).

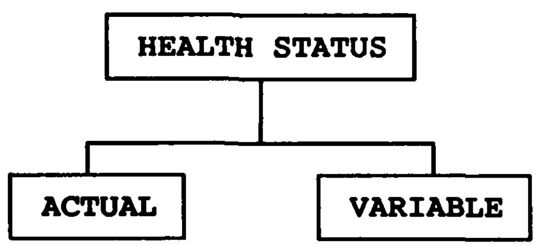

Figure 2. Conceptual model of health states.

The actual health state portion of health status is comprised of individuals that have diagnosed conditions who may (or may not), currently be receiving care from the health care system. Other individuals in the actual health state are those who have an undiagnosed disease, disability or handicap, and have experienced a negative effect in their health status.

Primary examples of individuals in the actual health state category are hospital inpatients and ambulatory clinic outpatients. The variable health state part of health status is composed of individuals who are not currently experiencing any negative effects from a disease, disability or handicap. Examples of individuals in this category are people who are healthy and people who have been previously sick and are now recovered.

Current requirement for health status measures

Health care policy decisions manifested in legislation produced by our elected government bodies must reflect the value our society places on health. For policymakers to provide their constituents meaningful legislative service on health care issues, they must be equipped with current relevant information on the health status of the population. According to Stewart, Ware, and Brook (1977), "policymakers in the medical care arena presumably could make better decisions regarding how the medical care system should be altered if data were available describing the impact on health of various policies or programs" (p. 939). This concept is supported by Reisine (1984) who states that there is a "need for outcome measures that link clinical assessments to social issues such as health care planning and health care policy development" (p. 1158). Llewellyn-Thomas, Sutherland, Tibshirani, Caimpi, Till, and Boyd (1984) succinctly summarize the requirement for health status measurement saying "to evaluate and compare different programs there is a need to make quantitative assessments of different states of health" (p.534). Given the pressures currently being exerted on our health care system, the requirement to provide accurate, timely, relevant,and insightful information on the health status of a population has never been greater.

Purpose of health status measures

The requirement for a measure of a population's health status is deeply rooted in the need to answer difficult questions. Scarce resources available for health care services demand ever increasing accountability from health care administrators responsible for resource allocation and utilization. For society to realize the greatest good per health care dollar expenditure, careful and prudent management must direct precise allocation of health care resources. Reisine and Miller (1985) address the need for oral health status measures stating that:

> "... empirical data on the social, economic and psychological consequences of dental disease would provide justification for allocation of health care resources; it would provide a fuller understanding of the scope of oral

health problems and it would provide a method of evaluating treatment protocols and quality of care as an alternative to clinical measures (p. 1309)."

The ideas of Reisine and Miller, while directed specifically to dental health, are clearly applicable to the entire continuum of health care services.

Health status measures are important to the conduct of medical practice. The development of health status measurement instruments that provide information essential to understanding the dynamics of health care is an issue which has received considerable attention. Boyle and Torrance (1984) describe procedures for the development of "multiattribute health indexes" to be used to study the health of a population and evaluate health care programs (p. 1045). Roos, Roos, Mossey, and Havens (1988) propose a methodology for using secondary administrative data in lieu of traditional survey data, to predict important health outcomes. Bergner (1985) pointedly states that "we need to monitor constantly the general health status of our population" (p. 701).

Focused health status measures

The specific questions that measures of health status can answer are wide ranging. Any relevant health care question that can be answered by information obtained through a health status measure is a valid reason for that measure. Bergner (1985) discusses four specific issues reasonable for a health status measure to address: preventable deaths; disease prevention and health promotion; death avoidance and high-technology medical care; and health monitoring. Reisine and Miller (1985) applied dental health status measures to determine the amount of work loss related to dental disease. Ware (1985) reports on the "considerable demand for sound methods for assessing health outcomes to inform both health policy analysts and clinical investigators" (p. 706). The worth of a health status measure lies with the individual for whom the measure provides information. The specific question requiring health status measurement determines the overall value of the instrument and the applicability of the measure to the perception of health status. Bergner (1985) states that the properties which comprise the health status measure lead away from the measurement of health status and center on the "specific question or issue that the measure is to address" (p. 699).

Total Sick Days (TSDs) as a health status measure

When health status is defined in terms of physical, mental and social well-being, with the dichotomous health states actual and variable, then the amount of time associated with the actual health state of individuals in that population represents an indicator of the overall health status of the population. The time accumulated by a population that is the result of negative effects on respective individual's health status due to an actual health state, can be captured in terms of sick days. The sum of all individual sick days for a given time frame, i.e. a month, year, etc., within a population, represents the proportion of lost time that the population experienced due to the effects of disease, disability or handicap. TSDs lost by the population are an implicit indicator of the population's overall health status in terms of the prevalence of negative effects caused by the respective disease, disability or handicap that individual population members experienced.

<u>Health status and the military</u>

For the military commander the readiness of his unit to deploy into combat is a primary responsibility. Unless United States Army units can optimize resources in their preparation for war (if and when war becomes a reality), the ability of those units to accomplish their assigned mission is questionable. The health of a unit is a vital resource that contributes to the efficient utilization of other scarce readiness resources in the preparation for wartime mission accomplishment.

The commander's perception of his unit's health status can directly effect decisions regarding the readiness of that unit to fight in combat. The perception the field commander has of the health of his unit is a function of the interface he and his soldiers have with the health care delivery system. While the health care system serves his unit's medical requirements, it can also be perceived as a major liability and detractor from maximum operational readiness. This perception recognizes that for every soldier who receives care from the health care system one less soldier is available to perform mission requirements and potentially one less soldier is available for wartime deployment. This readiness perception of the health care system can be conceptualized as shown in Figure 3.

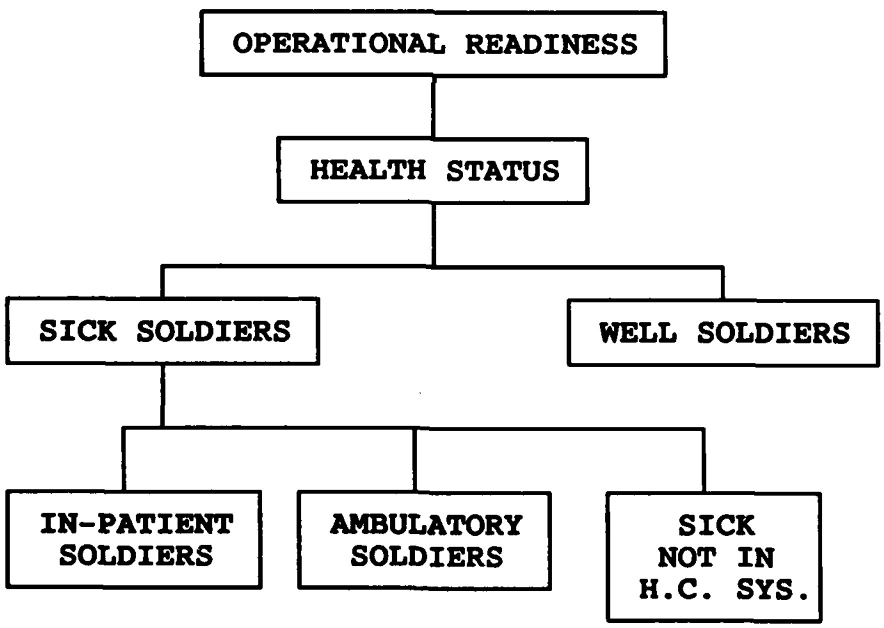

Figure 3. Conceptual model of military operational readiness and health status.

This conceptual model of health status and military operational readiness considers four distinct segments of the active duty population: active duty inpatients, active duty ambulatory outpatients, sick active duty individuals not receiving health care treatment, and healthy active duty individuals. For the unit commander healthy individuals represent a positive influence on the unit's overall health status and operational readiness. Sick individuals not receiving health care could potentially represent a negative influence on health status and operational readiness. However, these individuals are not accounted for by the health care system and are therefore extremely difficult to identify. Ambulatory active duty patients receiving health care on an outpatient basis represent a detractor to health status and a potentially negative influence on operational readiness. This negative influence, however, is only temporary. Unless the patient's condition warrants restriction from duty, the individual remains under the control of the unit commander and is normally available for mission requirements. Inpatient active duty individuals represent an important component of the overall health status of a unit. Individuals who receive health care on an inpatient basis are not available to unit commanders for training and performance of mission requirements. The time active duty inpatients spend away from their units represents a serious resource loss to the unit commander. This time is equivalent to Sick Days and is accounted for by the MTF.

<u>Total Sick Days (TSDs) and Medical Treatment Facility (MTF) administration</u>

TSDs have a special importance to the management of a MTF. Over time TSDs represent the actual workload of a MTF in terms of inpatients served. Since TSDs are correlated with the health status of the population served, the capability of the facility and assigned staff, and the availability of health care resources, TSDs are a meaningful measure of demand and productivity for the MTF. Retrospective study of historic TSD data will provide the health care administrator in-depth information about the workload of the facility, the potential of the hospital structure and staff, and the health status of the population served. Predictive models developed to forecast future TSDs for a given population based on historic data could provide MTF management with insightful information to utilize in problem solving and administrative decision making. Specific examples that illustrate the uses of TSDs for administrative purposes include resource allocation decisions based on increased or decreased workload, personnel assignments based on facility and staff capabilities, and preventive medicine protocols based on population health status. These and other uses for TSDs as an indicator of health status demonstrate the importance of TSDs for MTF administration.

<u>Purpose of the Study</u>

Major Diagnostic Category Groups (MDCGs) are five segregated groupings of twenty three Major Diagnostic Categories (MDCs) that contain 474 Diagnostic Related Groups (DRGs). MDCGs represent the total realm of available physician diagnoses that health care providers currently utilize in diagnosing and admitting patients for inpatient medical treatment. For the purpose of this research MDCs were combined into MDCGs according to organizational and medical rationale to reduce the number of independent variables effecting TSDs.

Time represents a critical variable in definitive research. The effects of seasonal variations in resource input to the delivery of health care and the demand for specific services based on the time of year can be significant. To determine the actual effect of seasonal or any other time sensitive periodic variation on TSDs this research examines TSDs while giving consideration to the contribution of quarterly fiscal year time frames in determining TSDs. It is expected that significant differences in TSDs due to the effects of time period will not be substantiated.

Gender is an important consideration to address in this research to determine if significant differences in TSDs are the result of inpatient gender differences. If gender is a significant variable in determining TSDs, new questions may arise relative to the dedication of health care resources to health care delivery and the overall mission of the military establishment. Given the disparity of males in the target population significant gender effects upon TSDs would be expected.

TSDs represent an important element of the overall health status of an active duty military population. For both the unit commander and the MTF commander, TSDs are a management tool that requires attention if we are to maximize the application of scarce resources to mission accomplishment. The purpose of this study is to analyze the amount of work loss accrued by active duty military inpatients (measured in TSDs), to determine if Major Diagnostic Category Groups (MDCGs), time period and gender are a standard set of criteria which accurately reflect TSDs as the inpatient portion of the health status of an active duty population.

CHAPTER II

Methods and Procedures

Study Design

This research was designed to test the effects of MDCGs upon TSDs. The population under study was active duty military inpatients at the United States Army Medical Department Activity (MEDDAC), Ireland Army Community Hospital (IACH), Fort Knox Kentucky. The time frame for this research was from 1 October 1986 to 30 September 1987 (Fiscal Year 1987), from 1 October 1987 to 30 September 1988 (Fiscal Year 1988), and from 1 October 1988 to 30 December 1988 (one quarter of Fiscal Year 1989). The functional format of this study was that TSDs are a function of MDCGs. All data were collected from the Individual Patient Data System (IPDS) maintained by the United States Army Patient Administration Systems and Biostatistics Activity, Fort Sam Houston, Texas. Given that patient identities were not solicited as part of the research and that the research does not include experimentation with human subjects, ethical considerations in terms of informed consent were not addressed.

Dependent and Independent Variables

The dependent variable for this research is TSDs. TSDs are operationally defined as the total number of sick days per month accounted for by the MTF. They represent a significant indicator of the health status of the active duty population. Included in the calculation of TSDs are Absent Sick Days (ABSD), Convalescent Leave/Cooperative Care Days (CL/CC), Supplemental Care Days (SUPC), Bed Days (BDs), and Other Days (OTH).

TSDs in this research are used as a health status indicator; they are an integral part of the overall health status of the respective population. TSDs also represent the portion of the active duty population not available to the line commander due to the patient's presence in the MTF. From the line commanders' perspective lost manpower in the health care system effects readiness. TSDs are accounted for by MTFs on a monthly basis, based on the actual number of inpatients who were admitted to the facility. TSD data were recovered from the IPDS and are equal to the total number of patients with a disposition during the month, times that month's average length of stay (ALOS).

ALOS is the mean number of days inpatients remain in the MTF for medical treatment. The functional format for determining ALOS is the total number of inpatient sick days accounted for by an MTF, for a given time period, divided by the total number of inpatients treated during the same time period. ALOS is a gross indicator of the severity of patient medical conditions and the efficiency and effectiveness of the MTF to treat the patient and return him/her to duty (or to some other disposition). ALOS is included as a secondary variable in this research because it is a natural product of the primary research variables, TSDs and inpatients.

The independent variables for this research are MDCGs, patient gender, and time period (i.e. fiscal year quarter). MDCGs represent the 474 inpatient DRGs. The International Classification of Diseases (IDC-9), nineth edition, coding application respectively collapses these 474 DRGs into 23 MDCs based on clinical similarity. For the purpose of this research, the 23 MDCs are then further collapsed into five MDCGs. The five MDCGs used in this study are Surgery, Internal Medicine, Obstetrics/Gynecology, Psychological and Social, and Other. The methodology for collapsing DRGs into MDCs and then into MDCGs is shown in Figure 4.

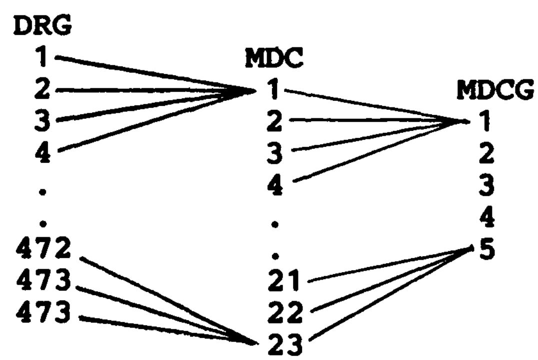

Figure 4. Conceptual model for collapsing Diagnostic Related Groups (DRGs) into Major Diagnostic Category Groups (MDCGs).

Appendix A outlines the 23 MDCs broken down respectively into MDCGs. The five MDCGs represent the four major areas medical treatments are typically categorized into; surgery, internal medicine, obstetrics/gynecology, psychological/social, and one additional group called other, which was created for treatments not falling into one of the other four groups. MDCGs were coded 1 if the sick days for a particular month were accounted for by the respective MDCG, 0 otherwise.

To control any observed variance in TSDs that may be attributable to the time of year or some other seasonal variable, the research time period was grouped into FY quarters. Each quarter (QTR) represents a three month time period for a total of nine QTRs. QTRs were coded 1 if the TSDs were in the respective QTR, 0 if otherwise. This coding methodology allowed tests to be conducted that isolated the effect of QTRs upon TSDs to reduce any confounding effect of QTR upon TSDs.

To control any observed variance in TSDs that may be attributable to gender, respective patient TSDs were divided into groups based on patient's sex. Groups were coded 1 if TSDs captured were from males, 0 otherwise. As with QTRs, this methodology allowed tests to be conducted that isolated the effect of MDCGs on TSDs without confounding the results due to the effects of gender.

Statistical Analysis

The hypothesized effects of the independent variables, MDCG 1 through MDCG 5, upon TSDs, were tested using multiple linear regression analysis. The hypothesis equations for these analyses are shown in Appendix B. Table B-1. The full model includes all of the effects of MDCG 1 through MDCG 5, QTR 1 through QTR 9, and gender. Restricted Model Number One tests TSDs for the effects associated with MDCG 1 through MDCG 5, while controlling for the effects of QTR 1 through QTR 9, and gender. Restricted Model Number Two tests for the effects of gender upon TSDs, while controlling for the effects of QTR 1 through QTR 9, and MDCG 1 through MDCG 5. Finally, Restricted Model Number Three tests TSDs for effects across time (QTR 1 through QTR 9), while controlling for the effects of MDCG 1 through MDCG 5, and gender.

CHAPTER III

RESULTS

Findings

Descriptive statistics for TSDs, number of inpatients admitted to the hospital, and the ALOS per QTR are shown in Appendix C, Table C-1. The fourth quarter of FY 87 had the highest number of TSDs with 19,492 sick days, while the fourth quarter of FY 88 had the fewest number of TSDs with 12,061 sick days. Appendix C, Figure 5 graphically displays TSDs per QTR for the research period. Appendix C, Figure 6 is a graphic presentation of the total number of hospital inpatients admitted per QTR during the research period. The mean number of TSDs for the research period was 16,258.33 sick days per quarter, with a standard deviation of 2,134.35 sick days per quarter. The second quarter of FY 88 experienced the greatest number of inpatients with 1309 patients, while the fourth quarter of FY 88 had the fewest number of inpatients with 796 patients. The mean number of inpatients was 1,095.44 patients per quarter, with a standard deviation of 174.48 patients per quarter. The third quarter of FY 87 had the highest ALOS with 21.64 days, while the second quarter of FY 88 experienced the lowest ALOS with 11.52 days. The mean ALOS for the period was 15.17 days, with a standard deviation of 2.65 days. Appendix C, Figure 7 shows the ALOS per inpatient admitted per QTR.

Descriptive statistics for mean TSDs and the mean number of inpatient dispositions per MDCG, per month, by fiscal year quarter are shown in Appendix C, Table C-2. As shown in Table C-2, the third quarter of FY 87 experienced the highest average number of TSDs per month with 6,612.67 sick days, while the fourth quarter of FY 88 experienced the fewest average number of TSDs with 4,020.33 sick days. The mean number of TSDs per month for the research period was 5,452.78 sick days, with a standard deviation of 758.02 sick days per month.

The second quarter of FY 87 had the highest average number of inpatient dispositions per month for MDCG 1 with 294.67 dispositions per month, and the fourth quarter of FY 88 had the lowest with 174.67 dispositions. The mean number of dispositions for MDCG 1, per month was 242.88 dispositions, with a standard deviation of 38.11 dispositions per month. For MDCG 2 the second quarter of FY 88 experienced the most dispositions per month with 125.33 dispositions, and the third quarter of FY 87 had the fewest with 45.33 dispositions per month. The mean number of disposition for this group of MDCGs was 76.44 dispositions per month, with a standard deviation of 24.25 dispositions per month. During the fourth quarter of FY 87 dispositions for MDCG 3 were greatest at 27.00 dispositions per month. The fourth quarter of FY 88 experienced the fewest dispositions in this group with 15.33 dispositions per month. The mean for MDCG 3 was 21.41

dispositions per month, with a standard deviation of 3.62 dispositions per month. The first quarter of FY 87 had the highest dispositions per month for MDCG 4 with 29.67 dispositions, while the lowest number was experienced during the fourth quarter of FY 88 with 16.33 dispositions per month. Slightly more than 21 dispositions per month was the mean for MDCG 4 with a standard deviation of 4.09 dispositions per month. MDCG 5 had the greatest number of dispositions during the first quarter of FY 87 with 19.00 dispositions per month, and the least during the second quarter of FY 87 with 2.33 dispositions per month. The mean for this group was 2.96 dispositions per month, with a standard deviation of .75 dispositions per month.

Descriptive statistics for TSDs and inpatient gender by QTR are shown in Appendix C, Table C-3. Appendix C, Figure 8 and Figure 9 present a graphic picture of the distribution of TSDs by gender. Figure 8 shows that for males the fourth quarter of FY 87 had the greatest number of TSDs with over 16,700 TSDs; the fourth quarter of FY 88 experienced the fewest with close to 10,000 TSDs. Figure 9 displays the first quarter of FY 88 as having the highest number of TSDs for females with close to 3,000 TSDs; the fourth quarter of FY88 having the lowest with nearly 1,500 TSDs.

Table C-3 shows that male hospital inpatients generally outnumbered female inpatients significantly. The fourth quarter of FY 87 experienced the greatest number of male inpatients, and number of TSDs for male inpatients with 1,128 patients and 16,779 sick days. The lowest number of male inpatients and lowest TSDs for male inpatients were during the fourth quarter of FY 88, with 701 patients and 10,607 sick days. The mean number of male inpatients were 973.00 patients per quarter, with a standard deviation of 169.03 patients per quarter. The mean number of TSDs for male inpatients were 13,966.67 sick days per quarter, with a standard deviation of 1,825.39 sick days per quarter.

The fourth quarter of FY 87 experienced the highest number of female inpatients with 145 patients, while the lowest number of female inpatients was during the fourth quarter of FY 88, with 95 inpatients. The first quarter of FY 88 had the greatest number of female inpatient TSDs with 2,859 sick days; the fourth quarter of FY 88 had the fewest TSDs for female inpatients with 1,454 sick days. The mean number of female inpatients was 122.44 patients per quarter, with a standard deviation of 15.37 female inpatients per quarter. The mean TSDs for female inpatients were 2291.67 sick days per quarter, with a standard deviation of 426.95 sick days per quarter.

Descriptive statistics for the number of inpatient dispositions per MDCG, by QTR, are shown in Appendix C, Table C-4. Table C-4 shows that for MDCG 1, the second quarter of FY 87 had the greatest number of dispositions with 884 dispositions, while the fourth quarter of FY 88 had the fewest with 524 dispositions. The number of dispositions per quarter for this MDCG was 728.67 dispositions, with a standard deviation of 114.32 dispositions per quarter. MDCG 2 experienced the highest number of dispositions during the second quarter of FY 88 with 376 dispositions. The fewest number of dispositions happened in the third quarter of FY 87 with 136 dispositions. The mean number of dispositions per quarter for MDCG 2 was 229.33 dispositions with a standard deviation of 72.76 dispositions per quarter. Eighty-one dispositions per quarter and 46 dispositions per quarter were the respective high and low numbers of dispositions for the fourth quarter of FY 87 and the fourth quarter of FY 88 in MDCG 3. The mean number of dispositions for this group was 64.22 dispositions per quarter, with a standard deviation of 10.84 dispositions per quarter. The first quarter of FY 87 had the high number of dispositions for MDCG 4 with 89 dispositions and the low number for MDCG 5 with 4 dispositions. For MDCG 4 the low number of dispositions was experienced during the fourth quarter of FY 88 with 49 dispositions. The high number of dispositions for MDCG 5 was during the first quarter of FY 88 with 12 dispositions. MDCG 4 had a mean number of dispositions per quarter of 64.44 dispositions, with a standard deviation of 12.26 dispositions per quarter. MDCG 5 had a mean number of dispositions of 8.89 per quarter, with a standard deviation of

2.23 dispositions per quarter. Appendix C, Figures 10 through 14 present graphic illustrations of the number of TSDs for each MDCG per quarter.

The results of the multiple linear regression analysis test overall are shown in Appendix D, Table D-1. The Full Model showed that TSDs can be predicted at a highly statistically significant level, using the independent variables included in the model. Further, Restricted Models One (MDCGs) and Two (Gender) showed statistical significance at the alpha = .001 level. The Restricted model test of time (QTR) effects (Model 3) was not significant.

As shown in Table D-1, the Full Model testing for the effects of MDCGs, QTR, and Gender, accounted for over 56% of the total variance in TSDs. This model had a coefficient of multiple determination (R^2) of .566 and was highly statistically significant with an F ratio of $F(15, 255) = 22.17$, $p < .001$. This model demonstrates that 99.999 times out of 100 opportunities, 56.58% of the variance in TSDs can be predicted based on the independent variables included in the model.

Testing for the effects of MDCG 1 through MDCG 5, Restricted Model One showed that MDCGs accounted for over 41% of the variance in TSDs. Restricted Model One had an R^2 of .156 and was highly statistically significant having an F ratio of $F(5,255) = 48.23$, $p < .001$. This model substantiates the hypothesis that

MDCGs are a valid and reliable predictor variable in determining TSDs.

The results of the test for the effects of gender upon TSDs indicate that gender is a statistically significant predictor variable of TSDs. Restricted Model Two attributed over 14% of the variance in TSDs to the effects of gender. This model had an R^2 of .415 and was highly statistically significant with an F ratio of $F(1,255) = 88.66$, $p < .001$. Restricted Model Two demonstrates that inpatient gender is an important variable in examining TSDs, which must be considered when addressing military health care delivery issues.

Tests conducted on TSDs across time showed that time was not a statistically significant factor in determining TSDs. Restricted Model Three had an R^2 of .561 and was not statistically significant having an F ratio of $F(9, 225) = .32$, n/s. This model demonstrates that the effects of time do not contribute in a meaningful way to determining TSDs.

Since results of the hypotheses test indicate that MDCGs significantly affect approximately 41% of the variance in the number of TSDs, information on the ALOS by MDCG was studied. Descriptive statistics for the average length of stay by MDCG are shown in Appendix C, Table C-5. The third quarter FY 87 experienced some of the highest ALOSs for MDCG 1, MDCG 2, and MDCG 4. The highest ALOS was for MDCG 4 during the third quarter

FY 87 with an ALOS of 36.17 days. The lowest ALOS was for MDCG 5 for the third quarter FY 88 having 3.93 days ALOS.

It was hypothesized that ALOS was effected by MDCGs and QTRs. Multiple linear regression was used to test this and the hypothesis equations used are shown in Appendix B, Table B-2. The Full Model includes the effects of MDCG 1 through MDCG 5 and QTR 1 through QTR 9. Restricted Model One tests ALOS for the effects of MDCG 1 through MDCG 5 while controlling for the effects of QTR 1 through QTR 9. Restricted Model Two tests for the effects of QTR 1 through QTR 9 upon ALOS, while controlling for the effects of MDCG 1 through MDCG 5.

The results of the multiple linear regression tests on the effects of MDCGs and QTRs upon ALOS are shown in Appendix D, Table D-2. The Full Model accounts for over 75% of the total variance in ALOS. The Full Model has a coefficient of multiple determination (R^2) of .756 and was highly statistically significant with an F ratio of $F(14,30) = 6.63$, $p < .005$. Restricted Model One tested the effects of MDCGs and accounted for over 66% of the variance in ALOS. This model has an R^2 = .098 and is statistically significant with an F ratio of $F(5,30) = 16.16$, $p < .005$. Restricted Model Two tested the effects of QTR upon ALOS and is not significant. Restricted Model Two has an R^2 = .658 and an F ratio of $F(9,30) = 1.33$, n/s.

The predicted values for TSDs per QTR determined from the effects of MDCGs, while controlling for the effects of QTR and gender are shown in Appendix D, Table D-5. The fourth QTR, FY 87 had the highest predicted TSDs with 19,152 TSDs, and the fourth QTR, FY 88 recorded the fewest predicted TSDs with 12,061 TSDs. Compared to the actual TSDs experienced shown in Appendix C, Table C-1, the predicted values demonstrate a high degree of accuracy for the model.

The average number of predicted TSDs per MDCG for males and females, across the nine QTR research period are shown in Appendix D, Table D-6. As shown, MDCG 1 experienced the greatest number of predicted TSDs for both males and females, and overall. MDCG 5 accounted for the fewest number of predicted TSDs for males, females and in total.

Appendix D, Table D-7 shows the average predicted ALOS per MDCG across the nine QTR research period. MDCG 4 had the highest predicted ALOS at 25.56 days, while MDCG 5 had the lowest predicted ALOS at 8.12 days. These predicted ALOS values correspond exactly with the ALOS data per MDCG found in Appendix C, Table C-5.

QTRs.CHAPTER IV

Discussion

Utility of Findings

The ability to determine if inpatient TSDs accounted for by the MTF have significantly changed from historic experience provides the MTF Commander valuable information to be considered in his assessment of the health status of the active duty population he serves. Monitoring TSDs over time will allow for quick and timely identification of potential contributors to decreased health status in the population. Additionally, continuous monitoring of TSDs will identify variables that have had a positive effect in improving the health status of the population by reducing TSDs. The comparison of monthly TSDs, to both the historic mean TSD and to the predicted estimate of TSDs based on historic data, can provide insight regarding the relative health status of the active duty population with respect to the actual experiences of the past. Being able to closely examine factors which contribute to TSDs stimulates problem identification and may direct focused management attention.

To facilitate the explanation of the utility of predicting TSDs, the third QTR of FY 87 (see Appendix D, Table D-2.) will be used as an example. Table D-3 shows that mean TSDs for the third QTR FY 87 were significantly worse (18,938 TSDs, t=-3.55) than the nine quarter mean of TSDs (16,258.33). This is different than what would be expected. To determine why statistically significant differences exist for that QTR's mean TSDs (compared to the nine quarter TSD mean) MDCGs can be examined. Table D-3. shows that despite the negative direction of TSDs, MDCG 1 (609 dispositions, t=2.96) and MDCG 2 (136 dispositions, t=3.63) had significant positive effect on TSDs in terms of the number of dispositions that quarter, while the remaining MDCGs had no significant effect on TSDs. These numbers describe a situation where there were significantly fewer inpatients in MDCG 1 and MDCG 2 during the QTR. MDCG 3 and MDCG 5 both experienced a greater number of dispositions than the nine quarter mean, however, the number of dispositions were not statistically significant. MDCG 4 experienced a decrease in the number of dispositions; however, that decrease was insignificant.

At this point in the investigation the conclusion that since the MTF experienced a significant increase in TSDs and no significant increase in number of dispositions was experienced in any MDCG, then MDCG 3 and MDCG 5 together must be solely responsible for the negative effect seen in TSDs, could be made. This conclusion, however, would be erroneous since the total increase in the number of inpatient dispositions in MDCG 5 for the QTR was only .11 dispositions and the increase for MDCG 3 was only 1.78 dispositions. Recognizing that, this data requires additional exploration into the variables that contributed to the increased TSDs.

Table D-4 shows that the ALOSs for the third QTR of FY 87 in MDCG 1 (21.57 days, t=-6.47), MDCG 2 (23.40 days, t=-5.59), and MDCG 4 (36.17 days, t=-5.14) all increased by statistically significantly amounts over the nine quarter ALOS mean. The ALOS for MDCG 3 experienced a statistically significant decrease (18.07 days, t=3.71). The ALOS for MDCG 5 was increased, however, the increase was not statistically significant when compared to the nine quarter mean ALOS. These increases in ALOS provide a clearer picture of the factors that combined to increase TSDs for that QTR. From this information the Commander can deduce that although TSDs increased for that QTR, resulting in a negative impact on health status, that result was actually attributable to the increases in average length of stay for MDCGs 1, 2 and 4.

The results of hypothesis testing on the effects of MDCGs upon ALOS provides additional information for the Commander. Since MDCGs effect ALOS, when no significant change in TSDs are apparent due to changes in MDCGs, changes in ALOS due to changes in MDCG may have effected TSDs. By using two independent variables dependent upon MDCGs, the Commander is better equipped to determine how the health status of the population has changed in terms of TSDs.

Several possible explanations for the specific changes in ALOS and the number of dispositions for each suspect MDCG can now be explored by the Commander. Two primary variables of major importance are differences in inpatient population health status and differences in health care delivery processes. Other potential causes of changes in TSDs, manifested as variances in ALOS and number of dispositions, are financial resource reductions, changes in the population (additional units assigned to the installation), and MTF mission changes (e.g. addition or deletion of services provided). Since the MTF at Ft Knox and the respective patient population had not experienced any significant change in financial resourcing, population fluctuation or mission realignment, those variables cannot be adequately addressed. Discussion will concentrate on possible differences in population health status and on health care delivery processes.

Differences in population health status are manifested in the actual health state of individuals in the population. Information on individuals who have encountered a negative impact on their own health status, who have sought and received medical treatment, can be categorized into groups based on the professional diagnosis of a health care provider. Additional information can be obtained regarding the type of medical treatment received, in terms of inpatient versus outpatient. Capturing this data for active duty inpatients and structuring the data into MDCGs provides the necessary elements to utilize the predictive power of the TSD model. In this way Commanders can pinpoint, by diagnosis, the medical conditions that have significantly effected the health status of the population served.

Knowing the exact group of diagnoses that are responsible for increasing TSDs provides the Commander information facilitating further investigation into the causes of either the disease itself or of the performance of the health care delivery processes associated with the particular diagnosis. Depending on the disease Commanders may identify inherent systematic problems in preventive medicine that have been ignored or previously unidentified. In such cases the Commander possesses empirical evidence to support action required to address and rectify the situation.

When the results of investigation indicate that no significant differences in the health status of the population have occurred, the Commander may determine that changes in the health care delivery process have contributed to increased TSDs. One example of a change in a health care delivery process that could trigger a residual increase in TSDs is the seasonal rotation of assigned medical staff. As a new physician assumes duties in the hospital, he/she is usually less familiar with organizational peculiarities than his predecessor; ALOS may increase until the new physician fully understands the system designed to support him. Here again, the Commander can be alerted to a significant rise in TSDs, trace that increase by MDCG to the responsible health care delivery process, identify individuals involved in the process, and take appropriate management action. Such management problem identification protocol provides Commanders data to be used in problem identification. Then appropriate management attention can be directed toward improving the health care delivery system, reducing TSDs, and ultimately improving the health status of the population.

<u>Practicality</u>

The practicality of implementing the TSD prediction model to forecast TSDs and improve the management of scarce health care resources depends directly on three assumptions. First, the model must be provided timely reliable data. Second, MTF Commanders must place a high degree of confidence in the power of the model and then effect appropriate management action. Third, hospital administrators must dedicate resources toward managing the model on a continuous basis.

The acquisition of timely reliable data for use in the TSD model is essential. Without such data the TSD model will provide erroneous information which will misdirect MTF Commanders in their efforts to identify variables contributing to decreased population health status. Management decisions based on unreliable information will result in the misapplication of resources and a possible degradation of services provided.

The key to providing the TSD model accurate data is the utilization of an automated, comprehensive, and integrated data base. Such a hospital information system, the Composite Health Care System (CHCS), is currently being tested in the MTF at Ft. Knox. Since the variables utilized in the model are all elements of the medical record, program software to retrieve and stratify the data should be developed for use with CHCS. Software currently exists which will encode dictated medical diagnoses and assign the appropriate DRG. Modification of the automated medical record in the CHCS system to accommodate a DRG field is being developed now. When the CHCS system is modified to include the DRG field all variables required for using the TSD model will be easily accessible.

Any predictive model must undergo stringent evaluation and testing prior to full acceptance. In the management of health care systems decisions to utilize resources must be made with the fullest confidence that the information upon which the decision is based is reliable and valid. The TSD model satisfies the requirements of validity and reliability in the utilization of secondary data in a more sophisticated manner. If Commanders are convinced of the validity and reliability of the management information their MTFs are currently generating (and if the automated system for gathering those data are designed to ensure reliability), then Commanders should have confidence in the TSD model. The primary argument for implementing the TSD model is experiencing the positive result of actually utilizing the model. When Commanders recognize the predictive power of this model and associate the management information produced by the model with the potential for improving the health care delivery process, confidence in the model will be assured.

As emphasized above, the primary variable is gaining the confidence of MTF Commanders in using the model. To administrators faced with diminished financial resources and skyrocketing operating costs, the prospect of another expensive system, even one designed to improve management, is not extremely attractive. However, the amount of resources required to implement and sustain the TSD model at the local level is minimal, provided that full CHCS patient accounting functionality becomes reality. The TSD model also requires the use of a personal computer (PC) programed with "off the shelf" statistical analysis software package. Once CHCS data base retrieval programs are available, data retrieval and analysis can be performed on a daily, weekly or monthly basis. Total additional funding associated with implementation of the TSD model is very small since existing hardware and software can be utilized. Management of this model can be assigned to existing personnel as part of regularly assigned duties.

Weaknesses of the Study

Despite the high statistical significance of the TSD model several weaknesses in this research are apparent. First, the use of TSDs as a measure of health status is only minimally supported in the literature; it represents only one element of the entire health status construct. Second, the use of MDCGs as independent variables grossly approximates the more powerful individual DRGs as predictor variables. Third, the use of the entire active duty military population as a homogeneous population eliminated differences that may exist between individual active duty units and missions.

The use of TSDs as a health status indicator may engender criticism as an inaccurate and incomplete measure. However, TSDs are a stable, measurable variable that do represent a distinct portion of health status. TSDs also accurately represent time lost from normal daily activities due to decreased health status. TSDs are a valid measurement of inpatient time, which are important to consider when examining total health status. Future research is required for developing measurement instruments that represent partial sick days and other time lost as a result of decreased health status. An ambulatory time lost measurement instrument, combined with TSDs, could prove to be a far superior measurement tool for representing overall population health status.

The use of MDCGs as predictor variables is a valid weakness in this research because they oversimplify the DRG coding system to a severe extent. Using groups that more evenly distribute DRGs into narrowly defined clinical subsets such as MDCs could result in a more definitive model. The most desirable grouping of diagnoses would be the individual DRGs themselves, however, utilizing 474 independent variables was beyond the scope of this research.

The retrieval of data from existing data bases constrained this research with respect to the use of military units as an independent variable. Because the IPDS has accepted local MTF postal zip codes instead of the Unit Identification Code (UIC) from reporting MTFs, the database for coding the dependent variable depending on unit was impossible. The CHCS system has attempted to correct this severe shortcoming in the medical record database, however, to date this effort has been unsuccessful. Future research on the differences in health status among active duty units would be extremely beneficial.

Notwithstanding the weaknesses listed above the TSD model still provides the commander with important information hereforto generally unavailable. Innovation in developing health status measurement instruments can further improve the degree of accuracy in representing a population's health status. If sufficient refined computing power can be amassed to process the TSD model with 474 independent variables, future medical data bases can be designed to correct the inaccuracies currently present in the IPDS data base. Additional research on the TSD model would then be feasible and is highly recommended.

CHAPTER V

Conclusions and Recommendations

Conclusions

Two important conclusions are derived from this research. First, MTF Commanders can use data generated from normal hospital operations to produce information pertinent to assessing the overall health status of the active duty military population they serve. Second, information produced for assessing the health status of a population can also be utilized to improve management decisions regarding health care delivery processes and ultimately serve to positively effect the population's health status.

The TSD prediction model presented in this research utilized data generated by the MTF to develop information describing, explaining, and predicting the health status of the active duty military population served by Ireland Army Community Hospital, Fort Knox, Kentucky. The model used MDCGs as predictor variables to forecast the amount of TSDs the population would experience. A conceptual model of health status has been presented which accounts for TSDs as an integral part of the more global health status construct. TSDs were established as a primary variable in total population health status, and the validity and reliability of TSDs as a measure of health status was examined. MTF

Commanders can use the TSD model as a meaningful management tool to assist them in the difficult task of providing high quality health care.

In addition to predicting TSDs experienced by the population, the TSD model contains important information that the MTF Commander can use to improve the health care delivery process. Because the model contains comprehensive data pertinent to the entire inpatient workload performed by a MTF, Commanders can selectively investigate conditions that have significantly effected the health status of the beneficiary population. The ability to identify potential weaknesses in the health care delivery process and effect corrective action, that will positively effect the population's health status is a significant improvement over currently available management techniques. MTF Commanders using the TSD model now possess the empirical power to succinctly identify root causes of a problem which has negatively effected the operational readiness of the military population and concomitantly effected the ability of the MTF to more efficiently perform its mission.

Recommendations

This research supports three important recommendations. First, the medical database containing MTF DRG workload data must be improved and purified if the TSD model is to be adequately tested. Second, research seeking more accurate instruments for measuring health status must be undertaken. Third, MTF Commanders must be educated as to the value, validity, and reliability of the TSD model. If these recommendations are accepted, the TSD model can be adopted as a primary management tool by the MTF Commander. Using the TSD model MTF Commanders will be able to better describe, predict, explain, and control the different variables that combine to form the complex health status of the military population they serve.

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Appendix A

Composition of Major Diagnostic Category Groups (MDCGs) by Major Diagnostic Category (MDCs)

Major Diagnostic Category Groups (MDCGs)

MDCG1: Surgery.

- MDC 02, Disease and disorders of the eye.
- MDC 03, Disease and disorders of the ear, nose and throat.
- MDC 06, Disease and disorders of the digestive system.
- MDC 07, Disease and disorders of the hepatobiliary system and pancreas.
- MDC 08, Disease and disorders of the musculoskeletal system and connective tissue.
- MDC 09, Disease and disorders of the skin, subcutaneous tissue and breast.
- MDC 10, Endocrine, nutritional and metabolic diseases and disorders.
- MDC 11, Disease and disorders of the kidney and urinary tract.
- MDC 12, Disease and disorders of the male reproductive system.
- MDC 16, Disease and disorders of blood and blood forming organs and immunological disorders.
- MDC 21, Injuries, poisonings and toxic effects of drugs.
- MDC 22, Burns.

MDCG2: Internal Medicine.

- MDC 01, Disease and disorders of the nervous system.
- MDC 04, Disease and disorders of the respiratory system.
- MDC 05, Disease and disorders of the circulatory system.
- MDC 17, Myeloproliferative diseases and disorders, and poorly differentiated neoplasms.
- MDC 18, Infectious and parasitic diseases (systemic or unspecified sites).

MDCG3: Ob/Gyn.

- MDC 13, Diseases and disorders of the female reproductive system.
- MDC 14, Pregnancy, childbirth and the puerperium.

MDCG4: Psychological/Social.

- MDC 19, Mental diseases and disorders.
- MDC 20, Substance use and substance induced organic mental disorders.

MDCG5: Other.

- MDC 23, Factors influencing health status and other contacts with health services.

Note: MDC 15, Newborns and other neonates with conditions originating in the perinatal period, is not included in this study since the typical active duty military inpatient does not include individuals which could be diagnosed has having a medical condition from this category.

Appendix B

Hypotheses Equations

Table B-1.

Hypothesis equations tested using multiple regression analysis for the effects of Major Diagnostic Category Groups (MDCGs), Quarter (QTR), and Gender upon Total Sick Days (TSDs).

Full Model (All effects present)

$$Y_{TSD} = a_oU + b_1MDCG_1 + b_2MDCG_2 + \ldots + b_5MDCG_5 + b_6QTR_1 + b_7QTR_2 + \ldots + b_{14}QTR_9 + b_{15}GENDER$$

Restricted Model 1 (MDCG effects removed)

$$Y_{TSD} = a_oU + b_1QTR1 + b_2QTR_2 + \ldots + b_9QTR_9 + b_{10}GENDER$$

Restricted Model 2 (Gender effects remover)

$$Y_{TSD} = a_oU + b_1MDCG_1 + b_2MDCG_2 + \ldots + b_3MDCG_3 + b_4QTR_1 + b_5QTR_2 + \ldots + b_{12}QTR_9$$

Restricted Model 3 (Time effects removed)

$$Y_{TSD} = a_oU + b_1MDCG_1 + b_2MDCG_2 + \ldots + b_5MDCG_5 + b_6GENDER$$

Table B-2.

Hypothesis equations tested using multiple linear regression analysis for the effects of Major Diagnostic Category Groups (MDCGs) and Fiscal Year Quarter (QTR) upon Average Length of Stay (ALOS).

Full Model (All effects tested)

$$Y_{ALOS} = a_oU + b_1MDCG_1 + b_2MDCG_2 + \ldots + b_5MDCG_5 + b_6QTR_1 + b_7QTR_2 + \ldots + b_{14}QTR_9$$

Restricted Model One (MDCG effects removed)

$$Y_{ALOS} = a_oU + b_1QTR_1 + b_2QTR_2 + \ldots + b_9QTR_9$$

Restricted Model Two (QTR effects removed)

$$Y_{ALOS} = a_oU + b_1MDCG_1 + b_2MDCG_2 + \ldots + b_5MDCG_5$$

Appendix C

Descriptive Statistics

Table C-1.

Descriptive statistics for Total Sick Days (TSDs), number of inpatients admitted, and average length of stay (ALOS), by Quarter (QTR).

QTR	TSDs*	Patients**	ALOS*
1/87	15004	1131	13.27
2/87	17379	1233	14.09
3/87	18938	875	21.64
4/87	19492	1273	15.31
1/87	17115	1224	13.98
2/88	15085	1309	11.52
3/88	15667	950	16.49
4/88	12061	796	15.15
1/89	15584	1068	14.60
Mean	16258.33	1095.44	15.17
SD	2134.35	174.48	2.65

Note: * represents the number of actual days.

** represents the actual number of inpatients.

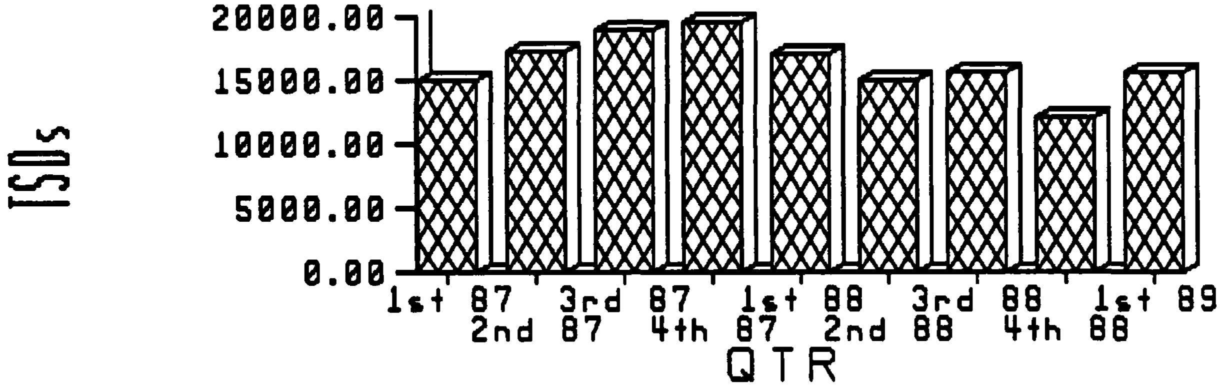


Figure 5. Total Sick Days per Fiscal Year Quarter (QTR).

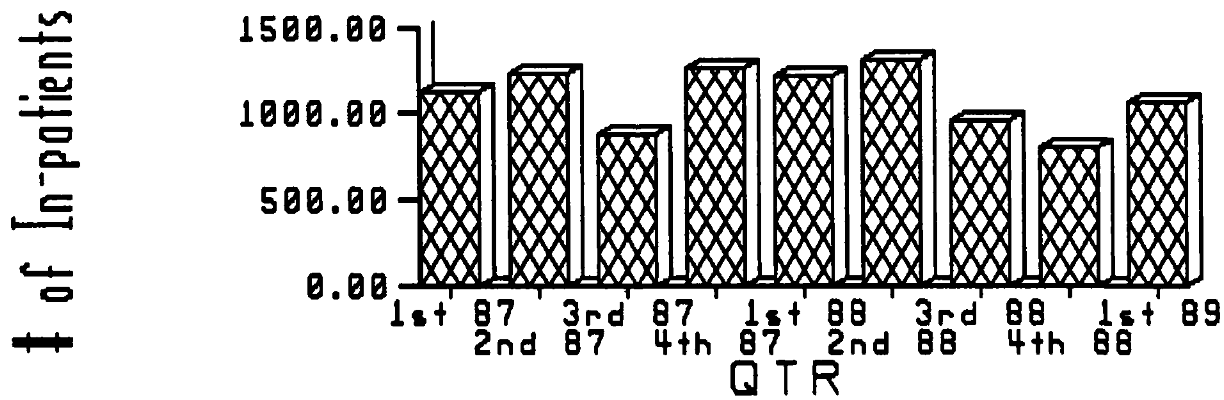
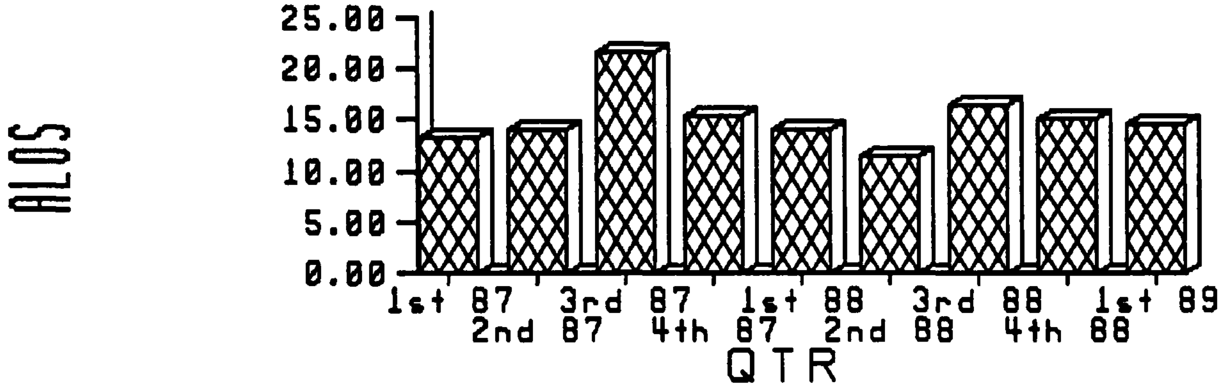


Figure 6. Total number of inpatients admitted per Fiscal Year Quarter (QTR).



<u>Figure 7</u>. Average Length of Stay (ALOS) per inpatient admitted per Fiscal Year Quarter (QTR).

Table C-2.

Descriptive statistics for mean Total Sick Days (TSDs) and mean number of dispositions per Major Diagnostic Category Group (MDCG), per month, by Quarter (QTR).

QTR	TSD**	MDCG[1]*	MDCG[2]*	MDCG[3]*	MDCG[4]*	MDCG[5]*
1/87	5001.33	268.33	57.67	20.00	29.67	1.33
2/87	5793.00	294.67	68.67	24.67	19.67	3.33
3/87	6612.67	203.00	45.33	22.00	18.33	3.00
4/87	6497.33	271.33	95.33	27.00	27.00	3.67
1/88	5705.00	257.00	101.67	24.67	20.67	4.00
2/88	5028.33	268.33	125.33	21.33	18.67	2.67
3/88	5222.33	200.33	71.67	21.33	20.00	3.33
4/88	4020.33	174.67	56.67	15.33	16.33	2.33
1/89	5194.67	248.33	65.67	16.33	23.00	3.00
Mean	5452.78	242.88	76.44	21.41	21.48	2.96
SD	758.02	38.11	24.25	3.62	4.09	.75

Notes: * number of inpatient dispositions per month.

** sick days per month.

Table C-3.

Descriptive statistics for Total Sick Days (TSDs), number of inpatients, and inpatient Gender, by Quarter (QTR).

QTR	TSDs**	Males		Females	
		Number*	TSDs**	Number*	TSDs**
1/87	15004	1021	13060	110	1944
2/87	17379	1112	15018	121	2361
3/87	18938	738	16504	137	2434
4/87	19492	1128	16779	145	2713
1/88	17115	1084	14256	140	2859
2/88	15085	1191	12838	118	2247
3/88	15667	824	12980	126	2687
4/88	12061	701	10607	95	1454
1/89	15584	958	13658	110	1926
Mean	16258.33	973.00	13966.67	122.44	2291.67
SD	2134.35	169.03	1825.39	15.37	426.95

Notes: * represents the number of inpatients.

** represents the number of sick days in days.

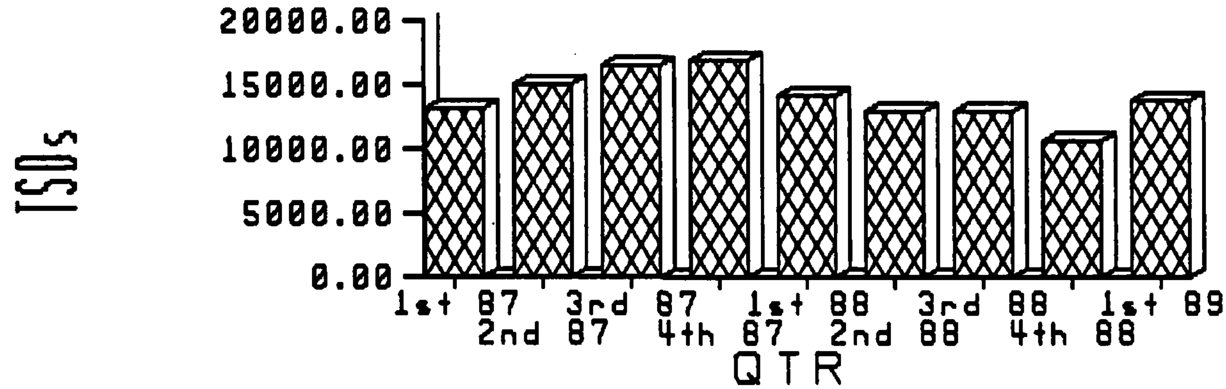


Figure 8. Number of Total Sick Days (TSDs) for male inpatients per Fiscal Year Quarter (QTR).

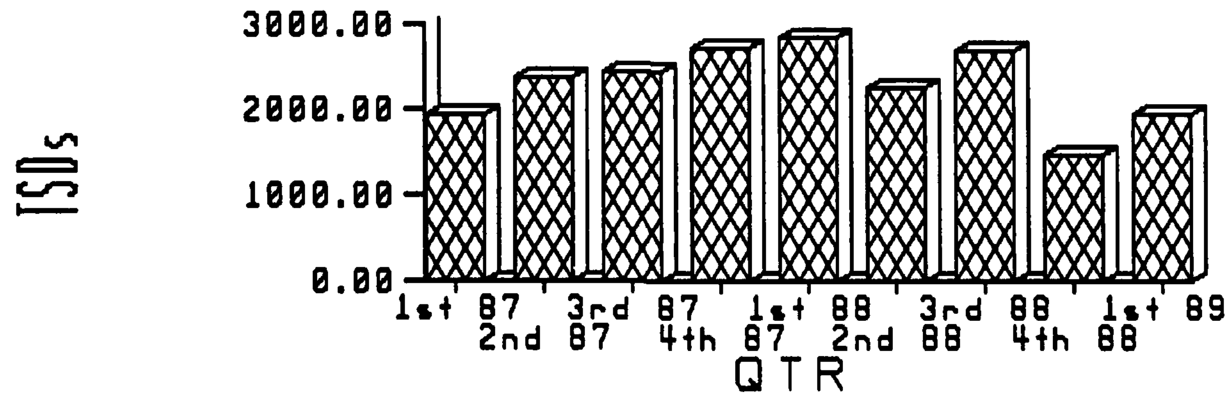


Figure 9. Number of Total Sick Days (TSDs) for female inpatients per Fiscal Year Quarter (QTR).

Table C-4.

Descriptive statistics for number of inpatient dispositions per Major Diagnostic Category Group (MDCG) by Quarter (QTR).

QTR	MDCG[1]*	MDCG[2]*	MDCG[3]*	MDCG[4]*	MDCG[5]*
1/87	805	173	60	89	4
2/87	884	206	74	59	10
3/87	609	136	66	55	9
4/87	814	286	81	81	11
1/88	771	305	74	62	12
2/88	805	376	64	56	8
3/88	601	215	64	60	10
4/88	524	170	46	49	7
1/89	745	197	49	69	9
Mean	728.67	229.33	64.22	64.44	8.89
SD	114.32	72.76	10.84	12.26	2.23

Notes: * represents the number of inpatient dispositions.

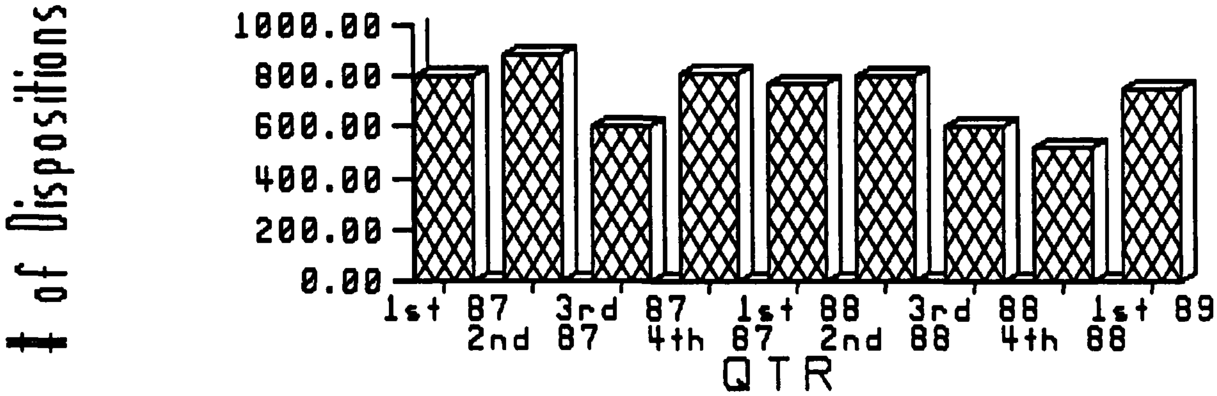


Figure 10. Number of Dispositions for Major Diagnostic Category Group 1 (MDCG 1) per Fiscal Year Quarter (QTR).

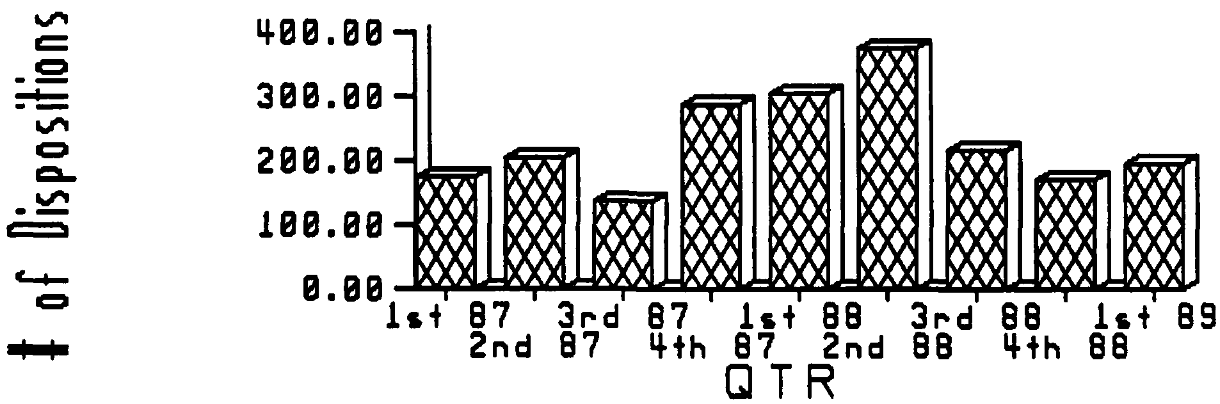
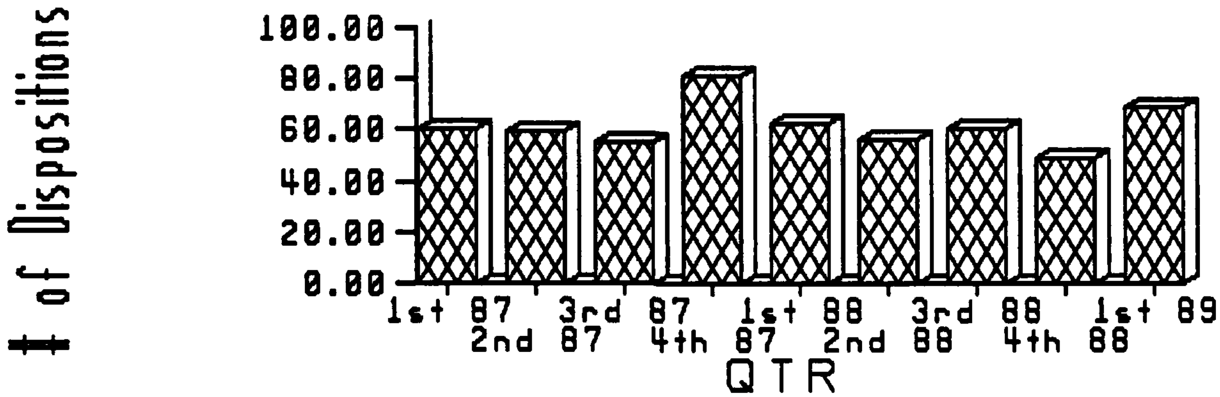
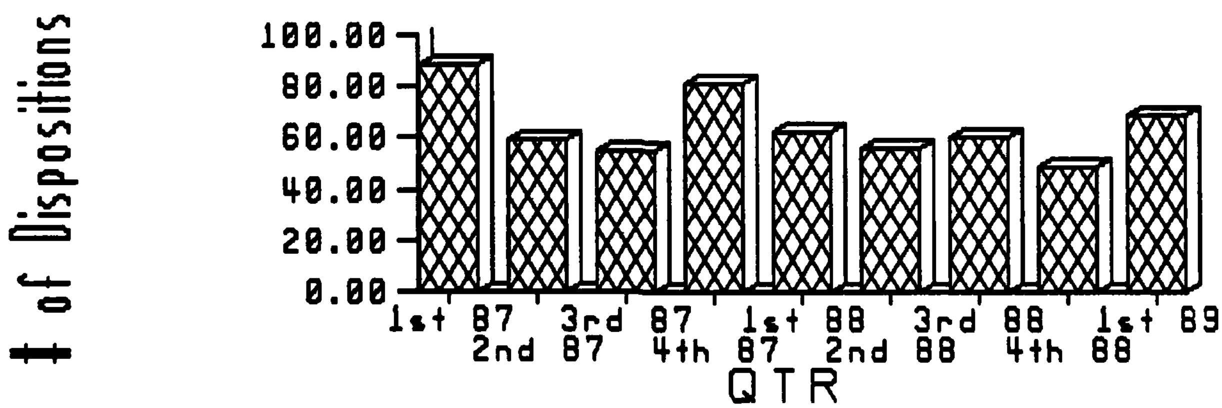


Figure 11. Number of Dispositions for Major Diagnostic Category Group 2 (MDCG 2) per Fiscal Year Quarter (QTR).



<u>Figure 12</u>. Number of Dispositions for Major Diagnostic Category Group 3 (MDCG 3) per Fiscal Year Quarter (QTR).



<u>Figure 13</u>. Number of Dispositions for Major Diagnostic Category Group 4 (MDCG 4) per Fiscal Year Quarter (QTR).

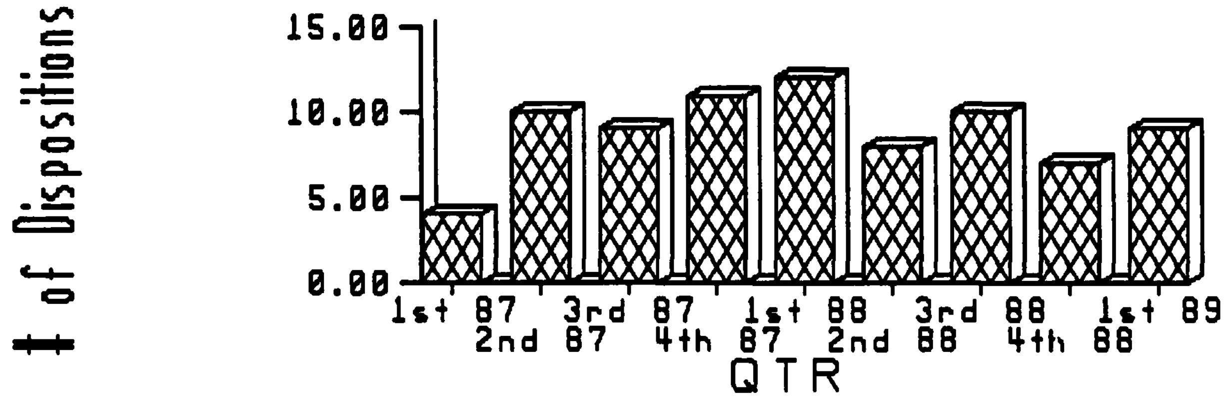


Figure 14. Number of Dispositions for Major Diagnostic Category Group 5 (MDCG 5) per Fiscal Year Quarter (QTR).

Table C-5.

Descriptive statistics for mean average length of stay per inpatient, by Major Diagnostic Category Group (MDCG).

QTR	MDCG[1]*	MDCG[2]*	MDCG[3]*	MDCG[4]*	MDCG[5]*
1/87	13.03	10.03	20.77	17.67	19.00
2/87	12.97	16.27	21.40	17.23	2.33
3/87	21.57	23.40	18.07	36.17	9.50
4/87	14.67	14.70	21.27	27.07	11.37
1/88	16.00	6.63	19.07	21.33	10.17
2/88	12.37	6.60	19.73	24.23	5.77
3/88	16.67	10.37	22.13	31.77	3.93
4/88	16.63	7.00	17.43	27.87	5.03
1/89	12.44	14.72	20.42	26.16	6.00
Mean	15.15	12.19	20.03	25.50	8.12
SD	2.80	5.29	1.49	5.87	4.78

Notes: * represents days.

Appendix D

Results of Statistical Analysis

Table D-1.

Results of hypothesis tests for the effects of Major Diagnostic Category Groups (MDCGs), Quarter (QTR), and Gender upon Total Sick Days (TSDs).

Test for Effects	R^2	F	df^1	df^2	p
Full Model	.566	22.17	15	255	*
Restricted Model One					
(Due to MDCGs)	.156	48.23	5	255	*
Restricted Model Two					
(Due to gender)	.415	88.66	1	255	*
Restricted Model Three					
(Due to time)	.561	.32	9	255	n/s

Notes: * $p < .001$

n/s not significant

Table D-2.

Results of hypothesis tests for the effects of Major Diagnostic Category Groups (MDCGs) and Quarter (QTR) upon Average Length of Stay (ALOS).

Test for Effects	R^2	F	df[1]	df[2]	p
Full Model	.756	6.63	14	30	*
Restricted Model One					
(Due to MDCGs)	.098	16.16	5	30	*
Restricted Model Two					
(Due to QTR)	.658	1.33	9	30	n/s

Notes: * $p < .005$

n/s not significant

Table D-3.

Difference of means t-test for Total Sick Days (TSDs) and number of dispositions per Major Diagnostic Category Group (MDCG).

QTR	TSD	p	MDCG[1]	p	MDCG[2]	p	MDCG[3]	p	MDCG[4]	p	MDCG[5]	p
1/87	1.66		-1.89		2.19		.40		-5.67	**	-6.19	**
2/87	-1.49		-3.84	**	.91		.73		1.26		-1.41	
3/87	-3.55	**	2.96	*	3.63	**	-2.03		2.18		-.14	
4/87	-4.29	**	-2.11		-2.20		-6.85	**	-3.82	**	-2.67	*
1/88	-1.14		-1.05		-2.94	*	-.25		.56		-3.94	**
2/88	1.55		-1.89		-5.70	**	1.70		1.95		1.13	
3/88	.78		3.16	*	.56		.40		1.03		-1.41	
4/88	5.56	**	5.06	**	2.31	*	3.99	**	3.56	**	-2.39	*
1/89	.89		-.40		1.26		-2.54	*	-1.05		-.14	

Notes: * $p < .05$.

** $p < .01$.

Table D-4.

Difference of means t-test for average length of stay per Major Diagnostic Category Group (MDCG).

QTR	MDCG[1]	p	MDCG[2]	p	MDCG[3]	p	MDCG[4]	p	MDCG[5]	p
1/87	2.14		1.56		-1.40		3.77	**	-6.44	**
2/87	2.20		-2.78	*	-2.59	*	3.98	**	3.43	**
3/87	-6.47	**	-5.99	**	3.71	**	-5.14	**	-.82	
4/87	.48		-1.34		-2.34	*	-.76		-1.92	
1/88	-.86		2.97	*	1.82		2.01		-1.21	
2/88	2.80	*	2.99	*	.57		.61		1.39	
3/88	-1.53		.97		-3.97	**	-3.02	*	2.48	*
4/88	-1.49		2.77	*	4.92	**	-1.14		1.83	
1/89	2.73	*	-1.35		-.73		-.32		1.26	

Notes: * $p < .05$.

** $p < .01$.

Table D-5.

Predicted values for Total Sick Days (TSDs) per Quarter (QTR) determined from the effects of Major Diagnostic Category Groups (MDCGs), while controlling for the effects of Quarter (QTR) and Gender.

QTR	Predicted TSDs*
1/87	15300
2/87	17379
3/87	18933
4/87	19152
1/88	17088
2/88	15084
3/88	15657
4/88	12061
1/89	15586

Notes: * sick days.

Table D-6.

Average Number of Predicted Total Sick Days (TSDs) per Major Diagnostic Category Group (MDCG) for Males and Females Across Nine Quarters.

	Males*	Females*	Total*
MDCG[1]	6526.25	4205.04	10731.29
MDCG[2]	2455.18	136.93	2592.10
MDCG[3]	1800.12	-521.23	1278.89
MDCG[4]	1930.40	-390.96	1539.44
MDCG[5]	1197.79	-847.53	350.27

Notes: * denotes predicted sick days.

Table D-7.

Average Predicted Average Length of Stay (ALOS) per Major Diagnostic Category Group (MDCG) across nine Quarters (QTRs).

	ALOS*
MDCG[1]	15.15
MDCG[2]	12.19
MDCG[3]	20.03
MDCG[4]	25.56
MDCG[5]	8.12

Notes: * denotes predicted ALOS in days.