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The goal for Military Treatment Facility commanders under TNEX is to maximize the utilization of their funds through MTF optimization plans. The studies purposes are to identify healthcare being referred to the local purchase care market under the current process that could be recaptured by the organization, to perform a cost-benefit analysis to determine the best financial location for the delivery of this care (BJACH or the purchase care market) and to provide recommendations to the command on a best practice referral management model to optimize the referral process and the organization's purchase care resources. The results indicated that the mean cost of MRI procedures for active duty dependent spouses was significantly higher than the sponsors, both active and retired, and their children. Further, the addition of MRI services would provide a positive health care convenience to the prime beneficiary while adding financial and social value to the organization. Finally, by adopting the best practice referral model recommendations, the Referral Management Center can better position the facility for financial success under TNEX.

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A Quantitative Analysis of the Referral Management Process under the Next Generation of TRICARE Contracts (TNEX)

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Fort Polk, Louisiana

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Running Head: REFERRAL MANAGEMENT UNDER TNEX

U.S. Army Baylor University Graduate Program in

Health Care Administration

Graduate Management Project

A Quantitative Analysis of the Referral Management Process under the Next Generation of TRICARE Contracts (TNEX)

Presented to A. David Mangelsdorff, Ph.D. MPH

In partial fulfillment of the requirements for a Masters Degree in

Health Care Administration

by

CPT Stephen J. Williams

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Abstract

The TRICARE Management Activity negotiated the next generation of TRICARE contracts (TNEX) to improve the cost, quality, and accessibility of services for its beneficiaries. The goal for Military Treatment Facility commanders under TRICARE is to maximize the utilization of their funds through MTF optimization plans. The studies purposes are to identify healthcare being referred to the local purchase care market under the current process that could be recaptured by the organization, to perform a cost-benefit analysis to determine the best financial location for the delivery of this care (BJACH or the purchase care market) and to provide recommendations to the command on a best practice referral management model to optimize the referral process and the organization's purchase care resources. The results indicated that the mean cost of MRI procedures for active duty dependent spouses was significantly higher than the sponsors, both active and retired, and their children. Further, the addition of MRI services would provide a positive health care convenience to the prime beneficiary while adding financial and social value to the organization. Finally, by adopting the best practice referral model recommendations, the Referral Management Center can better position the facility for financial success under TNEX.

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A QUANTATATIVE ANALYSIS OF THE REFERRAL MANAGEMENT PROCESS UNDER THE NEXT GENERATION OF TRICARE CONTRACTS (TNEX)

Introduction

Conditions that prompted the study

Current guidance from the Military Health Services System (MHS) requires that all care provided to active duty service members is coordinated at the MTF level. Additionally, eligible dependents of service members and retiree beneficiaries can receive direct care at the MTF on a space-available basis. The medical mission of the Department of Defense (DoD) "is to provide and maintain readiness, medical services, and support to the armed forces during military operations and to provide medical services and support to members of the armed forces, their family members, and others entitled to DoD medical care" (TRICARE Management Activity, 2004). In response to this DoD directive, TRICARE Management Activity (TMA) was developed to function as the managed care policy and implementation entity of the MHS. The TRICARE program has allowed the MHS to transition to a more comprehensive managed Health Care system, but the evolutionary changes continue. In an attempt to improve the cost, quality, and accessibility of services for its beneficiaries, TMA negotiated the next generation of TRICARE contracts (TNEX) to better serve its beneficiaries and move the MHS towards a more comprehensive managed care model. One of the key differences of TNEX and previous versions of the TRICARE contracts is that the MTF commanders will control their purchase care dollars at the MTF level and will be increasingly held accountable for MTF performance through their business plans. A key goal for MTF commanders under TNEX is to maximize the utilization of purchase care funds through

MTF optimization plans, thus improving the quality and access to care while lowering cost to the MHS (Williamson, 2003). Cost savings realized through MTF optimization and the prudent use of purchase care resources will provide MTF commanders funds that can be invested into MTF operations and services to enhance care and improve services for the MTF beneficiaries.

While many aspects of TRICARE remain the same under TNEX as compared to the previous contracts, notable changes to the utilization and direction of the care system become strikingly apparent. An increased focus on customer service and customer performance standards more in line with current civilian models has been added to the new contracts. Further, the TRICARE regions were consolidated from 11 to 3 stateside regions, with each region having a managed care support contractor (MCSC). By consolidating the TRICARE regions, the MHS will be able to develop integrated business plans for regional market development and provide an increase in MCSC oversight (Williamson, 2003). Additionally, standards relating to network adequacy, timeliness of consultative reports resulting from referrals to/from the network, and the range of TRICARE Prime coverage area further demonstrate contract changes. Most notably, changes to the financial business rules, specifically the concept of revised financing, will provide the most germane challenge for the MTF commanders. Under the concept of revised financing, the MTF commanders will have the control and oversight of their private sector care funding for their prime enrollee. According to the TRICARE TNEX financial business rules (TMA, 2004), "revised financing provides incentives to maximize the MTF capacity and operations, aligning financial responsibility with authority…this design should encourage MTFs to minimize [private sector care] costs

through effective recapture initiatives and sound referral management" (p. 4). Under TNEX, referral management and MTF optimization becomes the centerpiece for success for local commanders (Williamson, 2003). The goal of MTF optimization "is to optimize the MTF assets and deliver the best value Health Care while effectively managing the...Health Care budget" (Humana Military Health Care Services [HMHS], p. 1, 2004).

The Research Question

In response to the focus on MTF optimization, this study will examine the referral management process at BJACH, located at Fort Polk, LA, in the newly created TRICARE south region; Humana Military Health Care Services is the MCSC for this region (Williamson, 2003). With an increased emphasis on the referral management process, MTF commanders must prudently manage their use of the purchase care resource services and the associated costs of these services. Under the revised financing concept, cost savings realized by the MTF through prudent resource management will be retained at the MTF level for reinvestment in the organization (TRICARE Management Activity, 2004). The purpose of this study is to evaluate the referral management process, in response to the next generation of TRICARE contracts, at Bayne-Jones Army Community Hospital. The objectives of the analysis are to identify healthcare being referred to the local purchase care market under the current process that could be recaptured for the organization, perform a cost-benefit analysis to determine whether it would be financially beneficial to BJACH to retain these services under TNEX or refer these services to the purchase care market, and to provide recommendations to the command on how to optimize the referral process and the organization's purchase care resources.

Literature Review

Managed Care

In 2001, the World Health Organization reported that the United States spent roughly 13 percent of its gross domestic product on Health Care for its citizens (World Health Organization, 2001). As Health Care expenditures continue to increase nationally, the MHS has fallen victim to this increased cost of care. With over nine million beneficiaries system wide, the challenge of controlling Health Care costs continues to be at the forefront of MHS policy making. In response to these rising expenditures, the MHS, like its civilian counterparts, has increasingly turned to managed care as a source of cost control.

The most popular managed care entity is the Health Maintenance Organization (HMO). According to Kongstvedt (2001), "Health Maintenance Organizations are organized Health Care systems that are responsible for both the financing and delivery of a broad range of comprehensive health services to an enrolled population for a prepaid, fixed fee" (p.12). Conceptually invented in the 1930's, the wide-scale acceptance of HMO Health Care management did not develop until the 1970's. In 1973, the passage of the HMO Act secured the role of managed care in our Health Care system. Currently, over 75 million Americans are enrolled in HMOs across the nation (Markovich, 2003). Deriving their fiscal and legislative power from large enrollment, HMOs have developed a significant influence on the Health Care industry (Markovich, 2003). Most managed care plans are employer purchased, thus, the goal of the plan is to reduce the cost of Health Care for the purchaser. Essentially buyer driven, HMOs, unlike conventional insurance, seek to restrict provider and service choice in an attempt to control cost for the

buyer/employer (Gaynor & Haas-Wilson, 1999). Like the civilian Health Care industry, the MHS has adopted the HMO concept as the framework for TRICARE.

In a 1995 study published in the *RAND Journal of Economics*, Goldman examined the impact of managed care reforms on medical service utilization in the MHS. One issue the researcher identified was that the military managed care entities, unlike civilian plans, encouraged inpatient utilization, which contributed to the higher cost of care. Further, the study concluded that military HMO enrollees demonstrated an increased demand for health care services relating to liberal health care benefit coverage and increased access to care at the MTF level. The author states, "Accessing the Health Care delivery system is almost entirely a patient initiated transaction. Thus, this expansion in use must be due to an elastic beneficiary response to the generous benefit design" (Goldman, 1995, p. 294). The study concluded that the comprehensive benefit package provided to military beneficiaries stimulates the demand for Health Care thus; cost savings can be obtained through less comprehensive benefit packages to negate the moral hazard associated with such a generous benefit package (Goldman, 1995).

In 1991, RAND Health's National Defense Research Institute (NDRI) conducted an evaluation of Health Care utilization and cost within the MHS. The authors found that military beneficiaries' utilization rates, both inpatient and outpatient, for Health Care services, were 30% to 50% higher than the civilian Health Care fee-for-service plans. Several factors contributed to this higher demand for Health Care such as: high injury rates among active duty personnel, health maintenance requirements for active duty, and frequent family separations. All contribute to higher utilization rates. The study concluded the availability of essentially free care for MHS beneficiaries drove the higher

demand for Health Care services. In response to this higher demand, the researchers recommended limiting direct care to non-active duty beneficiaries and supported the use of civilian purchase care facilities for this population (Bennett, Buchanan, Hanley, Hawes-Dawson, Hosek, Madison, et al., 1991).

In an attempt to better manage the allocation of Health Care resources in relation to the increased demand for services, the MHS must determine, specifically, what services should be offered by the MTF versus the network to maximize the benefit to beneficiaries while minimizing the cost of services. As Health Care resources become limited, researchers have turned to case management models to further control cost and demonstrate positive returns on Health Care program investments. Erdley, Pope, and Sackett (2004) studied the return on investment of a prenatal program in a managed care organization. They felt that timely and accurate patient information is essential for the providers of care and resource managers. By using tools of economic analysis, the authors demonstrated the positive financial impact case management has on Health Care programs and the ability to identify services that can provide increased benefits to patient and provider while controlling the cost of care. In an information paper outlining the clinical case manager's role in managed care contracting, Rehberg (1996) cited "organizations that approach managed care as a system that blends the resources of management, finance, and clinicians will enjoy the greatest potential for success" (p. 12). He viewed case management as a critical part in the relationship of providers, payers, families, and patients, which leads to positive patient outcomes and increased cost savings to the organization and consumer (Rehberg, 1996).

Referral Management

In 2002, a study by Forrest, Nutting, Starfield, & von Schrader examined the Primary Care Manager (PCM) decision-making process on referrals to specialty care. The researchers studied 2,535 specialty care referrals by 131 family physicians over a period of 15 business days. The authors determined that 1 in every 20 office visits result in a referral. In addition, one third of referrals were made in non-office visit settings, such as telephone consults or bedside conversations in which the most common reason for a referral was to obtain advice. The researchers recommended "Physicians in training should be taught the skills required to recognize the boundaries of their clinical uncertainty and scopes of practice" (p. 219).

In 2000, Franks, Mooney, and Sobero studied the effects provider referral rates have on Health Care cost, risk of avoidable hospitalization, health status, and patient satisfaction. The results of their study showed that no statistically significant relationship exists between physicians' referral rates to specialty providers and the empanelment member costs after a case mix adjustment was made to the referral rate. Additionally, they found a modest relationship exists between increased patient satisfaction and physician referral practices which imply an increased patient preference for specialty care (Franks, Mooney, & Sobero, 2000).

The next generation of TRICARE contacts was implemented throughout the MHS as of November 1, 2004. As previously noted, the responsibility of managing purchase care resources now resides with the local MTF commanders. The mission of the MTF resource managers is to prudently mange their network referrals to optimize their purchase care resources. According to the U.S. Air Force referral management guide

(2004), "the financial incentive for the MTF is to retain as much specialty care within the MTF as access, capability, and capacity will allow" (pg. 6). By definition, referral management is the process of supervising internal and external patient referrals to ensure timely, cost efficient, and informed decisions regarding the effective utilization of Health Care resources, and additionally, when appropriate, recapturing services that would otherwise be referred to the local purchase care market under current business practices (TMA, 2004).

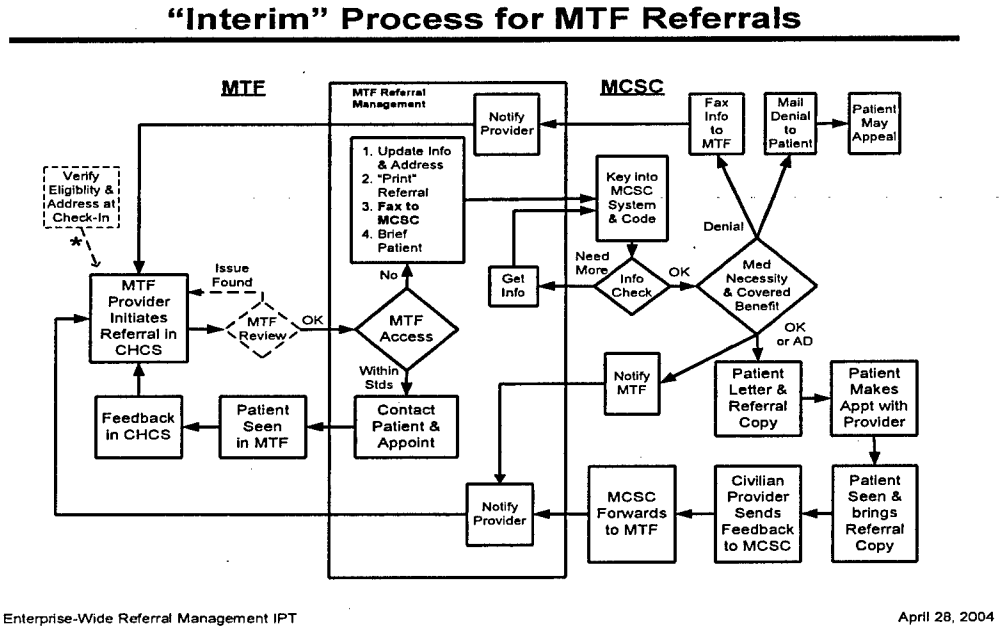
The process of referral management has two distinct functions: a clinical function that emphasizes utilization review as a tool to evaluate the medical necessity and appropriateness of referred care and an administrative function that monitors and tracks referrals for access standards, patient eligibility, and continuity of care (TMA, 2004). In combination, these clinical and administrative functions provide a powerful process tool, which allows MTF resources managers to objectively evaluate and manage their internal and external referral processes.

The MHS has identified the establishment of a Referral Management Center (RMC) as the first step in prudent referral management. The RMC is the single point of contact for the MCSC and the referring provider. Patient focused, the RMC serves as the information and process controller between and for their stakeholders: the patient, provider, the MTF and the MCSC. The MHS has recommended that in order to better service these stakeholders, minimum-staffing levels must be maintained in the center. The U.S. Air Force (2004) has recommended that one RMC staff member can efficiently process 30 to 40 referrals per day. According to MHS guidance, the duties of the RMC include, but are not limited to: welcoming the patient into the center, accessing the

nature of the referral, determining the referral status, providing specialty care appointment, referring care to the network, patient education, customer focus service, referral tracking, right of first refusal determination, management of network referrals, and collecting referral results for distribution within the MTF

In an attempt to streamline the referral process, the MHS is developing the Enterprise Wide Referral and Authorization System or EWRAS. This enterprise-wide information management system is a web-based integrated management tool to process direct and purchase care referrals. Currently, the EWRAS system is under construction, so this management tool was unavailable at the start of TNEX.

Figure 1. TMA suggested interim process for MTF referral management to network providers from the MTF.



Source: Naval Medicine MTF Referral Management Interim Guidance (2004).

An interim referral process, illustrated in Figure 1, was recommended by TMA as the model to support the referral process until the EWRAS system has been fully developed.

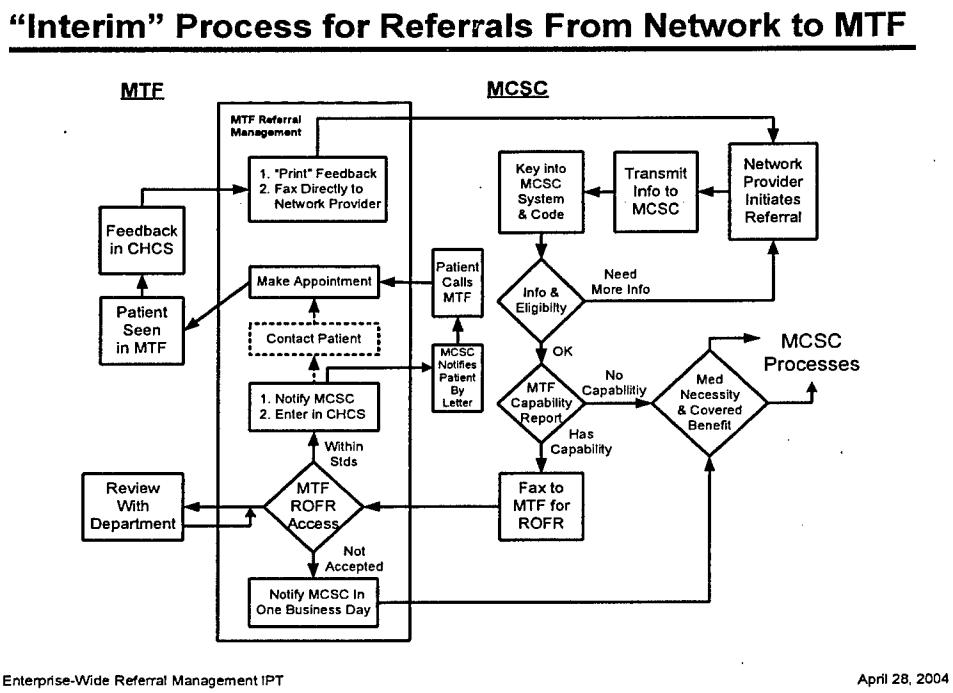
This interim process will depend on facsimile machines as the communication tool between MTF referral centers and MCSC.

As illustrated in Figure 1, 12 critical steps are germane to the interim process for referring patients to the purchase care market. The steps in the process are as follows. The provider verifies patient eligibility and demographic information. The MTF provider places a referral in the Composite Health Care System, or CHCS, and the referral is reviewed by MTF Utilization Management (UM) staff; if capability is available in the MTF for the patient's Health Care needs, the appropriate appointment is made for the patient and results are available in CHCSII for to the referring provider. If the UM staff determine capacity is not available in the MTF for the patient's Health Care needs or can only be provided outside the TRICARE access guidelines, the referral is copied from CHCS and faxed to the MCSC. The MCSC will then enter the referral into its referral tracking system and verify all required information is present for a clean referral. If information is lacking, the referral is sent back to the MTF for additional information to allow processing. The MCSC will perform a medical necessity review (MNR) and covered benefit review (CBR) for a non-active duty patient. If these predetermined criterions are not met, the referral is denied, and the MTF and patient are notified of the denial. All referral denials can be appealed by the patient through the MCSC. If the referral meets the MNR and CBR criteria, an authorization letter is sent to the patient, network provider specialist, and to the MTF. The patient makes an appointment with the network provider, and the patient takes a copy of the referral to the network provider appointment. The network provider then communicates the results of the referral to the MCSC, which in turn, forwards the information to the MTF. A consult of care report

must be provided to the MTF within 10 days of the appointment. The RMC notes receipt of the report in the RMC tracking system and forwards the information to the provider and the medical records section (Naval Medicine MTF Referral Management Interim Guidance, 2004).

When patients are provided care in the purchase care market, situations may arise when treating the patients that require the network provider refer a patient for alternate forms of care. In this case, an interim process for Network to MTF referral has been developed to provide continuity of care and increased resource control by the MHS while delivering the best possible care to the patient. This process is illustrated in Figure 2.

Figure 2: TMA suggested interim process for MTF referral management from the network providers to the MTF.



Source: Naval Medicine MTF Referral Management Interim Guidance (2004).

One key provision in the network to MTF referral process is the right of first refusal (ROFR). The ROFR gives the MTF the ability to review all network referrals, and when appropriate, the MTF retains the right to deny network referrals and recapture that patient and workload back into the MHS direct-care system. As illustrated in Figure 2, nine critical steps are germane to the interim process for Network to MTF referrals. The steps in the interim network to MTF referral process are as follows. The network provider refers the patient for care. The referral is communicated to the MCSC, the referral is tracked in the MCSC referral management system, and the MCSC verifies all necessary information is present in the referral. The MCSC evaluates the referral against the MTF's capabilities report; if capacity exists in the MTF, the referral is given to the RMC for ROFR evaluation. The MCSC will perform a medical necessity review (MNR) and covered-benefit review (CBR). If the RMC refuses the referral, the MCSC will refer the patient to a network provider. The RMC has until the next business day, by 1600, to accept or deny the referral. If accepted, the MTF must be able meet TRICARE access-to-care standards. If the MTF accepts the referral, the MCSC is notified and the MTF provides an appointment to the patient. The RMC inputs the referral into CHCS for the documentation of care, and the MTF provides care to the patient. A consult of care report must be provided to the network-referring provider within 10 days of the appointment (Naval Medicine MTF Referral Management Interim Guidance, 2004).

To ensure the timely completion of referrals to specialty care, researchers have attempted to isolate predictors of referral completion. Baker, Bocian, Forrest, Glade, Starfield, and von Schrader (2000) studied the referral process and how physicians coordinate patient specialty care. Additionally, they examined the referring physicians'

satisfaction with the care their patients received and the overall referral completion. The authors found that when a referring physician personally made the appointment and sent the specialist information regarding the referral, the likelihood of referral completion increased three times in comparison to baseline referral completion rates. Further, the authors found no significant difference in referral-rate completion in the presence of insurance plans and gatekeeping arrangements (Baker, Bocian, Forrest, Glade, Starfield, & von Schrader, 2000).

Utilization Management

Utilization management is an organizational process that attempts to balance the cost and quality of Health Care services while maintaining optimal patient centered outcomes. According to the MHS Population Health and Medical Management Support Center (2004), "The ultimate goal of UM is to maintain the quality and efficiency of Health Care delivery by keeping the patient at the appropriate level of care, coordinating all existing Health Care benefits and community resources, and holding costs to a minimum" (p.1). The purpose of UM is to oversee the resource utilization within the MTF by monitoring, evaluating, and identifying inconsistencies in the care provided at the MTF. Simplified, UM is the process of managing the Health Care resources at the MTF in the most efficient manner available to the providers of care and the patient (MHS Population Health and Medical Management Support Center, 2004).

A 1998 Baylor Graduate Management Project (GMP) (Prevo, 1998) analyzed the capacity-management process of a Family Care clinic. The goal of the study was to determine the optimal enrollment capacity of the clinic, utilizing a computer simulation model, under a capitated reimbursement system. By determining the appropriate capacity

of the clinic, the author could demonstrate the maximum patient empanelment for the clinic, which would provide managers with the necessary information needed to recapture patients to the family care clinic (Prevo, 1998).

A Baylor GMP by Taylor conducted a cost analysis of the TRICARE Health Care program in comparison to the Federal Employee's Health Benefits (FEHB). The study compared the average cost per beneficiary of the FEHB program to the average cost per beneficiary for TRICARE beneficiaries. The study recommended the expansion of the FEHB program to DoD beneficiaries over the age of 65 as a means to augment their cost of care for this patient population (Taylor, 1996).

A retrospective cohort study by Barnett, Rosenthal, & Wahls (2004) developed a method to aid in the prediction of resource utilization in the Veterans Health primary care population. The study compared the adjusted clinical groups (ACG) and the chronic diseases index (CDI) to predict future outpatient and inpatient utilization in the Veterans Administration system. The study concluded that tools based on diagnosis-related measures were superior in predicting future patient utilization.

Cost Benefit Analysis

A cost-benefit analysis is a convenient process in which a Health Care resource manager can assess the long-term impact of adopting new services or deciding on whether to continue a specific product line. Essentially a decision-making tool, cost-benefit analysis can assist the researcher in evaluating all-relevant costs associated with a project or service and compare this information to the benefits of the service. Prest & Turvey (1965) noted "cost-benefit analysis is a practical way of assessing the desirability of projects…it implies the enumeration and evaluation of all relevant costs and benefits"

(p.683). Further demonstrating the tools of economic analysis, Erdley, Pope, and Sackett (2004) used the measure of return on investment (ROI) to demonstrate the financial profitability of disease management programs. The authors studied prenatal programs that focused on high-risk pregnancies in western New York. They revealed that investments in these disease programs generated a positive ROI of 37% based on the overall decreased Health Care costs of low-birth-weight babies in the study population.

Quantitative analysis in the military setting has focused on reducing budgetary cost while maintaining operational readiness. Feldstein cites (1963) "economists who approach military operational research as problems for cost-benefit analysis, stressing that these decisions can be reduced to finding the maximum military capacity which can be achieved subject to various budgetary constraints" (p.21). Further, the author stresses the importance of cost-benefit analysis as a decision tool in National Health Care planning. In 1994, Kupper used the economic tool of cost-benefit analysis to evaluate the third-party collections program of the radiology department at the Charleston Naval Hospital. Conducted during a period of military downsizing, the author exposed a third-party collection program valued at $700,000 to the facility, demonstrating the profitability of the department.

Method and Procedures

Variables and Working Hypothesis

To fully understand the nature of the procedures and patient groups being referred to the local purchase care market, this researcher decided to undertake a statistical analysis of the 2004 non-institutional (outpatient) purchase care data for BJACH catchment area. The analysis goals are to identify a procedure or service for a cost-benefit analysis that is currently being referred to the purchase care market, identify statistically significant beneficiary groups associated with this procedure, and highlight the overall historical financial picture of the facilities purchase care market. The source of the purchase care data is the M2 data mart, an enterprise-level data repository for the MHS. All patient information, financial billing, and procedure information from the CHCS system, the Medical Expense Productivity Reporting System (MEPRS) and the MCSC's billing data is collected at the enterprise level in the M2 repository in which 109 variables are collected and stored relating to network non-institutional purchase care (M2 Data Dictionary, 2004). The historical data for FY2004 were obtained from the M2 data mart for all the network non-institutional purchase care at BJACH over the past year, before the start of TNEX. Currently, the M2 data mart is the sole source of historical Health Care financial information for the MHS.

The dependent variable for the statistical portion of the study is the amount paid, total, defined in the M2 data dictionary as the total amount paid when all claims have been processed (M2 Data Dictionary, 2004). The independent variables consist of the following: Provider Zip Code (zip code of facility where care was provided), Nature of Service (code indicating the nature of the type of service or referred to as type of service),

Place of Service (code to indicate the place or institution type where care is provided), Beneficiary Category Common (categorization of beneficiaries based on a given sponsor status for cost sharing and reporting purposes), Defense Enrollment Eligibility Reporting System (DEERS) Dependent Suffix Code (code maintained by DEERS that uniquely identifies the patient within the family), gender (male or female), age, and CPT codes. (codes used by hospitals from the American Medical Association Current Procedural Terminology (CPT) manual 2003) (M2 Data Dictionary, 2004). These variables are listed in Figure 3.

Figure3: Dependent and Independent Variables for Outpatient Purchase Care Data.

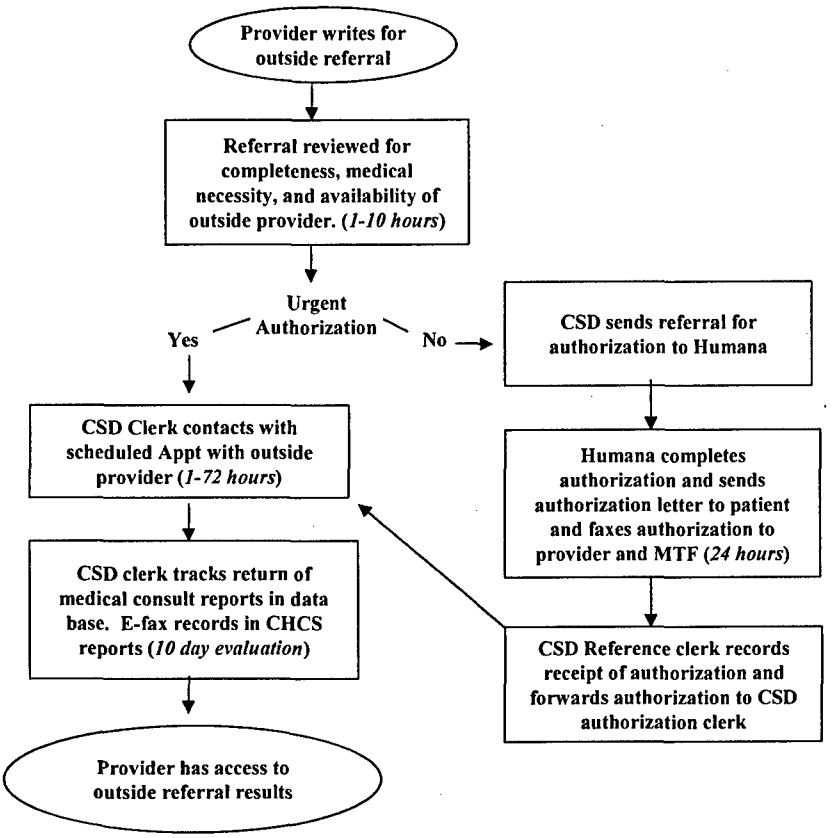
Dependent and Independent Variables for Outpatient Purchase Care Data	
Dependent	Independent
Amount Paid, Total	Provider Zip Code Nature of Service Place of Service Beneficiary Category Common DEERS Dependent Suffix Code Gender Age CPT Procedure Code

The goal of the statistical analysis is to identify a target procedure for the cost-benefit analysis. Once identified, a financial analysis is performed to compare local purchase care pricing models to the cost of delivering direct care at BJACH. The objectives of this analysis are to identify a procedure being referred to the local purchase care market, under the current process, that could be recaptured by the organization and to perform a cost-benefit analysis to determine whether this procedure should be recaptured into the facility or remain outsourced to the purchase care market. Additionally, this analysis will assist in providing recommendations to the command on

additional services for the MTF. The analysis will compare the cost of adding this service to the facility versus continuing to outsource this service, given historical resource utilization. Fixed costs associated with adding a new service include the capital costs of new equipment and facilities, utilities and maintenance, and personnel requirements. Variable cost associated with adding a service includes the direct cost of providing a service, supplies, and expendable equipment to the patient, or the per patient or unit costs. The total cost of providing the service will be obtained from adding the fixed and variable costs and comparing these costs to the cost of purchasing the service in the local market.

In preparation for the next generation of TRICARE contracts, the staff at BJACH developed a redesigned referral management process to help better manage the external referral process using the TMA recommended Interim model as a guide but modifying it to fit the local constraints. This study will analyze the efficiency of this process by auditing the referral management database implemented at the start of TNEX. The audit will examine the referral process, based on the previously discussed criteria outlined in the referral management section of the review of literature, and make recommendations to the command for creating and implementing the best practice model for external referral management. Potential problems in the referral process are the ability to provide care within TRICARE access standards, effectively utilizing the ROFR within timelines of the contract, return of results and inadequate documentation that results in a denial of referrals. Figure 4 illustrates the current referral process at BJACH.

Figure 4: Current referral management process at BJACH.



The Method

The MHS's data warehouse is the M2 database. M2 is a powerful analytic tool supporting Health Care analysts around the MHS. The objective of the M2 data mart is to provide a broad management view of MHS operations. M2 provides a single, authoritative, timely source of MHS management data to analysts and executives throughout the MHS. M2 data include direct care, inpatient and outpatient data, purchase care data, and normative benchmarks. The M2 data mart source of information originates from a variety of MHS data systems. Examples of MHS data systems from which M2 draws its information are CHCS, DEERS, Pharmacy Data Transaction Service (PDTS), and the TMA-Aurora Claims System (TMA-Aurora). With the exception of the TMA-

Aurora Claims System, critics have questioned the validity and reliability of the data located within the systems that source M2. According to the Military Health System Information Management Program (2004), audits from the DoD Office of the Inspector General (IG) and the Government Accounting Office (GAO) have questioned the reliability of the data tracked by the MHS. With the M2 data mart as the sole and only source of data for the MHS, this researcher decided to concentrate on only non-institutional purchase care data derived from TMA-Aurora that M2 reports (Working Information Systems to Determine Optimal Management Course (WISDOM), 2004).

TMA-Aurora is a DoD database that records all Health Care claims from the civilian purchase care market for the MHS. The source of data for TMA-Aurora is the Health Care Service Reports (HCSR) and TRICARE Encounter Data (TED) by which claims processed by the MCSC with the industry-approved software system, ClaimCheck billing software, are entered into the system. Examples of programs from billing software developers are the programs developed by Wisconsin Physicians Services (WPS), a TRICARE-approved national claims-processing company. Additionally, WPS supports the Electronic Data Interchange (EDI) claims-processing system. This software has been developed to reduce payment and data entry errors, edit data during entry by relational, financial, and validity edits outlined in the TRICARE systems manual (TMA, 2004), and provide for instant verification of benefits (WPS, 2004). Further, claims processed into the HCSR deemed valid by initial software screens are the only claims accepted by the TMA-Aurora system. The Director of the TRICARE Program Integrity Office, Mrs. Rose Sabo, states "The validity of the information from the national data-base is such that it's been accepted in criminal cases in federal and state courts...Because of the built-in

controls and edits to ensure validity" (R. M. Sabo, personal communication, January 3, 2005). Additionally, Dr. Richard Guerin from the TRICARE Health Program Analysis and Evaluation Program states "purchase care data located in M2 is the most reliable data the MHS has to their disposal" (personal communication, January 4, 2005). TMA-Aurora has developed the TMA claims audits or Meridian audits to access and monitor the accuracy of claims within the HCSR and TED databases. The primary purpose of the TMA claims audit is to determine the accuracy of institutional claims payments, non-institutional claims payments, and institutional and non-institutional payment record coding. Approximately 1600 cleared claims, claims that have been deemed valid by the ClaimCheck software, are selected monthly for the Meridian audit. The ensuing error rates are used in the evaluation of contractor performance and in the quarterly application of incentive provisions of contracts. The scope of the contract requires the evaluation of contractor payment determinations based on the claims, attendant documentation, other source documents and files used in the adjudication process, and the evaluation of contractor payment record coding based on the previously noted documentation and the contractor payment determinations. These evaluations are made by comparing the contractor's processing and coding decisions with requirements in the TRICARE Policy Manual, the TRICARE Reimbursement Manual, the TRICARE Operations Manual, the TRICARE Systems Manual, and the individual contracts. Commonly, each contract is audited on a quarterly basis. Samples of each contractor's processed claims are selected from the edited payment record submissions received at TMA within each calendar quarter. This sample selection process is automated and begins the sequence of auditing events. The following is an example of one variable audit description from the TED audit

claims guidelines obtained from TMA-Aurora (G. Woskow, personal communication, January 12, 2005).

> DRG NUMBER. This is a three position alphanumeric field which identifies the Diagnosis Related Group (DRG) determined for the care on an institutional TED record. This is required if the record is processed under the TRICARE DRG reimbursement methodology. The auditor will verify the TED record entry with the 3M Health Systems Information (HIS) DRG Grouper program on the personal computer. Payment Error: The following may constitute payment errors: 1. Payment based on erroneous DRG number. 2. DRG reimbursement for number exempt from DRG payment. 3. Erroneous outlier determinations. 4. DRG payment based on erroneous weighing factors.

The TED claims audit examines 67 different variables in each claim selected for examination. Audit guidelines specific for each variable are similar to the previous example provided (K. Johnson-Griffith, personal communication, January 10, 2005). Further, the overall claims database is monitored through frequency distributions on a monthly basis. Any observed outliers in the frequency distributions are selected for supplementary audit for claim accuracy and relational check, such as beneficiary eligibility, DRG appropriateness (male patients having a vaginal delivery), and covered benefits (G. Woskow, personal communication, January 12, 2005). Given that the purchase care data located in M2 is the sole source of purchase care data for the MHS, this researcher is confident in assuming the validity and reliability of the purchase care data for this study.

The purchase care data is analyzed using the statistical program for the social sciences (SPSS). Utilizing the select cases function in SPSS, each subgroup within the independent variable is isolated and descriptive statistics (mean, standard deviation, frequencies, and sums) are analyzed for the dependent-variable amount paid, total, to illustrate which subgroup within the independent variable, in terms of overall cost and frequency, accounts for the majority of the purchase care resources. As an example, the independent variable nature of service has the groups of radiology, orthopedics, and multiple other overall hospital services coded within the variable. After determining which service is the major consumer of purchase care resources, the service will be isolated, using the select case function, and analyzed for frequently-occurring CPT codes associated with this service, such as radiology services and the group of CPT codes for magnetic resonance imaging (MRI). After isolating the CPT codes for the target service, an analysis of variance (ANOVA) is performed to uncover the main effects and categorical effects of the independent variables (Beneficiary Category Common, CPT codes, DEERS Dependent Suffix Code, Provider Zip Code, Place of Service, and Age) on the dependent variable, Amount Paid, Total. The key statistic for the ANOVA is the *F-test*. The *F-test* is used to determine if there is a statistical difference between the group means. Once a difference is determined, $p=.05$, a post hoc Scheffe test is performed for multiple comparisons of group means to determine which groups account for the significance and to control for type 1 error.

Once the target service is identified, a cost-benefit analysis will be performed to determine whether this procedure should be retained or outsourced to the purchase care market. The statistical analysis is used to identify the target service and describe the total

purchase care resources consumed by this service before the start of TNEX. Once known, an examination of the fixed costs associated with adding a new service, such as the capital costs of purchasing a new MRI machine and the initial start-up costs, facility modification costs, utilities and maintenance, and personnel requirement costs, such as physician, radiology technicians, and support personnel will be studied. Further, the variable costs associated with adding a service such as the direct costs of providing a service, supplies, and expendable equipment to the patient, or the per patient or unit costs will be analyzed. The total cost of providing the service will be obtained from adding the fixed and variable costs and then comparing these costs to the cost of purchasing the service in the local market.

After this analysis, a recommendation will be given to the command on how providers and managers can better manage their external referrals and posture the facility for success under TNEX. This analysis will audit the referral management database implemented at the start of TNEX. This audit will examine the referral process, based on the previously discussed criteria outline in the referral management section of the review of literature, and make recommendations to the command for creating and implementing the best practice model for external referral management. Examining the current referral process at BJACH and comparing it to the best-practice model submitted by the MHS will assist in the development of the best practice model. Interviews with the referral management staff, to identify current problems with the process and to facilitate buy-in, will be crucial in developing the best practice model.

Results

Fiscal Year 2004 Purchase Care Data Analysis

To fully understand the purchase care referral process at BJACH, we must first describe what services are being referred to the civilian purchase care market. As previously noted, the goal of this analysis is to identify procedures or services for a cost-benefit analysis that are currently being referred to the purchase care market, identify statistically significant beneficiary groups associated with these procedures, and highlight the overall historical financial picture of the facilities purchase care needs. The source of the purchase care data is the M2 data mart, an enterprise-level data repository for the MHS.

Under the revised financing concept of TNEX, non-institutional purchase care for TRICARE Prime beneficiaries enrolled to an MTF will be financed locally from the MTF's purchase care resources. The total fiscal year 2004 non-institutional purchase care data for BJACH, catchment area code 0064, was downloaded from the M2 data repository. The data encompasses all DoD beneficiaries eligible for care: TRICARE Prime, Extra, and Standard. To highlight the financial picture of the facilities purchase care market and to position the MTF's referral management program for the TNEX transition, only beneficiaries enrolled to catchment area 0064, Prime, were selected for the analysis. This will provide a clearer financial profile of the facilities non-institutional purchase care requirements under the TNEX revised financing concept. During fiscal year 2004, there were 83,666 episodes of care to the non-institutional purchase care market for TRICARE Prime beneficiaries enrolled to catchment area 0064. This accounted for approximately $9,668,000 of non-institutional reimbursement to network

and non-network providers. The mean payment to network providers was $115.55 with a standard deviation of $353.30.

A frequency analysis for the independent variable Nature of Service identified the categories of services being referred to the local market. The select cases function, in SPSS, enabled the isolation of each group in the variable Nature of Service. Subsequently, an analysis of the descriptive statistics for the dependent variable, Amount Paid Total, determined the cost each service represented in total purchase care capital. An inspection of Table 1 identifies the group Medical Care as the largest consumer of the non-institutional purchase care resources.

Table 1

Nature of Service by Descriptive Statistics to Outpatient Purchase Care Market

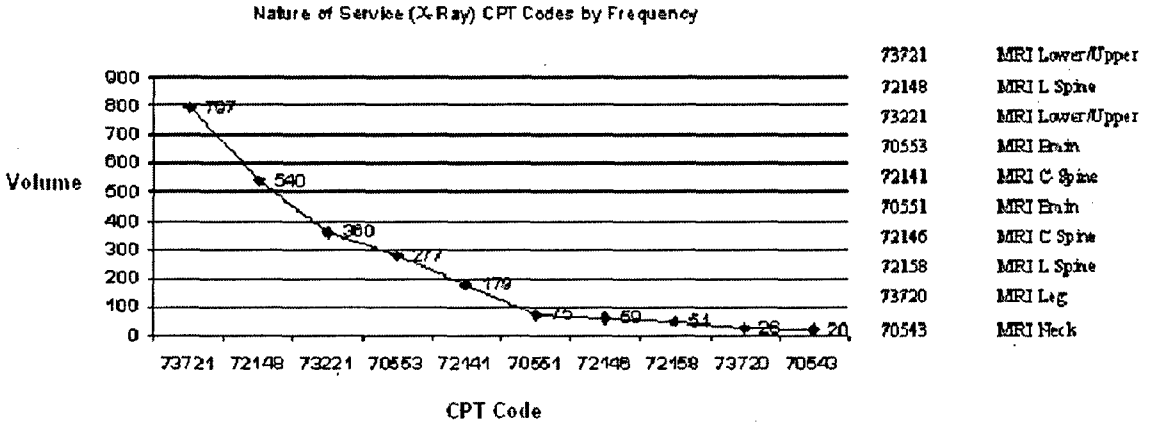
Code	freq	Sum	Mean	Std. Deviation	Nature of Service
1	24447	$3,217,498.62	$131.61	$489.77	Medical Care
4	9081	$1,475,846.73	$162.52	$246.11	Diagnostic X-Ray
11	17482	$1,293,727.06	$74.00	$193.82	Drugs
2	3986	$1,098,704.99	$275.64	$610.78	Surgery
9	1215	$483,335.94	$397.81	$542.22	Other Medical Service
13	907	$391,954.65	$432.14	$362.44	Ambulatory Surgery
3	2336	$307,719.06	$131.72	$59.06	Consultation
5	11313	$276,416.22	$24.43	$69.41	Diagnostic Laboratory
10	1180	$246,017.14	$208.48	$506.94	Equipment Rental
18	7330	$218,924.54	$29.86	$24.38	PT/OT
Total	79277	$9,010,144.95	$186.82	$310.49	

Broadly defined, isolating any one group of procedures for the cost analysis would prove difficult. Given the purpose of the analysis to target a procedure for the cost-benefit analysis, the group, Diagnostic X-Ray, was selected for further examination. Diagnostic X-Ray referrals accounted for $1,475,846.73 of non-institutional reimbursement to purchase care market providers. The mean payment was $162.52 with a

standard deviation of $246.11. The frequencies and descriptive statistics for all groups coded within the variable Nature of Service are summarized in Table 1 in terms of the dependent variable, Amount Paid Total.

Utilizing the select cases function in SPSS, the Diagnostic X-Ray group from the variable Nature of Service, was isolated and analyzed for CPT code frequencies. The results of the analysis, Figure 5, indicate the majority of the group's referrals were in CPT code set for MRI, thus making MRI a noteworthy target for the statistical analysis.

Figure 5: Nature of Service by CPT code frequency.



Utilizing the pivot table function in Microsoft Access permitted the isolation of all MRI CPT codes in the purchase care data. The MRI-specific encounters were then downloaded into a SPSS file for descriptive and inferential statistical analysis. The American Medical Association procedural manual (2003) provided all current MRI procedure codes. Additionally, the referral management office verified the list for completeness.

The data were inspected for completeness and variables recoded for the analysis. Frequencies and descriptive statistics for the variable, Amount Paid Total, revealed that MRI referrals had generated 2,688 encounters of care to the purchase care market. The

Table 2

Descriptive Statistics for Beneficiary Category Common and Amount Paid Total

Group	N	Mean	Std. Deviation	Std. Error	Minimum	Maximum
Active Dependent	490	530.68	372.11	16.81	0.00	1662.61
Retired Sponsor	201	408.62	336.80	23.76	0.00	1662.61
Retired Dependent	273	428.29	340.82	20.63	0.00	1691.74
Active Sponsor	1724	415.17	275.51	6.64	0.00	2603.76
Total	2688	437	309.92	5.98	0.00	2603.76

Table 3

Analysis of Variance for Beneficiary Category Common and Amount Paid Total

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	5305038.924	3	1768346.308	18.777	0.000
Within Groups	252774593.996	2684	94178.314		
Total	258079632.919	2687			

Table 4 represents the means and standard deviations by Modified DEERS Dependant Suffix Code (MDDS). A one-way ANOVA yielded a significant difference among the MDDS group means, $F(2, 2687) = 21.302$, $p = .000$. Table 5 represents the analysis of variance summary. A post hoc analysis using Scheffe procedure ($p = .05$) revealed the mean for DEERS group 3 (spouse of sponsor) was significantly higher than the groups 1 (dependent Child) and 2 (sponsor). There was no significant difference between the means of groups 1 (dependent Child) and 2 (sponsor).

Table 4

Descriptive Statistics for Modified DEERS Dependant Suffix Code and Amount Paid Total

Group	N	Mean	Std. Deviation	Std. Error	Minimum	Maximum
Child	152	433.49	348.33	28.25	0.00	1405.26
Sponsor	1930	414.95	282.41	6.43	0.00	2603.76
Spouse	606	508.41	367.88	14.94	0.00	1691.74
Total	2688	437.07	309.92	5.98	0.00	2603.76

Table 5

Analysis of Variance for Modified DEERS Dependant Suffix Code and Amount Paid Total

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	4031083.228	2	2015541.614	21.302	0.000
Within Groups	254048549.692	2685	94617.709		
Total	258079632.919	2687			

Table 6 represents the means and standard deviations by Modified CPT Codes. A one-way ANOVA yielded a significant difference among the Modified CPT Codes, $F(12, 2687) = 39.046$, $p = .000$ Table 7 represents the analysis of variance summary. A post hoc analysis using Scheffe procedure ($p = .05$) revealed the mean for CPT code group 1 (diagnostic/other) was significantly higher than the groups 5 (c-spine), 6 (T-spine), 7 (L-spine), 10 (u/l extremity), and 12 (toe). Group 2 (TMJ/neck) was significantly higher than the groups 5 (c-spine), 6 (T-spine), 10 (u/l extremity), and 12 (toe). Group 3 (brain) was significantly higher than the groups 1 (c-spine), 6 (T-spine), 7 (L-spine), 10 (u/l extremity), and 12 (toe). Group 5 (c-spine) was significantly lower than the groups 1 (diagnostic/other) 2 (TMJ/neck) 3 (brain), and 11 (leg). Group 6 (t-spine) was significantly lower than the groups 1 (c-spine), 2 (TMJ/neck), and 3 (brain). Group 7 (l-spine) was significantly lower than the groups 1 (c-spine) and 3 (brain). Group 10 (t-spine) was significantly lower than the groups 1 (c-spine), 2 (TMJ/neck), 3 (brain), and 11 (leg). Group 11 (leg) was significantly higher than the groups 5 (c-spine), 10 (u/l extremity), and 12 (toe). Group 12 (toe) was significantly lower than the groups 1 (c-spine), 2 (TMJ/neck), 3 (brain), and11 (leg). There was no significant difference between the means of group 4 (chest), 8 (pelvis), and 9 (hand).

Table 6

Descriptive Statistics for Modified CPT Codes and Amount Paid Total

Group	N	Mean	Std. Deviation	Std. Error	Minimum	Maximum
Diagnostic/other	167	697.80	375.11	29.03	0.00	1691.74
TMJ/neck)	30	638.50	357.51	65.27	52.83	1097.43
Brain	362	636.42	441.49	23.20	0.00	1662.61
Chest	5	800.18	340.51	152.28	389.56	1193.05
C-spine	179	353.24	176.63	13.20	0.00	793.77
T-spine	60	338.51	215.26	27.79	0.00	735.08
L-spine	620	403.20	255.25	10.25	0.00	1663.27
Pelvis	21	492.36	347.70	75.88	63.51	1107.88
Hand	15	506.26	280.94	72.54	56.81	964.56
U/L extremity	371	372.78	194.35	10.09	0.00	1031.96
Leg	39	599.67	554.83	88.84	0.00	2603.76
Toe	803	353.72	225.65	7.96	0.00	1774.76
Abdomen	16	473.45	452.33	113.08	0.00	1382.47
Total	2688	437.07	309.92	5.98	0.00	2603.76

Table 7

Analysis of Variance for Modified CPT Codes and Amount Paid Total

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	38467032.614	12	3205586.051	39.046	0.000
Within Groups	219612600.305	2675	82098.168		
Total	258079632.919	2687			

Table 8 represents the means and standard deviations by Modified Provider Zip Code. A one-way ANOVA yielded a significant difference among the Modified Provider Zip Code group means, $F(7, 2687) = 254.074$, $p = .000$. Table 9 represents the analysis of variance summary. A post hoc analysis using Scheffe procedure ($p = .05$) revealed the mean for Modified Provider Zip Code group 1 (all other) was significantly lower than the group 3 (Deridder). Group 2 (New Orleans/Lake Charles) was significantly lower than

the groups 3 (Deridder) and 6 (Leesville) and significantly higher than the group 4 (Shreveport). Group 3 (Deridder) was significantly higher than the groups 1 (all other), group 2 (New Orleans/Lake Charles), 4 (Shreveport), 5 (Alex), 6 (Leesville), 7 (Arkansas) and 8 (Texas). Group 4 (Shreveport) was significantly lower than the groups group 2 (New Orleans/Lake Charles), 3 (Deridder), 5 (Alex), and 6 (Leesville). Group 5 (Alex) was significantly lower than the groups 3 (Deridder) and 6 (Leesville) and significantly higher than the group 4 (Shreveport). Group 6 (Leesville) was significantly lower than the group 3 (Deridder) and significantly higher than the groups 2 (New Orleans/Lake Charles), 4 (Shreveport), 5 (Alex), 7 (Arkansas) and 8 (Texas). Group 7 (Arkansas) was significantly lower than the groups 3 (Deridder) and 6 (Leesville). Group 8 (Texas) was significantly lower than the groups 3 (Deridder) and 6 (Leesville).

Table 8

Descriptive Statistics for Modified Provider Zip Codes and Amount Paid Total

Group	N	Mean	Std. Deviation	Std. Error	Minimum	Maximum
All other	10	258.84	246.51	77.95	23.35	685.02
New Orleans/Lake Charles	40	318.32	281.81	44.56	16.73	997.69
Deridder	731	621.60	271.69	10.05	0.00	1774.76
Shreveport	533	98.70	110.85	4.80	0.00	943.27
Alex	210	279.98	252.63	17.43	0.00	1405.26
Leesville	1125	521.96	259.74	7.74	0.00	2603.76
Arkansas	10	204.10	189.94	60.07	15.00	481.51
Texas	29	154.42	236.72	43.96	62.68	1259.92
Total	2688	437.07	309.92	5.98	0.00	2603.76

Table 9

Analysis of Variance for Modified Provider Zip Codes and Amount Paid Total

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	102948953.090	7	14706993.299	254.074	0.000
Within Groups	155130679.829	2680	57884.582		
Total	258079632.919	2687			

Table 10 represents the means and standard deviations by Modified Place of Service. A one-way ANOVA yielded a significant difference among the Modified Place of Service group means, $F(3, 2687) = 109.566$, $p = .000$. Table 11 represents the analysis of variance summary. A post hoc analysis using Scheffe procedure ($p = .05$) revealed the mean for Modified Place of Service group 1 (office) was significantly higher than the groups 2 (inpatient hospital) and 3 (outpatient hospital). Group 2 (inpatient hospital) was significantly lower than the groups 1 (office) and 3 (outpatient hospital). Three (outpatient hospital) was significantly lower than the group 1 (office) and significantly higher than the group 2 (inpatient hospital). There was no significant difference between the mean of group 4 (Ambulatory Surgery Center) and the other groups.

Table 10

Descriptive Statistics for Modified Place of Service and Amount Paid Total

	N	Mean	Std. Deviation	Std. Error	Minimum	Maximum
Office	882	578.83	283.16	9.53	0.00	1774.76
Inpatient hospital	25	103.25	26.47	5.29	60.57	151.95
Outpatient hospital	1776	371.53	298.92	7.09	0.00	2603.76
Ambulatory Surgery Center	5	376.06	408.90	182.87	65.88	982.22
Total	2688	437.07	309.92	5.98	0.00	2603.76

Table 11

Analysis of Variance for Modified Place of Service and Amount Paid Total

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	28157511.464	3	9385837.155	109.566	0.000
Within Groups	229922121.455	2684	85663.980		
Total	258079632.919	2687			

Table 12 represents the means and standard deviations by Modified Age. A one-way ANOVA yielded a significant difference among the Modified Age group means, $F(7, 2687) = 109.566$, $p = .029$. Table 13 represents the analysis of variance summary. A post hoc analysis using Scheffe procedure ($p = .05$) revealed the means for Modified Age contained no significant group differences.

Table 12

Descriptive Statistics for Modified Age Group and Amount Paid Total

Age Group	N	Mean	Std. Deviation	Std. Error	Minimum	Maximum
0-1	11	233.19	238.78	72.00	65.39	818.79
2- 5	31	456.09	381.37	68.50	65.67	1002.40
6-12	42	515.61	360.61	55.64	9.50	1405.26
13-17	43	440.08	336.59	51.33	0.00	1333.57
18-25	714	444.13	301.06	11.27	0.00	1946.50
16-40	1169	443.40	304.30	8.90	0.00	2603.76
41-60	585	425.62	317.49	13.13	0.00	1691.74
>60	93	356.14	328.28	34.04	0.00	1324.01
Total	2688	437.07	309.92	5.98	0.00	2603.76

Table 13

Analysis of Variance for Modified Age Group and Amount Paid Total

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1496148.250	7	213735.464	2.232	0.029
Within Groups	256583484.670	2680	95740.106		
Total	258079632.919	2687			

Additionally, descriptive statistics for the variable Modified Gender, code 1 if male and 0 otherwise, yielded $n = 2688$ with an $M = .62$ and a $SD = .485$. A post hoc analysis of the variable was inappropriate because the variable contained less than three groups. Appendix A contains all significant Post Hoc Scheffe SPSS outputs associated with the statistical analysis.

Cost-Benefit Analysis: MRI Service

The purpose of this cost-benefit analysis is to identify health care being referred to the local purchase care market under the current process that could be recaptured for the organization and perform a cost-benefit analysis to determine whether it would be financially beneficial to BJACH to retain these services under TNEX or refer these services to the purchase care market. The results of the statistical analysis indicate the majority of Radiology referrals were in CPT code set for MRI, thus making MRI a noteworthy target for the cost-benefit analysis. In order to make certain the MRI project is a sound financial decision for the organization's leadership, the project will be analyzed utilizing several financial techniques. First, the project will examine the scenario that no professional Radiology services, physician reads, will require outsourcing since capacity exists at BJACH to absorb the additional workload. The second scenario will assume that no professional service exists at BJACH to absorb the

additional workload; therefore, all reads must be outsourced to local providers. Both scenarios will demonstrate the estimation of project cost and the operating and terminal cash flows, the risk, sensitivity, payback, and scenario analysis for the project, and finally, a buy versus lease comparison (Gapenski, 2003).

The first step in the analysis is to estimate the cost and/or revenue associated with each variable in the project. The project is based on an expected life span of five years. The following list outlines the projects estimated costs and revenues:

1. System cost and description: The MRI system is a General Electric (GE) 1.5 Tesla Sigma Excite scanner. GE MRI scanners are the recommended system identified as the prime vendor from the MEDCOM medcase office. The system includes software, computer terminals, initial coil packages, and 4 days of training onsite with an estimated cost of $1,457,718.44. The annual lease payment, which includes maintenance costs, is $482,856.48. The first month of the lease will require an additional $1200.00 document fee (G. Garrision, personal communication, February 13, 2005).
2. Related expenses: The Entrée building by PDC facilities Inc. is a re-locatable building designed specifically for GE MRI scanners with an estimated cost of $431,540.00 (B. Maslowski, personal communication, February 13, 2005). The BJACH facility manager estimates site preparation and installation equipment costs are $78,000.00 (J. Rutherford, personal communication, February 15, 2005).
3. Weekly volume: The average weekly volume of MRI referrals to the purchase care market is 52 scans over the last 18 months.

4. Uncollected percent: No third-party payers are factored into the analysis.
5. Average Charge: The model assumes project revenues are what the facility would have paid, based on historical data, for an average scan previously referred to the purchase care market. The average per procedure cost for FY 2004 is $437.07. This figure was rounded down to $425 for the analysis to make the results more conservative in nature.
6. Labor cost: Both scenarios included the addition of three staff members for the project. One administrative support person, GS 5 Step 5, and two radiology technicians, GS 8 Step 5. Their base salaries were increased 30% to account for benefits ($152,053.20).
7. Maintenance: The annual cost for maintenance for the buy option is $151,546.00 after the first year warranty expires. Maintenance for the lease option is included in the payment (G. Garrision, personal communication, February 13, 2005).
8. Supplies: The Medical Expense and Reporting System (MEPRS) data were queried to obtain a per procedure unit cost for supplies for the Radiology department ($15.00).
9. Incremental overhead: MEPRS data were queried to obtain a per-procedure unit cost for all additional stepped down overhead for the Radiology department, which includes the costs associated with physician services ($30.00). The scenario addressing outsourced professional for reading services, physician services, includes an additional $100.00 per scan, but the in-house incremental overhead associated with the current physician services

was subtracted from the estimate ($125.00) (International Radiology Group, personal communication, February 15, 2005).

10. Depreciation: Straight-line depreciation is estimated at $350,000 per year over the next five years.
11. Salvage value: The salvage value of the system is estimated to be 30% of the purchase price after 5 years. The salvage value of the PDC building is 8% of the initial purchase price for a combined total of $463,000.00 (G. Garrision & B. Maslowski, personal communication, February 13, 2005).
12. Inflation Rate: The current United States inflation rate is 3.26% based on the current consumer price index (U.S. Department of Labor, 2005). To adjust for future market uncertainty, the inflation rate is increased to 5%.
13. Tax rate: Governmental facilities are tax-exempt.
14. Cost of capital: The cost of capital is 3.71%. The Lease rate and payments are based on an assumption that, at the time of funding, the most recent weekly average of the 5-year Treasury bond is 3.71% (G. Garrision, personal communication, February 13, 2005).

The risk analysis for the buy scenario without professional services reveals a net present value (NPV) to the facility of $2,009,000 with an internal rate of return (IRR) equaling 32.4% based on a weekly volume of 52 scans, average charge of $425, and a salvage value of $463,000. The sensitivity analysis fluctuated the weekly volume and salvage value by +/- 30% from the base scenario and the CMAC rate +/- 15%, assuming the base CMAC rate is –15%. The analysis of the project reveals that changes in the weekly volume had the most dramatic affect on the NPV, followed by the CMAC rate

and salvage value. The project remained profitable throughout the analysis. The payback analysis used the worst (volume –30%, CMAC rate –30%, and salvage value –30%), likely (base scenario), and best (volume +30%, CMAC +15% from base, and salvage value +30%) case scenarios to calculate payback times based on years of project life. The analysis revealed payback periods of no payback, 2.53, and 1.44 years respectively at the end of project life. Appendix B illustrates the sceneries analyzed.

The risk analysis for the buy scenario with professional services reveals a NPV to the facility of $788,000 with an IRR equaling 15.7% based on a weekly volume of 52 scans, average charge of $425, and a salvage value of $463,000. The sensitivity analysis fluctuated the weekly volume and salvage value by +/- 30% from the base scenario and the CMAC rate +/- 15%, assuming the base CMAC rate is –15%. The analysis of the project reveals that changes in the weekly volume had the most dramatic affect on the NPV, followed by the CMAC rate and salvage value. The project became unprofitable during the worst-case scenario. The payback analysis used the worst (volume –30%, CMAC rate –30%, and salvage value –30%), likely (base scenario), and best (volume +30%, CMAC +15% from base, and salvage value +30%) case scenarios to calculate payback times based on years of project life. The analysis revealed payback periods of no payback, 3.79, and 1.92 years respectively at the end of project life. Appendix B contains a detailed spreadsheet of all analysis results.

The risk analysis for the lease scenario without professional services reveals a NPV to the facility of $1,800,000 with an IRR equaling 70% based on a weekly volume of 52 scans and an average charge of $425. The sensitivity analysis fluctuates the weekly volume by +/- 30% from the base scenario and the CMAC rate +/- 15%, assuming the

base CMAC rate as –15%. The analysis of the project reveals that changes in the weekly volume had the most dramatic affect on the NPV, followed by the CMAC rate. The project remained profitable throughout all scenarios. The payback analysis used the worst (volume –30% and CMAC rate –30%), likely (base scenario), and best (volume +30% and CMAC +15%) case scenarios to calculate payback times based on years of project life. The analysis revealed payback periods of no payback, 1.53, and .62 years respectively at the end of project life. Appendix B contains a detailed spreadsheet of all analysis results.

The risk analysis for the lease scenario with professional services reveals a NPV to the facility of $579,000 with an IRR equaling 25.5% based on a weekly volume of 52 scans and an average charge of $425. The sensitivity analysis fluctuates the weekly volume by +/- 30% from the base scenario and the CMAC rate +/- 15%, assuming the base CMAC rate as –15%. The analysis of the project reveals that changes in the weekly volume had the most dramatic affect on the NPV, followed by the CMAC rate. The project became unprofitable during the worst scenario. The payback analysis used the worst (volume –30% and CMAC rate –30%), likely (base scenario), and best (volume +30% and CMAC +15%) case scenarios to calculate payback times based on years of project life. The analysis revealed payback period of no payback, 3.79, and .96 years respectively at the end of project life. Appendix B contains a detailed spreadsheet of all analysis results.

The buy-versus-lease analysis examined the cash streams of buying and leasing for the project. The results reveal the net advantage of leasing is negative $190,000 in the

terms of the project's present value of cost thus indicating the leasing alternative to be the less-costly alternative in the terms of financing for the hospital.

The Referral Management Process

Prior to the start of TNEX, the staff at BJACH developed a redesigned referral management process to enhance the external referral process and position the facility for success under the new business process. This study analyzes the efficiency of this process by auditing the referral management database, implemented at the start of TNEX, for referral processing inefficiencies and MCSC compliance that is outlined in the MOU agreement between HUMANA and BJACH, evaluation of BJACH referral process in relation to the best practice model presented at the 2004 TRICARE conference, and individual referral management staff interviews. The data gathered during this portion of the study will be used to develop BJACH's best practice model to optimize the referral process.

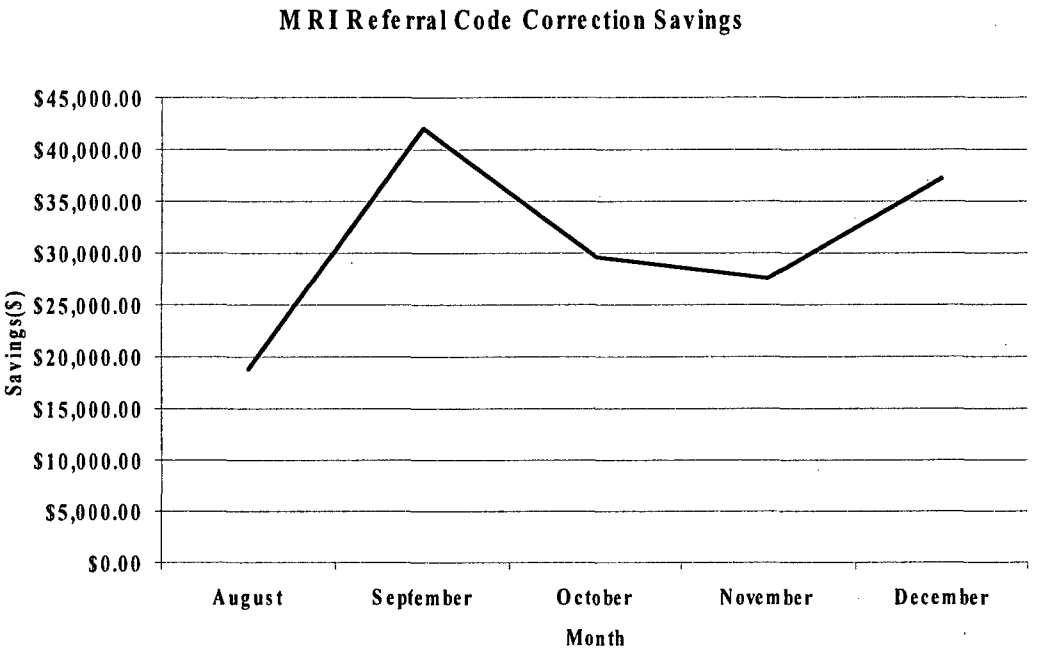
The staff of the referral management center has routinely documented external problems associated with referral processing by the MCSC HUMANA military health care. Since the start of TNEX, the referral management center has documented 3,667 referrals to the purchase care market. During a software upgrade, the error information of approximately 250 records was degraded, and 940 records were added to the database before the error option was available to track MCSC referral errors. An error required the RMC staff to reprocess the referral authorized by the MCSC, and a correct referral required no intervention by the RMC staff. The audit of the referral management database revealed the following referral processing errors by the MCSC during the period of 1 Nov 04 thru 1 Feb 05: correct referrals, 2618 (71.39%); incorrect referrals or incorrect data

inputs, 37 (1.01%); incorrect provider, 36 (0.98%); incorrect provider and service, 4 (0.11%); incorrect service, 14 (0.38%); referrals misdirected to other MTFs, 54 (1.47%); and unrecorded or degraded records 1190 (24.65%). The degraded and unrecorded records were not considered in the evaluation of the MCSCs performance (N. Key & A. Warren, personal communication, January 3, 2005).

An examination of the internal ordering process for external referrals reveals problems associated with provider order specifications. The referral process begins with the patient and provider encounter, which results in the determination that additional care is needed for the patient that is not provided at the facility. To refer a patient to an external provider, the PCM must place an external consult in CHCS. As dictated by the referral management guidelines, an MNR and CBR must take place in the RMC before the referral is processed for care in the purchase care market. Through the MNR, the RMC staff has found significant consult order errors from internal PCMs. Within the professional staff, Physician Assistants (PA) frequently generated referrals inconsistent with MNR standards. To illustrate this point, MRI referrals have been monitored and tracked by the RMC staff since the start of TNEX. The preponderance of order errors occur when the request for contrast utilization during the procedure was incorrectly added to the order. While the utilization of contrast is appropriate for various procedures, it is not appropriate for all procedures given the nature of the patient's diagnosis, the MRI site location, and medical information need for further diagnosis. During the first five months since the implementation of TNEX, the auditing of contrast request errors has resulted in a net savings to the facility of $155,373. Figure 6 illustrates the savings, over time, for MRI coding errors. Savings is defined as the difference of procedure costs associated

with the original order in relation to the costs associated with the changed order (N. Key & M. Whaley, personal communication, January 5, 2005).

Figure 6. MRI referral coding audit with order corrections savings.



Prior to the implementation of TNEX, presenters at the 2004 TRICARE conference published the "Best Practices in Referral Management" model in which criteria was established to evaluate current referral management process for optimal efficiency (Best Practices in Referral Management, 2004). The presentation outlined 13 established criteria that are identified as critical for an optimal referral process. The RMC at BJACH was evaluated for whether the criteria was fully met, partially met, or not met. The results are as follows:

1. Authorization of single visit only: Fully met. When external referrals are processed by the referral coordinator, the number of visits is authorized based on the nature of the patient's diagnosis. The single visit only is the default standard.

2. Prohibition of secondary referrals without PCM approval: Partially met. The patient's PCM is the only approved provider to refer for specialty care. Referrals from network providers must come back to the MTF for right of first refusal processing but care not requiring an authorization will not be referred to the MTF for an ROFR review.
3. Prospective review of referrals: Partially met. Currently, prospective review is completed for MRI referrals but no evidence exists for a comprehensive referral management review system.
4. Limited self-referrals: Fully met. Patients are not authorized to self refer for specialty care, with the exception of mental health care in which eight self-referred appointments can be made per calendar year.
5. Referral form standards: Fully met. Referrals are placed in standard form in CHCS.
6. Large case management team: Partially met. The RMC has one case manager for patient tracking. The reserve case management team tracks reserve personnel but is external to the RMC.
7. Capture of utilization data: Partially met. The RMC has utilization and review staff but the function of UM has been diverted to assist with the monitoring of referral problems associated with the MCSC. Contract staff have supplemented the UM staff but further refinement is needed in the UM function. Additionally, the timeliness of data entry into the referral management database has minimized the advantages of the tool.
8. PCM authorization system: Fully met.

9. Choose specialists based on demonstrating practice patterns of referral specialist: Partially met. While referral patterns to the purchase care market consider the quality of care to the beneficiary, no information on the cost of care can be obtained from the MCSC. Contract specific requests by the RMC related to the cost of care are still pending.
10. Provide single specialist for consultation: Partially met. The RMC has dedicated a referral specialist for referral/consult management, but the volume of referrals processed per day exceeds the 30 to 40 referral limit prescribed by the referral management guidelines (U.S. Air Force, 2004).
11. Utilize technology to improve referral tracking: Fully met. An access database was developed to track the referral process at the start of TNEX.
12. Educate on most common referrals for PCMs: Not met. No formal recurrent PCM education program has been noted.
13. Consult with other PCM on questionable referrals: Partially met. The process is efficient during duty hours, but no system of checks and balances is in place for off-shift referrals to the local market (N. Key & M. Whaley, personal communication, January 5, 2005).

To fully understand the referral process and the problems the RMC staff are facing with referral management, a series of individual interviews with the RMC staff were carried out for information-gathering purposes. The following are the most germane process improvement points from the interviews:

1. DEERS information within CHCS is often incorrect, requiring manual verification of patient contact and demographic data. This significantly slows the

efficient processing of the referral (M. Whaley, personal communication, January 5, 2005).

2. Providers are supplying inadequate documentation in the referral request for the MNR. Requests for additional information often require the referral manager to physically find the provider so the referral can be processed within referral management time guidelines (M. Whaley, personal communication, January 5, 2005).
3. CHCSII, the new electronic documentation system for the MHS does not support the external consulting system. The legacy system, CHCSI, is utilized for external referrals (N. Key & M. Whaley, personal communication, January 5, 2005).
4. MNR and CBR for referrals originating in the purchase care market are the responsibility of the MCSC. The quality and accuracy of the review is questionable and requires oversight by the local RMC (N. Key & M. Whaley, personal communication, January 5, 2005).
5. RMC licensed staff are performing clerical tasks that should be delegated to data entry and administrative personnel.
6. TRICARE service center (TSC) support for administrative tasks. The TSC will not fax referrals to non-network providers because their data entry system does not contain non-network providers. The RMC needs to research provider contact information and fax the referral for the TSC, which creates additional administrative workload for the RMC (M. Whaley, personal communication, January 5, 2005).

7. A review of the ROFR indicates that 2 to 4 referrals are examined per week. Since the start of TNEX, 28 cases have been examined under the ROFR. The MTF has recaptured 25 cases.
8. The RMC tracks all referrals from the MTF and the network for timely access to care consistent with the rules outlined in the MOU between the MCSC and BJACH. Currently, no divergence in the time standards has been observed. (N. Key & M. Whaley, personal communication, January 5, 2005).

Discussion

The analysis of the MRI purchase care data revealed multiple statistically-significant relationships exist for the independent variables means in respect to the dependent variable, Amount Paid Total. The purpose of the analysis was to identify a procedure or service for a cost-benefit analysis that is currently being referred to the purchase care market, identify statistically significant beneficiary groups associated with this procedure, and highlight the overall historical financial picture of the facility's purchase care market.

Clearly, multiple types of hospital services are represented in the purchase care data for the period studied. With the exception of Drugs, which is covered by a separate carve out under TNEX, most of the types of services represented in the purchase care data could have potentially been analyzed for recapture into the facility. The difficulty lies in determining the source of the purchase care referral and whether the referral originated in the direct care system or if it was the result of consult to a network provider. In theory, this is resolved with the ROFR provision under new referral management guidelines. Further, the group, Diagnostic Laboratory, is obviously a service provided at BJACH. Could the direct care system have provided this service, or did lack of technical capability and laboratory capacity necessitate the need to refer these procedures to the purchase care market? These are all valid questions that should be explored under the new business rules of TNEX. To limit the scope of this study, the focus was to isolate one service that would provide the most cost savings to the facility while adding a needed service for its beneficiaries. Radiology service referrals, specifically MRI, proved the logical choice for further examination.

The means of the independent variables, Beneficiary Category Common and DEERS Dependent Suffix Code, utilizing ANOVA were compared against the dependent variable, Amount Paid Total. The analysis reveals that the mean cost of MRI procedures for active duty dependent spouses was significantly higher than the sponsors, both active and retired, and their children. While sponsors in both categories clearly outnumber the dependents in both categories, approximately 3 to 1 in terms of frequency, the mean cost per procedure was higher for dependent spouses. Age, while statistically significant, failed to demonstrate any group differences in the post hoc analysis.

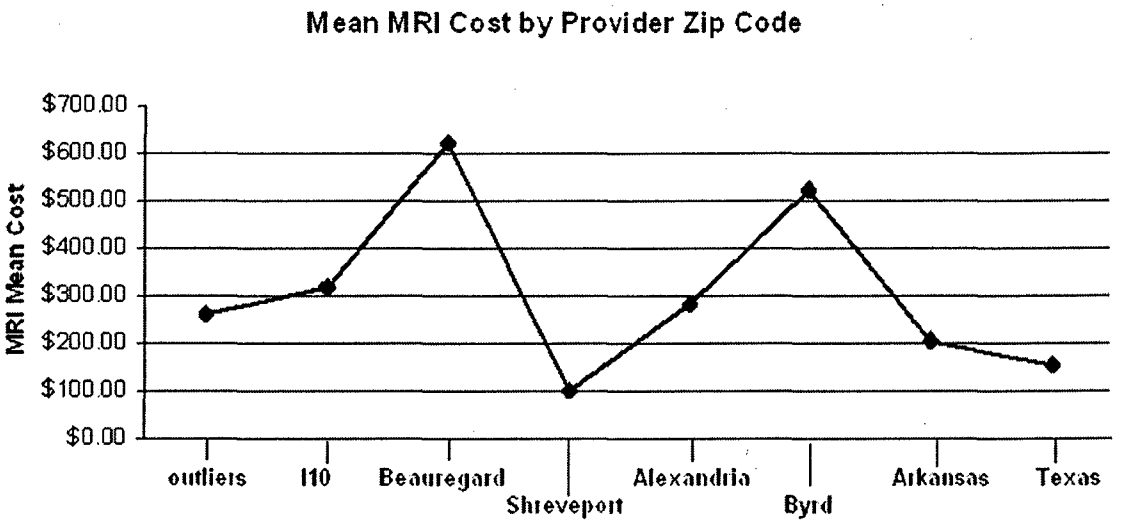
The results suggest that MRI procedure cost associated with independent office facilities as the Place of Service is significantly higher than the cost of a procedure from an inpatient or outpatient hospital. While significant, the referral management office states that facility charges, in addition to the procedure costs, may be added to the total MRI procedures that originate at hospitals. These charges are not reflected in the MRI data and thus may negate the possible cost differences between the groups.

The mean cost associated with the type of MRI has notable significant differences. In comparison, CPT codes associated with scans of the brain, neck, TMJ, chest, and diagnostic in nature had significantly higher differences in mean costs than other MRI procedure codes. MRIs of the chest, while not identified as significant in the post hoc analysis due to its low frequency, had a mean of approximately $800.17, which is nearly twice the mean for MRIs.

An analysis of provider zip codes, code where the procedure was performed, was the most germane result of the analysis. Zip codes were combined to reflect geographic locations where MRI referrals were performed. Code 1 reflects outliers not associated

with a specific area. A code 2 reflects providers along Interstate 10 from New Orleans to Lake Charles, LA. Code 3 reflects Beauregard Memorial Hospital in the city of Deridder, LA. Code 4 represents the providers in and around the city of Shreveport, LA. Code 5 represents the providers in and around the city of Alexandria, LA. Code 6 represents Byrd Regional Hospital in the city of Leesville, LA. Code 7 represents providers in the State of Arkansas. Code 8 represents providers in the State of Texas. The codes for Beauregard Memorial Hospital (code 3) and Byrd Regional Hospital (code 6) were significantly higher in cost compared to the other geographic regions. Figure 7 illustrates the mean plots.

Figure 7. Means plots for provider zip code for MRI service.



Beauregard Memorial Hospital's MRI service is classified as an independent facility or office in terms of place of service, while Byrd Regional Hospital's MRI service is classified as an inpatient and outpatient hospital. This would allow Byrd Regional Hospital to add an additional facility charge to the procedure that is not reflected in the current mean cost. Both Beauregard Memorial Hospital and Byrd Regional Hospital are BJACH local health care partners.

Capital decision can be one of the most important tasks health care administrators can undertake. First, decisions on capital investments provide strategic direction for the facility, given that these projects are usually long term in nature. Secondly, capital investments generally represent a key share of a health care organization's financial resources. In combination, the decision to undertake a capital project must be carefully analyzed to ensure the best possibility of success. The purpose of this cost-benefit analysis is to determine whether it would be financially beneficial for BJACH to establish an MRI service under TNEX or continue to refer this service to the purchase care market.

Throughout most of the scenarios analyzed, the project demonstrated positive NPVs and IRRs, which marginalized the project's stand-alone risk to the facility. Given the historic level of MRI utilization, the base case scenario demonstrated significant profitability in all scenarios studied. The sensitivity analysis revealed the variable of MRI volume had the most significant impact on project profitability when all other variables are held constant. It would be necessary for the average weekly volume to fall below 30 scans per week before the NPV demonstrated negative values in relation to the cost of capital. Further, the analysis assumed, in the base scenario, that the average cost of an MRI in the purchase care market was 15% below the average estimated CMAC rate.

The buy versus lease comparison clearly demonstrated the financial advantage of the leasing alternative. The results indicated the net advantage of leasing is $190,000 in the terms of the project's present value of cost which is the least costly alternative in the terms of financing. Further, the leasing scenario maintains the lowest payback periods in the four scenarios examined. Assuming the project maintains the most likely scenario studied, the buy versus lease comparison with no professional services demonstrated

payback periods of 2.53 and 1.52 years respectfully. The buy versus lease comparison with professional services demonstrated payback periods of 3.79 and 3.79 years respectfully. Assuming the facility can support the additional workload generated by the MRI service, the leasing alternative would provide the greatest value for the hospital with the quickest payback periods.

The addition of MRI services would provide a positive health care convenience to the prime beneficiary while adding financial and social value to the organization. The social value of a service is dependent on the financial stability of the project being analyzed. The positive NPVs associated with the MRI project facilitate the project's financial stability, thus creating social value to the organization by increasing access to needed services for the beneficiary and convenient access for providers within the organization.

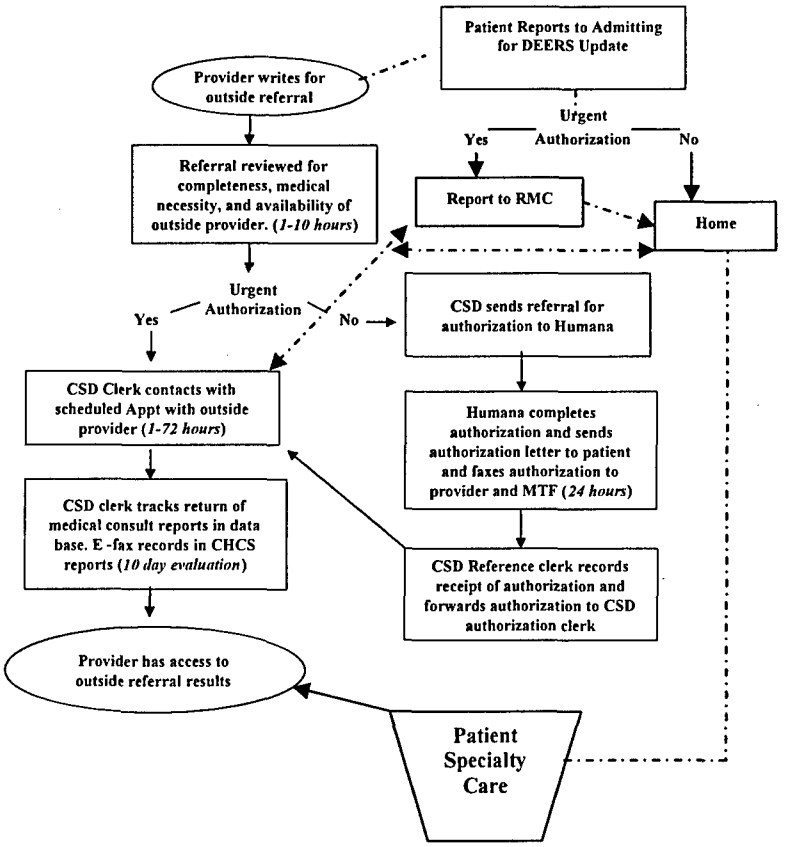
The source of funding for the proposed MRI project is the Venture Capital Program (VCP) under the new business rules of TNEX. The VCP has been developed at the MHS level to enhance the performance, productivity, and efficiency of health care operations at the MTF level. While no sunk and opportunity costs have been identified at the local MTF level, opportunity costs do exist at the MHS level since a predetermined quantity of resources have been allocated to the VCP. Funding the MRI project at BJACH could theoretically influence the funding of another project within the MHS (Venture Capital Program, 2005).

The staff at BJACH has developed a redesigned referral management process to enhance the external referral process and position the facility for success under the new business process. This study analyzed the efficiency of this process by auditing the

referral management database, implemented at the start of TNEX, for referral processing inefficiencies and MCSC compliance that is outlined in the MOU agreement between HUMANA and BJACH, evaluation of BJACH referral process in relation to the best practice model presented at the (Best Practices in Referrals Management, 2004) TRICARE conference, and individual referral management staff interviews. This information was used to develop a best practice model specific for the BJACH referral mission.

The flow of information remains somewhat constant in the best practice model for the RMC. Most problems noted with the current process are associated with external MCSC processes that the RMC has little control in modifying.

Figure 8. Patient and process information flow in best practice model.



The RMC does, however, have several internal processes that can be targeted for modification to allow the process to become more efficient. The general flow of patient and process information is illustrated in Figure 8.

The first change to the process is having the patient report to the admitting office for DEERS information verification and update after the provider has ordered the external referral. This would require DEERS modification capabilities for the clerk in the admitting office, which currently is a function reserved at the in and out-processing section of the Fort Polk Consolidated In/Out-Processing Center. The availability of timely and accurate patient demographic information has been identified as the primary internal process that increases unneeded workload to the referral management process. Adding DEERS-processing capability would elevate this workload. Education and training that promotes departmental and provider buy-in is needed to improve the efficiency of the referral management process. For example, in order to process a referral for authorization, an MNR and CBR must be completed by the RMC staff. If required information is missing in the consult input by the provider, a CHCS functional reply is sent requesting additional information for MNR requirements. Universally, these requests remain unanswered, requiring RMC referral managers to physically locate the provider for the required information. Further, ordering controls and oversight of physician extenders needs to be instituted to mitigate costly order errors for procedures not essential to meet the standard of care for the patient.

The modification of existing Information Management tools could improve the efficiency of the referral process. Currently, two data entry clerk FTEs are required to manually enter referral information into the referral management database. This function

could be replaced by a CHCS Ad Hoc report download to the database, thus eliminating the need for manual input. Additionally, tools such as M2 and TIP Ad Hoc could facilitate referral management utilization research so internal institutional programs could be developed to educate providers on their referral management patterns and provide insight on best practice referral care for their patients. Further, an additional study should examine the ROFR process with HUMANA. With such a small amount of ROFR reviews, it would indicate the possibility that ROFR cases that should be referred to the RMC for ROFR review are not being referred to the RMC. The recommendation section of this study will list additional process improvement recommendations.

Referral management benchmarking is necessary to determine whether the process is efficiently managed in comparison to the rest of the MHS. The goal is to determine how the "best in class" achieve their performance levels so these corrections can be made at other MTFs, thus improving performance at the local level. One problem persists; referral management in the MHS is a new concept for the entire corporate organization. Inquiries to senior level TMA analysts reveal no benchmarking standards have been developed at the corporate level. Additionally, the uniqueness of military health care and lack of civilian models for reference further complicate the target of the "gold standard." With this in mind, the recommendation is to measure and compare the performance of the RMC internally, over time, and externally, against other MTFs, to establish referral management standards in the MHS and compare BJACH's performance in the corporate setting. Trends analysis of referral patterns of organizational services should be tracked to verify the process is in control. Quantifiable referral management processes, such as ROFR rates, order errors, referral errors, referring services and

procedures, and access time standards, will provide benchmarking standards for the initial referral management process measurements.

Assumptions and Limitations

During this study, the following assumptions where factored into the analysis.

1. Many TMA level analysts were consulted regarding the validity and reliability of the non-institutional data located within M2. While confident the information is accurate, questions still exist on the precision with which the data is managed. The M2 data is the only MHS-accepted data source in which MTFs are evaluated by the MHS on budgetary and performance issues. Essentially, it is our MTF report card; this study assumes the data is valid.
2. The current referral volume of MRI workload will remain constant in the foreseeable future.
3. Capacity exists in the Radiology department to absorb the additional workload created by an additional MRI service.
4. Current staff and provider buy-in for the MRI service at BJACH.

The study noted the following limitations during the analysis.

5. Lack of timely and relevant information on the referral management models from TMA executives will lead to the development of local referral management policies inconsistent from MTF to MTF.
6. The accuracy of workload utilization and financial data stored at the MHS level limits the true picture of MTF's performance and resource consumption.
7. TRICARE business rules regarding MCSC compliance and responsibilities will make TNEX difficult to execute.
8. Inconsistent MCSC support and performance relating to authorizations, MNR, and CBR that is covered in the MOU between HUMANA and BJACH.

9. The MHS corporate decision to implement TNEX when the new business processes were not trial tested and still under development.

Conclusion

The statistical analysis of the purchase care data for fiscal year 2004 illustrates that a variety of hospital services are currently referred to the purchase care market. While many of these services could have been selected for further analysis, the goal was to identify a procedure or service for a cost-benefit analysis that is currently being referred to the purchase care market. MRI services cost the facility approximately $1,174,838.52 annually, which constitutes approximately 12% of the total purchase care referrals for the facility, thus providing a logical target for the analysis. Active duty dependent spouses were identified as a high-cost beneficiary group associated with MRI procedures. Further, the analysis revealed that exams of the brain, neck, chest, or diagnostic in nature were recognized as high-cost procedures for the service. The most germane results of the analysis proved to be the analysis of provider zip codes. The results indicated that the cost of MRI procedures from our local health care partners was significantly higher than the mean costs of the other geographic locations in the data. While BJACH is located in a medically-underserved geographic region, further validation of this result is warranted.

The goal of the cost-benefit analysis is to determine whether it would be financially beneficial for BJACH to establish an MRI service under TNEX or continue to refer this service to the purchase care market. Clearly, the addition of MRI services to the facility is financially advantageous to the organization. The value of the service, in NPV and IRR, demonstrates that the project is an economically sound decision while providing an additional source of revenue to fund other projects at the facility under the TNEX revised financing concept. Further analysis of the Radiology department's workload is

recommended to determine if additional professional services are needed to absorb the workload created by adding the MRI service to the facility.

The goal for the facility's redesigned referral management process to enhance the external referral process and position the facility for success under the new business process. The study's goal was to analyze the efficiency of this process by auditing the referral management database, implemented at the start of TNEX, for referral processing inefficiencies and MCSC compliance that is outlined in the MOU agreement between HUMANA and BJACH, evaluation of BJACH referral process in relation to the best practice model presented at the 2004 TRICARE conference, and individual referral management staff interviews. The results indicate that several internal processes can be targeted for modification to allow the process to become more efficient, thus making the process more capable under TNEX. With an increased emphasis on the referral management process, MTF commanders must prudently manage their use of the purchase care resource services and the associated costs of these services. Under the revised financing concept, cost savings realized under optimal resource management by the MTF will be retained at the MTF level for reinvestment in the organization (TRICARE Management Activity, 2004). By adopting the best practice referral model recommendations, the RMC can better position the facility for success under TNEX.

Recommendations

The following recommendations are a result of the statistical analysis of the fiscal year 2004 purchase care data.

1. The UM staff should review all MRI referrals for active duty dependent spouses for order correctness and appropriateness.
2. The UM staff should review all MRI referrals for exams of the brain, neck, chest, or diagnostic in nature for order correctness and appropriateness.
3. Further research is recommended to validate the higher cost of MRI procedures referred to our local health care partners. If validated, negotiations for MRI service price controls should be explored between management teams.

The following recommendations are a result of the cost-benefit analysis of the proposed addition of MRI services at BJACH.

4. Analyze the MRI project with the Venture Capital Program Business Case Tools, when available, at the TRICARE regional office.
5. Analyze the Radiology department's workload to determine if additional professional services are needed to absorb the workload created by the MRI service.

The following recommendations are a result of the review of the referral management process at BJACH.

6. DEERS information input capabilities should be available at the facility for verification and update of demographic data.

7. Implement an education and training program that promotes departmental and provider buy-in on the importance of the referral management process.
8. Implement ordering controls and oversight of physician extenders to mitigate costly order errors.
9. Have CHCS Ad Hoc reports download directly to the referral management database.
10. Need M2 and TIP Ad Hoc capabilities for referral management personnel.
11. Trends analysis of referral patterns of organizational services should be tracked to verify the process is in control.
12. Develop and implement a referral management benchmarking program to measure the performance of the program.
13. Analyze the ROFR process to verify all eligible ROFR cases are being referred back to the MTF.
14. Institute a referral management hospital committee to promote provider buy-in and create a problem-solving forum.
15. Consolidate case management functions into one center.
16. Examine and refine the UM process.

Appendix A

SPSS Post Hoc Scheffe Significant Outputs

Multiple Comparisons
Dependent Variable: AmountPaidTotal
Scheffe

(I) BenCatCom	(J) BenCatCom	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower	Upper
1	2	122.065	25.705	0.000	50.161	193.969
	3	102.400	23.177	0.000	37.568	167.232
	4	115.517	15.711	0.000	71.570	159.465
2	1	-122.065	25.705	0.000	-193.969	-50.161
3	1	-102.400	23.177	0.000	-167.232	-37.568
4	1	-115.517	15.711	0.000	-159.465	-71.570
(I) mdds	(J) mdds	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower	Upper
1	3	-74.923	27.904	0.027	-143.262	-6.584
2	3	-93.467	14.323	0.000	-128.547	-58.388
3	1	74.923	27.904	0.027	6.584	143.262
	2	93.467	14.323	0.000	58.388	128.547
(I) mCPTcodes	(J) mCPTcodes	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower	Upper
1	5	344.556	30.826	0.000	203.060	486.053
	6	359.285	43.127	0.000	161.327	557.242
	7	294.593	24.980	0.000	179.929	409.257
	10	325.012	26.700	0.000	202.455	447.569
	12	344.071	24.369	0.000	232.215	455.928
2	5	285.263	56.527	0.013	25.797	544.728
	6	299.991	64.070	0.039	5.902	594.080
	10	265.718	54.387	0.022	16.076	515.360
	12	284.778	53.281	0.005	40.211	529.344
3	5	283.186	26.181	0.000	163.012	403.360
	6	297.914	39.939	0.000	114.590	481.238
	7	233.222	18.953	0.000	146.226	320.218
	10	263.641	21.168	0.000	166.478	360.805
	12	282.701	18.139	0.000	199.439	365.962
4	5	446.937	129.916	0.459	-149.398	1043.272
	6	461.665	133.371	0.447	-150.529	1073.859
	12	446.452	128.537	0.441	-143.553	1036.457
5	1	-344.556	30.826	0.000	-486.053	-203.060
	2	-285.263	56.527	0.013	-544.728	-25.797
	3	-283.186	26.181	0.000	-403.360	-163.012
	4	-446.937	129.916	0.459	-1043.272	149.398
	11	-246.431	50.633	0.023	-478.845	-14.017
6	1	-359.285	43.127	0.000	-557.242	-161.327
	2	-299.991	64.070	0.039	-594.080	-5.902
	3	-297.914	39.939	0.000	-481.238	-114.590
	4	-461.665	133.371	0.447	-1073.859	150.529
	11	-261.160	58.935	0.075	-531.682	9.363

Multiple Comparisons
Dependent Variable: AmountPaidTotal
Scheffe

(I) mCPTcodes	(J) mCPTcodes	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower	Upper
7	1	-294.593	24.980	0.000	-409.257	-179.929
	2	-235.299	53.563	0.082	-481.162	10.564
	3	-233.222	18.953	0.000	-320.218	-146.226
10	1	-325.012	26.700	0.000	-447.569	-202.455
	2	-265.718	54.387	0.022	-515.360	-16.076
	3	-263.641	21.168	0.000	-360.805	-166.478
	11	-226.887	48.232	0.037	-448.280	-5.493
11	5	246.431	50.633	0.023	14.017	478.845
	6	261.160	58.935	0.075	-9.363	531.682
	10	226.887	48.232	0.037	5.493	448.280
	12	245.946	46.982	0.007	30.291	461.601
12	1	-344.071	24.369	0.000	-455.928	-232.215
	2	-284.778	53.281	0.005	-529.344	-40.211
	3	-282.701	18.139	0.000	-365.962	-199.439
	11	-245.946	46.982	0.007	-461.601	-30.291

(I) mproviderzip	(J) mproviderzip	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower	Upper
1	3	-362.759	76.601	0.002	-650.302	-75.217
2	3	-303.286	39.068	0.000	-449.938	-156.633
	4	219.619	39.443	0.000	71.560	367.679
	6	-203.642	38.711	0.000	-348.956	-58.327
3	1	362.759	76.601	0.002	75.217	650.302
	2	303.286	39.068	0.000	156.633	449.938
	4	522.905	13.704	0.000	471.465	574.345
	5	341.623	18.837	0.000	270.914	412.333
	6	99.644	11.430	0.000	56.739	142.549
	7	417.503	76.601	0.000	129.961	705.046
	8	467.183	45.554	0.000	296.181	638.185
4	2	-219.619	39.443	0.000	-367.679	-71.560
	3	-522.905	13.704	0.000	-574.345	-471.465
	5	-181.281	19.602	0.000	-254.864	-107.699
	6	-423.261	12.651	0.000	-470.751	-375.771
5	3	-341.623	18.837	0.000	-412.333	-270.914
	4	181.281	19.602	0.000	107.699	254.864
	6	-241.979	18.086	0.000	-309.870	-174.089

Multiple Comparisons
Dependent Variable: AmountPaidTotal
Scheffe

(I) mproviderzip	(J) mproviderzip	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower	Upper
6	2	203.642	38.711	0.000	58.327	348.956
	3	-99.644	11.430	0.000	-142.549	-56.739
	4	423.261	12.651	0.000	375.771	470.751
	5	241.979	18.086	0.000	174.089	309.870
	7	317.859	76.419	0.016	30.997	604.721
	8	367.539	45.249	0.000	197.684	537.394
7	3	-417.503	76.601	0.000	-705.046	-129.961
	6	-317.859	76.419	0.016	-604.721	-30.997
8	3	-467.183	45.554	0.000	-638.185	-296.181
	6	-367.539	45.249	0.000	-537.394	-197.684

(I) mplaceservice	(J) mplaceservice	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower	Upper
1	2	475.584	59.361	0.000	309.537	641.631
	3	207.298	12.056	0.000	173.573	241.023
2	1	-475.584	59.361	0.000	-641.631	-309.537
	3	-268.286	58.947	0.000	-433.177	-103.395
3	1	-207.298	12.056	0.000	-241.023	-173.573
	2	268.286	58.947	0.000	103.395	433.177

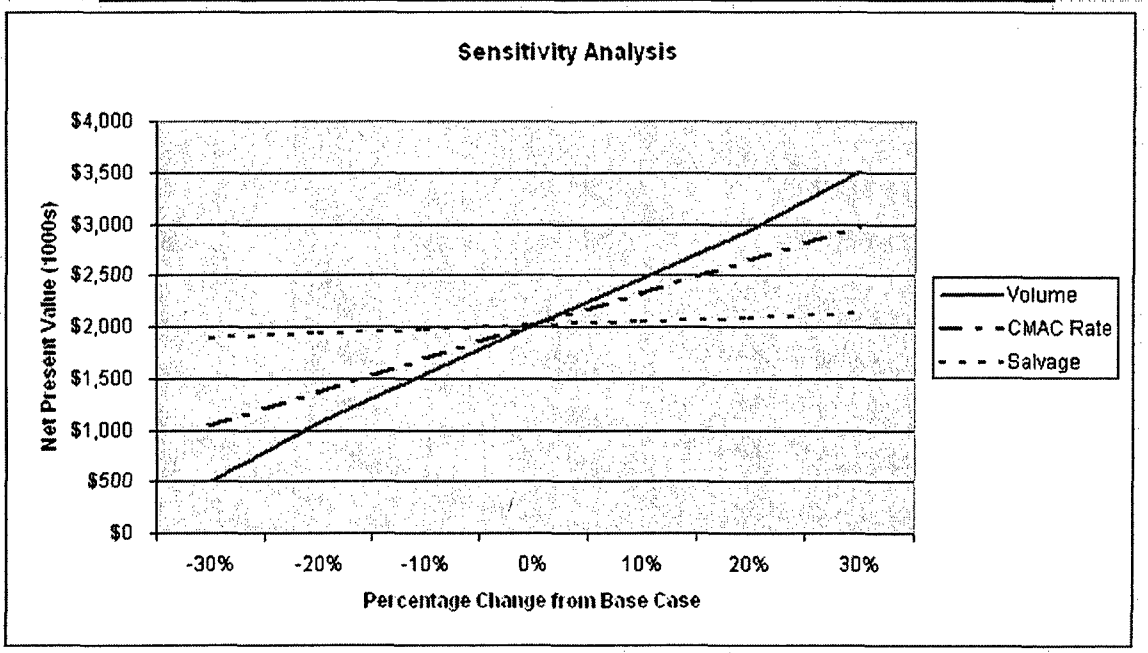
Appendix B

Risk Analysis: Buy Scenario without Professional Services.

System cost	$1,458	MRI Project BJACH	0	1	2	3	4	5
System rental	$0	System cost	($1,458)					
Related expenses	$510	System rental	$0	$0	$0	$0	$0	
Weekly volume	52	Start-up expenses	($510)					
Average charge	$425	Gross revenues		$1,105	$1,160	$1,218	$1,279	$1,343
Uncollectable percent	0.0%	Deductions		$0	$0	$0	$0	$0
Labor costs	$153	Net revenues		$1,105	$1,160	$1,218	$1,279	$1,343
Maintenance costs	$152	Labor costs		$153	$161	$169	$177	$186
Supplies cost/patient	$15	Maintenance costs		$0	$152	$152	$152	$152
Incremental overhead	$30	Supplies		$39	$41	$43	$45	$47
Depreciation	$350	Incremental overhead		$78	$82	$86	$90	$95
Salvage value	$463	Depreciation		$350	$350	$350	$350	$350
Inflation rate	5.00%	Operating income		$485	$375	$419	$465	$513
Tax rate	0.00%	Taxes		$0	$0	$0	$0	$0
Cost of capital	3.71%	Net op. income		$485	$375	$419	$465	$513
		Depreciation		$350	$350	$350	$350	$350
NPV =	$2,009	Net salvage value						$463
IRR =	32.36%							
MIRR =	19.93%	Net cash flow	($1,968)	$835	$725	$769	$815	$1,326

Sensitivity Analysis: Buy Scenario without Professional Services.

On Volume		$2,009	On CMAC Rate		$2,009	On Salvage Value		$2,009
-30%	36	$507	-30%	350	$1,045	-30%	324	$1,893
-20%	42	$1,070	-25%	375	$1,367	-20%	370	$1,932
-10%	47	$1,540	-20%	400	$1,688	-10%	419	$1,973
0%	52	$2,009	-15%	425	$2,009	0%	463	$2,009
10%	57	$2,479	-10%	450	$2,331	10%	509	$2,048
20%	62	$2,948	-5%	475	$2,652	20%	557	$2,088
30%	68	$3,512	0	500	$2,973	30%	602	$2,125



Scenario and Breakeven Analysis: Buy Scenario without Professional Services.

Scenario	Probability	Volume	Sal. Value	CMAC	NPV
Worst case	0.05	36	$324	$350	($276)
Most likely case	0.75	52	$463	$425	$2,009
Best case	0.20	68	$602	$500	$4,888
	1.00				
Expected value		52	$463	$425	$2,009

	Expected net cash flows (CF_t)		
Year (t)	Worst	Likely	Best
0	(1,968)	(1,968)	(1,968)
1	396	835	1,394
2	264	725	1,312
3	285	769	1,385
4	306	815	1,462
5	653	1,326	2,144

Worst

	0	1	2	3	4	5
Net cash flow	(1,968)	396	264	285	306	653
Cumulative cash flow	(1,968)	(1,572)	(1,308)	(1,024)	(717)	(64)
	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
	0.00	0.00	0.00	0.00	0.00	0.00
Payback =	0.00					

Likely

	0	1	2	3	4	5
Net cash flow	(1,968)	835	725	769	815	1,326
Cumulative cash flow	(1,968)	(1,133)	(408)	361	1,176	2,502
	FALSE	FALSE	FALSE	TRUE	FALSE	FALSE
	0.00	0.00	0.00	2.53	0.00	0.00
Payback =	2.53					

Best

	0	1	2	3	4	5
Net cash flow	(1,968)	1,394	1,312	1,385	1,462	2,144
Cumulative cash flow	(1,968)	(574)	738	2,123	3,585	5,729
	FALSE	FALSE	TRUE	FALSE	FALSE	FALSE
	0.00	0.00	1.44	0.00	0.00	0.00
Payback =	1.44					

Risk Analysis: Buy Scenario with Professional Services.

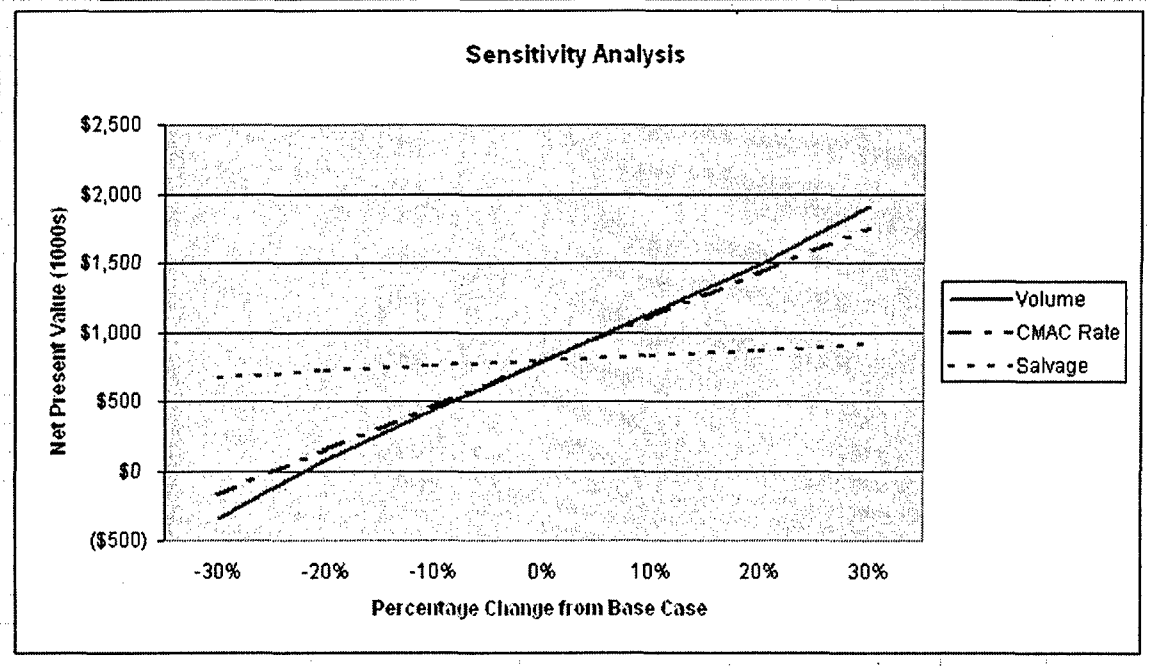
System cost	$1,458
System rental	$0
Related expenses	$510
Weekly volume	52
Average charge	$425
Uncollectable percent	0.0%
Labor costs	$153
Maintenance costs	$152
Supplies cost/patient	$15
Incremental overhead	$125
Depreciation	$350
Salvage value	$463
Inflation rate	5.00%
Tax rate	0.00%
Cost of capital	3.71%

NPV =	$788
IRR =	15.7%
MIRR =	11.4%

MRI Project BJACH	0	1	2	3	4	5
System cost	($1,458)					
System rental	$0	$0	$0	$0	$0	
Start-up expenses	($510)					
Gross revenues		$1,105	$1,160	$1,218	$1,279	$1,343
Deductions		$0	$0	$0	$0	$0
Net revenues		$1,105	$1,160	$1,218	$1,279	$1,343
Labor costs		$153	$161	$169	$177	$186
Maintenance costs		$0	$152	$152	$152	$152
Supplies		$39	$41	$43	$45	$47
Incremental overhead		$325	$341	$358	$376	$395
Depreciation		$350	$350	$350	$350	$350
Operating income		$238	$115	$146	$179	$213
Taxes		$0	$0	$0	$0	$0
Net op. income		$238	$115	$146	$179	$213
Depreciation		$350	$350	$350	$350	$350
Net salvage value						$463
Net cash flow	($1,968)	$588	$465	$496	$529	$1,026

Sensitivity Analysis: Buy Scenario with Professional Services.

On Volume		$788	On CMAC Rate		$788	On Salvage Value		$788
-30%	36	($338)	-30%	350	($175)	-30%	324	$673
-20%	42	$84	-25%	375	$146	-20%	370	$711
-10%	47	$436	-20%	400	$467	-10%	419	$752
0%	52	$788	-15%	425	$788	0%	463	$788
10%	57	$1,141	-10%	450	$1,110	10%	509	$827
20%	62	$1,493	-5%	475	$1,431	20%	557	$867
30%	68	$1,915	0	500	$1,752	30%	602	$904



Scenario and Breakeven Analysis: Buy Scenario with Professional Services.

Scenario	Probability	Volume	Sal. Value	CMAC	NPV
Worst case	0.05	36	$324	$350	($1,122)
Most likely case	0.75	52	$463	$425	$788
Best case	0.20	68	$602	$500	$3,292
	1.00				
Expected value		52	$463	$425	$788

		Expected net cash flows (CF_t)		
Year (t)		Worst	Likely	Best
0		(1,968)	(1,968)	(1,968)
1		225	588	1,071
2		84	465	973
3		96	496	1,029
4		108	529	1,088
5		445	1,026	1,752

Worst

	0	1	2	3	4	5
Net cash flow	(1,968)	225	84	96	108	445
Cumulative cash flow	(1,968)	(1,743)	(1,659)	(1,563)	(1,455)	(1,010)
	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
	0.00	0.00	0.00	0.00	0.00	0.00
Payback =	0.00					

Likely

	0	1	2	3	4	5
Net cash flow	(1,968)	588	465	496	529	1,026
Cumulative cash flow	(1,968)	(1,380)	(915)	(419)	110	1,136
	FALSE	FALSE	FALSE	FALSE	TRUE	FALSE
	0.00	0.00	0.00	0.00	3.79	0.00
Payback =	3.79					

Best

	0	1	2	3	4	5
Net cash flow	(1,968)	1,071	973	1,029	1,088	1,752
Cumulative cash flow	(1,968)	(897)	76	1,105	2,193	3,945
	FALSE	FALSE	TRUE	FALSE	FALSE	FALSE
	0.00	0.00	1.92	0.00	0.00	0.00
Payback =	1.92					

Risk Analysis: Lease Scenario without Professional Services.

System cost	$484
System rental	$483
Related expenses	$78
Weekly volume	52
Average charge	$425
Uncollectable percent	0.0%
Labor costs	$153
Maintenance costs	$0
Supplies cost/patient	$15
Incremental overhead	$30
Depreciation	$0
Salvage value	$0
Inflation rate	5.0%
Tax rate	0.0%
Cost of capital	3.7%

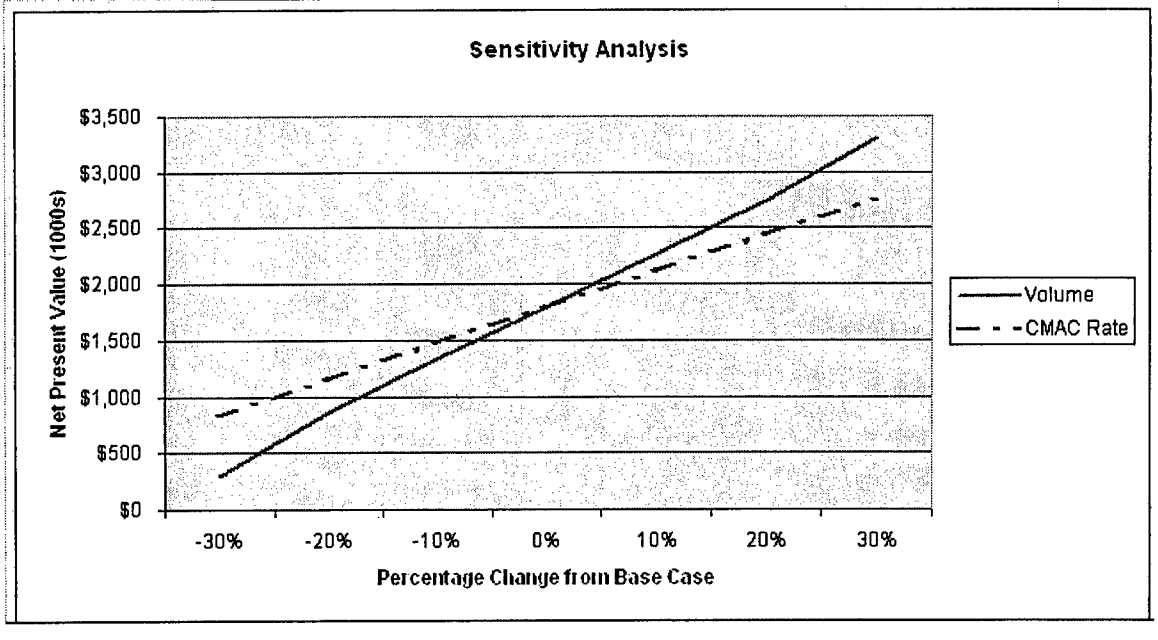
NPV =	$1,800
IRR =	70.0%
MIRR =	38.7%

MRI Project BJACH	0	1	2	3	4	5
System cost	($484)					
System rental		($483)	($483)	($483)	($483)	
Start-up expenses	($78)					
Gross revenues		$1,105	$1,160	$1,218	$1,279	$1,343
Deductions		$0	$0	$0	$0	$0
Net revenues		$622	$677	$735	$796	$1,343
Labor costs		$153	$161	$169	$177	$186
Maintenance costs		$0	$0	$0	$0	$0
Supplies		$39	$41	$43	$45	$47
Incremental overhead		$78	$82	$86	$90	$95
Depreciation		$0	$0	$0	$0	$0
Operating income		$352	$394	$438	$484	$1,015
Taxes		$0	$0	$0	$0	$0
Net op. income		$352	$394	$438	$484	$1,015
Depreciation		$0	$0	$0	$0	$0
Net salvage value						$0
Net cash flow	($562)	$352	$394	$438	$484	$1,015

Sensitivity Analysis: Lease Scenario without Professional Services.

On Volume		$1,800
-30%	36	$298
-20%	42	$861
-10%	47	$1,331
0%	52	$1,800
10%	57	$2,270
20%	62	$2,739
30%	68	$3,303

On CMAC Rate		$1,800
-30%	350	$836
-25%	375	$1,158
-20%	400	$1,479
-15%	425	$1,800
-10%	450	$2,122
-5%	475	$2,443
0	500	$2,764



Scenario and Breakeven Analysis: Lease Scenario without Professional Services.

Scenario	Probability	Volume	Sal. Value	CMAC	NPV
Worst case	0.05	36	$324	$350	($370)
Most likely case	0.75	52	$463	$425	$1,800
Best case	0.20	68	$602	$500	$4,563
	1.00				
Expected value		52	$463	$425	

		Expected net cash flows (CF_t)		
Year (t)		Worst	Likely	Best
0		(562)	(562)	(562)
1		(87)	352	911
2		(67)	394	981
3		(46)	438	1,054
4		(24)	484	1,131
5		481	1,015	1,694

Worst

	0	1	2	3	4	5
Net cash flow	(562)	(87)	(67)	(46)	(24)	481
Cumulative cash flow	(562)	(649)	(716)	(762)	(786)	(305)
	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
	0.00	0.00	0.00	0.00	0.00	0.00

Payback =	0.00

Likely

	0	1	2	3	4	5
Net cash flow	(562)	352	394	438	484	1,015
Cumulative cash flow	(562)	(210)	184	622	1,106	2,121
	FALSE	FALSE	TRUE	FALSE	FALSE	FALSE
	0.00	0.00	1.53	0.00	0.00	0.00

Payback =	1.53

Best

	0	1	2	3	4	5
Net cash flow	(562)	911	981	1,054	1,131	1,694
Cumulative cash flow	(562)	349	1,330	2,384	3,515	5,209
	FALSE	TRUE	FALSE	FALSE	FALSE	FALSE
	0.00	0.62	0.00	0.00	0.00	0.00

Payback =	0.62

Risk Analysis: Lease Scenario with Professional Services.

System cost	$484
System rental	$483
Related expenses	$78
Weekly volume	52
Average charge	$425
Uncollectable percent	0.0%
Labor costs	$153
Maintenance costs	$0
Supplies cost/patient	$15
Incremental overhead	$125
Depreciation	$0
Salvage value	$0
Inflation rate	5.00%
Tax rate	0.00%
Cost of capital	3.71%

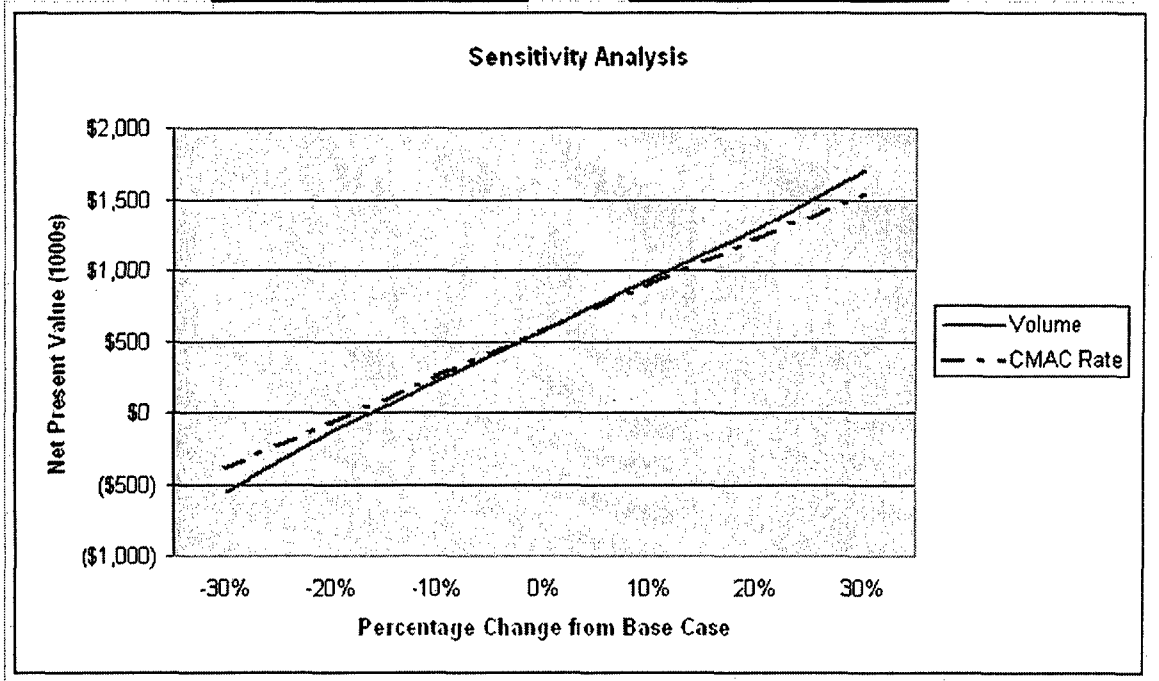
NPV =	$579
IRR =	25.5%
MIRR =	19.8%

MRI Project BJACH	0	1	2	3	4	5
System cost	($484)					
System rental		($483)	($483)	($483)	($483)	
Start-up expenses	($78)					
Gross revenues		$1,105	$1,160	$1,218	$1,279	$1,343
Deductions		$0	$0	$0	$0	$0
Net revenues		$622	$677	$735	$796	$1,343
Labor costs		$153	$161	$169	$177	$186
Maintenance costs		$0	$0	$0	$0	$0
Supplies		$39	$41	$43	$45	$47
Incremental overhead		$325	$341	$358	$376	$395
Depreciation		$0	$0	$0	$0	$0
Operating income		$105	$135	$165	$198	$715
Taxes		$0	$0	$0	$0	$0
Net op. income		$105	$135	$165	$198	$715
Depreciation		$0	$0	$0	$0	$0
Net salvage value						$0
Net cash flow	($562)	$105	$135	$165	$198	$715

Sensitivity Analysis: Lease Scenario with Professional Services.

On Volume		$579
-30%	36	($547)
-20%	42	($125)
-10%	47	$227
0%	52	$579
10%	57	$932
20%	62	$1,284
30%	68	$1,706

On CMAC Rate		$579
-30%	350	($384)
-25%	375	($63)
-20%	400	$258
-15%	425	$579
-10%	450	$901
-5%	475	$1,222
0	500	$1,543



Scenario and Breakeven Analysis: Lease Scenario with Professional Services.

Scenario	Probability	Volume	Sal. Value	CMAC	NPV
Worst case	0.05	36	$0	$350	($1,215)
Most likely case	0.75	52	$0	$425	$579
Best case	0.20	68	$0	$500	$2,967
	1.00				
Expected value		52	$0	$425	$579

	Expected net cash flows (CF_t)		
Year (t)	Worst	Likely	Best
0	(562)	(562)	(562)
1	(258)	105	588
2	(247)	135	642
3	(235)	165	698
4	(222)	198	757
5	273	715	1,302

Worst

	0	1	2	3	4	5
Net cash flow	(562)	(258)	(247)	(235)	(222)	273
Cumulative cash flow	(562)	(820)	(1,067)	(1,302)	(1,524)	(1,251)
	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
	0.00	0.00	0.00	0.00	0.00	0.00
Payback =	0.00					

Likely

	0	1	2	3	4	5
Net cash flow	(562)	105	135	165	198	715
Cumulative cash flow	(562)	(457)	(322)	(157)	41	756
	FALSE	FALSE	FALSE	FALSE	TRUE	FALSE
	0.00	0.00	0.00	0.00	3.79	0.00
Payback =	3.79					

Best

	0	1	2	3	4	5
Net cash flow	(562)	588	642	698	757	1,302
Cumulative cash flow	(562)	26	668	1,366	2,123	3,425
	FALSE	TRUE	FALSE	FALSE	FALSE	FALSE
	0.00	0.96	0.00	0.00	0.00	0.00
Payback =	0.96					

Buy vs. Lease Analysis.

Net purchase price	$1,968
Residual value	$463
Annual maintenance exp.	$152
Tax rate	0%
Loan interest rate	3.71%
Annual rental charge	$483

Cost of Owning	0	1	2	3	4	5
Net purchase price	($1,968)					
Maintenance cost		($152)	($152)	($152)	($152)	
Maintenance tax savings						
Depreciation tax savings						
Residual value						$463
Tax on residual value						
Net cash flow	($1,968)	($152)	($152)	($152)	($152)	$463

PV cost of owning =	($2,138)

Cost of Leasing	0	1	2	3	4
Lease payment	($562)	($483)	($483)	($483)	($483)
Tax savings from lease	$0	$0	$0	$0	$0
Net cash flow	($562)	($483)	($483)	($483)	($483)

PV cost of leasing =	($2,327)

Net Advantage to Leasing	
PV cost of leasing	($2,327)
PV cost of owning	($2,138)

NAL =	($190)

References

Baker, A., Bocian, A., Forrest, C., Glade, G., Starfield, B., & von Schrader, S. (2000). Coordination of specialty referrals and physician satisfaction with referral care. *Archives of Pediatrics and Adolescent Medicine*, 154(5), 499-506.

Barnett, M., Rosenthal, G., & Wahls, T. (2004). Predicting resource utilization in a veterans health administration primary care population. *Medical Care*, 42(2), 123-128.

Bennett, B. W., Buchanan, J., Hanley, J. M., Hawes-Dawson, J., Hosek, S. D., Madison, R., et al. (1995). *The demand for military Health Care: supporting research for a comprehensive study of the military Health Care system*. RAND National Defense Research Institute. (MR-407-1 -OSD). 1-141.

Best Practices in Referral Management. (2004, January). Retrieved January 31, 2005, from http://www.tricare.osd.mil/hpae/downloads/ICD%201300-1625-03%20HCSR-P%20M2.doc

Erdley, W., Pope, R., & Sackett, K. (2004). Demonstrating a positive return on investment for a prenatal program at a managed care organization: An economic analysis. *Journal of Perinatal and Neonatal Nursing*, 18(2), 117-127.

Feldstein, M. (1963). Economic analysis, operational research, and the national health services. *Oxford Economic Papers*, 15(1), 19-31.

Forrest, C., Nutting, P., Starfield, B., & von Schrader, S. (2002). Family physicians' referral decisions: Results from the ASPN referral study. *The Journal of Family Practice*, 51(3), 215-222.

Franks, P., Mooney, C., & Sorbero, M. (2000). Physician referral rates: Style without

much substance? *Medical Care*, 38(8), 836-846.

Gapenski, L. C. (2003). *Understanding health care financial management* (3rd Ed.). Washington D.C.: AUPHA Press.

Gaynor, M., & Haas-Wilson, D. (1999). Change, consolidation, and competition in health care markets. *Journal of Economic Perspectives*, 13(1), 141-164.

Goldman, D. P. (1995). Managed care as a public cost-containment mechanism. *RAND Journal of Economics*, 12(2), 277-295.

Humana Military Health Care Services. (2004, October). MTF Optimization training for the south region. Paper presented at a training meeting of the humana military health care services TRICARE managed care support contractor, Fort Polk, LA.

Kongstvedt, P. (4th Ed.). (2001). *The Managed Care Health Care Handbook.* Washington D.C.: Jones & Bartlett Publishers.

Kupper, L. (1994). *A cost benefit analysis of implementing a third party collections program for radiology at the Naval Hospital Charleston.* Graduate Management Project, U.S Army Baylor University at Fort Sam Houston. Retrieved October 8, 2004, from http://handle.dtic.mil/100.2/ADA293217

M2 Data Dictionary (MHS Management Analysis and Reporting Tool). (2004, April). Retrieved October 25, 2004, from https://eidsportal.ha.osd.mil.

Markovich, M. (2003). The rise of the HMOs. Doctoral Dissertation: RAND Graduate School.

MHS Population Health and Medical Management Support Center. (2004, October). Retrieved October 25, 2004, from http://www.mhsophsc.org/public/library_file_proxy.cfm/lid/663.

Military Health System Information Management Program. (2005, January). Retrieved January 5, 2005, from http://www.tricare.osd.mil/dataquality/bkginfo.htm.

Naval Medicine MTF Referral Management Interim Guidance. (2004, October). Retrieved October 25, 2004, from http://www.mhsophsc.org/public/library_file_proxy.cfm/lid/646.

Prest, A., & Turvey, R. (1965). Cost-benefit analysis: A survey. *The Economic Journal*, 75(300), 683-735.

Prevo, W. (1998). *Capacity analysis of a family care clinic using computer simulation to determine optimal enrollment under capitated resource allocation constraints.* Graduate Management Project, U.S. Army Baylor University at Fort Sam Houston. Retrieved October 8, 2004, from http://handle.dtic.mil/100.2/ADA372403

Rehberg, C. (1996). Managed care contracts: A guide for clinical case managers. *Nursing Case Management*, 1(1), 11-17.

Smallwood, R. D., Sondik, E. J., & Offensend, F. L. (1970). Toward an integrated methodology for the analysis of Health Care systems. Stanford University. Stanford, California.

Taylor, C. (1996). *Cost analysis of the TRICARE, the federal employees health benefits program, and a catchment area management project.* Graduate Management Project, U.S Army Baylor University at Fort Sam Houston. Retrieved October 8, 2004, from http://handle.dtic.mil/100.2/ADA324147

TRICARE Management Activity. (2004, October). TRICARE next generation of

contracts: FY 2004 financial business rules. Draft 15 March 2004. MTF Optimization training for the south region. Paper presented at a training meeting with the TRICARE Management Activity, Fort Polk, LA.

U.S. Air Force: MTF Referral Management Center (RMC) Users' Guide. (2004, October). Retrieved October 25, 2004, from http://www.mhsophsc.org/public/library_file_proxy.cfm/lid/643.

U.S. Department of Labor. (2005, January). Retrieved January 31, 2005, from http://www.bls.gov/home.htm.

Venture Capital Program. (2005, January). Retrieved January 31, 2005, from http://www.tricare.osd.mil/hpae/downloads/ICD%201300-1625-03%20HCSR-P%20M2.doc

Williamson, T. (2003, June). *T-NEX roadmap to success*. Office of the Surgeon General: TRICARE Division. MTF Optimization training for the South region. Handout presentation at a training meeting with the TRICARE Management Activity, Fort Polk, LA.

Wisconsin Physicians Services. (2004, December). Retrieved December 30, 2004, from http://www.wpsic.com/edi/edi_adv.shtml

Working Information Systems to Determine Optimal Management Course. (2004, December). Retrieved January 5, 2005, from http://services.tma.osd.mil/tricare_search/jsps2/webmain.jsp?SelectAll=on&Web=on&Homepages=on&Documents=on&News=on&MTF=on&Policy=on&NewQueryText=Dr.%20Richard%20Guerin

World Health Organization Country Profile. (2004, October). Retrieved October 5, 2004,

from http://www.who.int/en/