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In an era of finite health care resources, increased military operational tempo, and smaller expeditionary fighting forces, the US Navy has developed SMART (Sports Medicine and Rehabilitation Team) Center. SMART Centers address the multitude of muscular skeletal injuries encountered at Recruit Training Commands and Marine Corps Installations by offering an alternative to traditional Orthopedic Services. SMART Centers provide open access and one-stop shopping to multidisciplinary muscular skeletal services. This study attempts to use predictor (independent) variables such as access, surgical rates, and return to duty status to determine if there are differences between the SMART Center and the Orthopedic and Sports Medicine Clinics medical evaluation board reports (MEBRs). This study did not find the type of clinic to be a predictor of MEBRs, although this study discovered several significant subsequent findings associating the SMART Center with enhanced clinical outcomes over the Orthopedic and Sports Medicine Clinics.

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Abstract

In an era of finite health care resources, increased military operational tempo, and smaller expeditionary fighting forces, the US Navy has developed the SMART (Sports Medicine and Rehabilitation Team) Center. SMART Centers address the multitude of muscular skeletal injuries encountered at Recruit Training Commands and Marine Corps Installations by offering an alternative to traditional Orthopedic Services. SMART Centers provide open access and one-stop shopping to multidisciplinary muscular skeletal services. This study attempts to use predictor (independent) variables such as access, surgical rates, return to duty status, to determine if there are differences between the SMART Center and the Orthopedic and Sports Medicine Clinics medical evaluation board reports (MEBRs). This study did not find the type of clinic to be a predictor of MEBRs, although this study discovered several significant subsequent findings associating the SMART Center with enhanced clinical outcomes over the Orthopedic and Sports Medicine Clinics.

Running Head: SMART Centers an Empirical Analysis

U.S. Army Baylor University Graduate Program in

Health & Business Administration

Graduate Management Project

SMART (Sports Medicine and Rehabilitation Team) Centers: An Empirical Analysis.

Presented to Dr. Decima C. Garcia, CDR, USN, Ph.D., MBA.

In partial fulfillment of the requirements for a Dual
Masters Degree in Health & Business Administration

by

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Background

Over the last decade, prominent Department of Defense (DOD) studies have revealed the significant impact musculoskeletal injuries have had on our Armed Forces readiness (DOD Military Injury Prevention Priorities Working Group [DDMIPPWG], 2006). Component services face operational, economic, and morale burdens as a direct result of the multitude of injuries. According to the DDMIPPWG, physical training injuries and falls account for over 36% of all injury related hospitalizations for the Navy and 24% for the Marine Corps (2006).

Overview of Naval Hospital Camp Pendleton

Naval Hospital Camp Pendleton (NHCP) is located on Marine Corps Base (MCB) Camp Joseph H. Pendleton, the nation's busiest military base. NHCP is a 123 bed facility and is located approximately 10 miles from the main gate at MCB, Camp Pendleton, CA. The Base is located on a federal preserve in Southern California approximately 35 miles north of San Diego and 100 miles south of Los Angeles. Camp Pendleton covers over 125,000 acres and approximately 200 square miles of terrain.

NHCP is fully accredited by the Joint Commission on Accreditation of Healthcare Organizations (JCAHO). The hospital employs approximately 2,500 military, civilians and contract personnel. The hospital along with twelve branch medical clinics are responsible for providing service to 39,600 TRICARE Prime enrollees and over 200,000 beneficiaries overall.

The primary mission of NHCP is to ensure operational readiness of uniformed members and to provide primary and specialty care to them and to their families. The Naval Hospital and its Branch Medical Clinics provide care for active duty and retired personnel and their dependents residing in Camp Pendleton and the adjacent area. There are 278 providers on the medical staff, in addition to the 34 resident training billets in Family Practice. A list of this study's acronyms can be found in appendix A.

The Beginning

In 1996, the first SMART Clinic was christened on MCB Camp Pendleton in an effort to address the sheer number of injured Marines at the School of Infantry (SOI). The SOI trains approximately 23,000 Marines annually in basic warrior skills, advanced infantry techniques, and light armored vehicle tactics. SOI experienced an unusually high student attrition rate due the rigor of the infantry training. SMART Centers were a contemporary innovation in military medicine presenting Marines and Sailors an alternative to the traditional Orthopedic/Sports Medicine stove pipe patient access continuum. SMART Centers offer patients a "one stop shopping" approach to healthcare, integrating an amalgamation of healthcare providers (sports medicine doctors, physical therapists, certified athletic trainers [ATC's], podiatrists, and chiropractors) into one clinic. Core principals of the SMART Clinic methodology include: geographic availability to patient populations, open access to a multidisciplinary healthcare team, enhanced patient flow creating efficiencies in healthcare, and the expectation of patients to effectively self manage their rehabilitation.

Purpose

The purpose of this analysis is to examine NHCP's Musculoskeletal Support Services (MSS) healthcare delivery modalities in respect to the Medical Boards process. This study compares specific clinical and business practices between 52 Area SMART Center and NHCP's Orthopedics and Sports Medicine Clinics within a finite spectrum of International Classification of Diseases (ICD-9) Codes to determine each process's influence on the Medical Evaluation Boards Reports (MEBRs).

Research Questions

1. Does the NHCP 52 Area SMART Center offer MCB Camp Pendleton Marines and Sailors a better healthcare delivery model over NHCP's traditional Orthopedic and Sports Medicines Clinics?

2. What are the key distinctions between the 52 Area SMART Center, Orthopedics, and Sports Medicine Clinics, and do these differences provide a quantifiable difference in clinical outcomes?

3. Does the NHCP 52 Area SMART Center's rehabilitation model produce less Physical Evaluation Boards (PEBs), place fewer Active Duty Service Members (ADSMs) on Limited Duty Status (LIMDU), and return more ADSM's to duty?

4. Does the NHCP 52 Area SMART Center rehabilitation model provide a higher level of productivity than NHCP Orthopedics and Sports Medicine clinics for each ICD-9 code studied?

5. What are the patient demographics and injury characteristics for all MEBR generated by NHCP's MSS?

Theoretical Framework

This study proposes a theoretical framework for evaluating musculoskeletal clinical methodologies on MCB Camp Pendleton. This framework is an adaptation of Avedis Donabedian's theoretical model of Quality using a system of interrelated constructs (latent variables lacking empiricism) to predict previously unobserved relationships. Donabedian's model is a highly respected hierarchical model in which all three constructs are equally important, although sequentially based: Structure primarily influences Process, while Structure and Process jointly influence Outcome (1969).

Structure

The construct structure has been defined as "The relatively stable characteristics of the providers of care, of the tools and resources they have at their disposal, and of the physical and or organizational settings in which they work (Donabedian, 1980, p. 81)." Structural criteria refer to resource inputs, such as facilities, equipment, staffing levels, staffing qualifications, and organizational structure.

Process

According to Donabedian, Process is a series of operations or actions conducing to an end, to include interpersonal and technical care, as well as actions operations and relationships that produce that care (Kramer & Schmalenberg, 2005). Examples of process include: clinical diagnostic tests, waiting times, pharmaceutical care, and patient perceptions of care.

Outcomes

Outcomes are the causal results between structure and process. There are multitudes of healthcare indicators that have been used to determine outcomes from clinical effects to patient and staff satisfaction scores. Donabedian described the outcome of care as "recovery and restoration of function (1967, p. 187)." Outcomes are measured in a variety of ways but generally fall into two categories: generic assessments of patients' physical and mental health and disease specific measures. Donabedian's three components of medical care imply certain relationships among three conceptual domains. Simply stated, the appropriate structure and process will lead to favorable medical care outcomes.

GMP Framework

By operationalizing specific variables for each construct (Structure, Process, and Outcome) this theoretical model provides measurable components in a statistical predictive model. Empirical support for each variable is based upon a thorough review of the pertinent literature and quantitative observations from the data collected as a result of this study.

The construct Structure was operationalized by assigning the following independent variables for measure: productivity, patient appointments, and clinic type. The objective of assigning these variables for the construct of Structure was to be able to capture the SMART Center's geographically availability as well as the business efficiencies created through vertically integrating the healthcare delivery setting appendix B.

The construct Process was operationalized by assigning the following independent variables for measure: patient access and surgical disposition. Access was chosen as study criteria due to the significant role of patient access in clinical outcomes, patient compliance, and patient satisfaction. The variable surgical disposition was chosen to determine the role of surgical treatment in overall patient outcome.

The construct Outcome was operationalized by the independent variables return to duty (RTD) and the dependent variable aggregate disposition score (ADS). RTD is determined by the patient's physician and indicates a patient's fitness for duty. ADS is a composite score reflected by a clinics MEBR history. The MEBR documents the findings of the medical evaluation board (MEB). The MEB is a panel of medical providers attached to a military treatment facility (MTF) that evaluates an ADSM's fitness for duty; the MEB can assign or extend a LIMDU period for an ADSM, refer the ADSM to the a Department of the Navy (DON) PEB process, or find the ADSM fit for full duty. The ADS is calculated by the number times a patient has been placed into a LIMDU period or been referred to a DON PEB. ADS and RTD are not completely mutually exclusive but they measure two distinct outcomes. ADS is a composite score measuring the types of medical boards and their duration whereas RTD measures the final disposition of each patient: returned to full duty, PEB sent, or patient is still in LIMDU status. Appendix C shows a conceptual representation of this study's theoretical framework.

Literature Review

Force Health Protection

Since the end of the Cold War, the Department of Defense (DOD) has experienced a paradigm shift in the administration of military medicine. The U.S. Military has maintained a global footprint with a leaner, expeditionary type force. Military Medicine has had to embrace these changes through significant personnel reductions and frequent budget cuts (Force Health Protection Capstone paper, pg. 9). The Navy's operational tempo in support of the Global War on Terrorism (GWOT) is unprecedented, compelling Navy Medicine to assume a more active and mobile role in unilateral, joint, and international operations worldwide. In an effort to optimize readiness and maximize the performance of the Armed Forces, the DOD established Joint Force Health Protection doctrine. According to the DOD Force Health Protection Council (2004), "Force Health Protection (FHP) is a unified strategy that describes the integrated preventive and clinical programs that are designed to protect the Total Force (pg. 9)." Vice Admiral Nelson, former U.S. Surgeon General, before the subcommittee on the Defense of the House Appropriations Committee on Medical issues testified (2000), "FHP is a major theme in Navy Medicine's strategic plan." FHP doctrine is composed of three pillars.

1. Healthy and Fit Force
2. Prevention and Protection
3. Medical and Rehabilitative Care

Although a preponderance of the FHP doctrine is specifically concerned in regards to health prevention and promotion, force readiness is significantly impacted by injuries. According to the Assistant Secretary of Defense for Health Affairs, "Injuries are the leading health problem impacting on U.S. military force readiness today; leading in causes of death, disability, hospitalization, and lost productivity in the Department of Defense. (1999), p. 1." The DMIPPWG (2006) stated,

> The past decade has a growing recognition that injuries are a leading cause of morbidity and mortality for the U.S. Military, eroding combat readiness more than any other single disease or health condition in this generally healthy and physically active population. Service member injuries cost hundreds of millions of dollars annually, consuming the services' resources and challenging their operational effectiveness (p. 1).

Injury Prevalence

Historically, musculoskeletal injuries have plagued military operational readiness. Dillingham and Belandres (1998) found musculoskeletal injuries to have considerable impact throughout the U.S. combat record citing low back syndrome in World War II to the Persian Gulf War where musculoskeletal injuries were the most frequently reported medical diagnosis. In Operations DESERT SHIELD and DESERT STORM musculoskeletal injuries were the leading causes of medical evacuations and hospitalizations for Army personnel (Onate, 2004). Peake's (2000) research discovered non battle injury rates ranged from 152 out of 1000 Soldiers per year (10.5%) for DESERT SHIELD and DESERT STORM to 64 out of 1000 Soldiers per year (6.4%) for Operation JOINT ENDEAVOR in Bosnia.

Musculoskeletal injuries in the military utilize tremendous resources, consume millions of dollars in health care costs, and results in the physical attrition of thousands of ADSM's annually. In the 1980's musculoskeletal injuries became the leading cause of hospitalizations for each of the three armed services (Jones, Perrotta, Canham-Chervak, Nee, & Brundage, 2000). The military recruit population is particularly susceptible to musculoskeletal injuries, where 80% of all sick call visits are considered musculoskeletal. The cost burden of these recruit injuries are staggering; in 1991 musculoskeletal injuries prevented 488 recruits from completing basic training at the Naval Training Center Great Lakes, Illinois. The costs to the Navy were estimated at $5 million (Kelly & Bradway, 1997). According to Jones et al., "Although outpatient injuries are only mild to moderately severe in nature they result in large manpower losses because of the high number of occurrences" and "limited duty rates for the Army have been reported to be 40 to 120 days (limited duty) per 100 Soldiers per month (2000, p. 171)." The Armed Forces Epidemiological Board (AFEB), a scientific advisory body to the Assistant Secretary of Defense for Health Affairs concluded that injuries are the most important health problem confronting U.S. Military forces (2000).

Military Attrition

Recruiting, training, and retaining military recruits can come at a significant cost. According to the Government Accounting Office (GAO), the DOD spends about $390 million to recruit and train individuals who never make it to their first duty stations. The GAO also estimates close to one-third of all enlistees in the military services have failed to complete their first tours of duty (GAO, 1997). The Navy has invested tremendous resources in the establishment of SMART Centers. Traditionally the Navy has strategically located these SMART Centers at Recruit Training Centers in a direct effort to mitigate military attrition.

Medical Disability

When members of the military are found medically unfit for duty they are discharged and consequently compensated for medical disability. Disability is a particular concern for the military services as it affects the number of active duty and reserve personnel available for the military mission. Physical disability that results in discharge from the service carries significant compensation costs. Evidence shows that 30% to 50% of all military disabilities cases could be due to injury (Songer & LaPorte, 2000). A 2001 GAO report to the House Armed Services Committee identified the total military disability compensation for fiscal year (FY) 2000 totaling $1.42 billion. The GAO additionally stated for FY 2000, that 22,780 cases were evaluated for disability and only 4,100 (18%) of these members were returned to full duty. A recent RAND National Defense Research Institute report discusses the alarming future of the military medical disability program,

> "Disability rates are rising rapidly, so programs in both sectors can expect substantial growth. The increase for military retirees was 22 percent points between the 1971 cohort and the 2001 cohort (35 percent to 57 percent). Because military disability compensation continues for life, the higher

rates in recent cohorts will translate into higher future expenditures (Buddin & Kappur, 2005, p. 23).

To date the literature has yet to report quantifiable outcome data to substantiate the SMART Center's role in reducing overall disability due to the availability of definitive outcome data.

The Origin of Military Sports Medicine

Peake (2000) refers to the sheer volume of injuries throughout the U.S. military as a hidden epidemic and urges a call for action. In order to initially combat this epidemic the DMIPPWG (2006) recommended an aggressive mitigation program for sports and physical training injuries. In an effort to manage this growing injured population of musculoskeletal injuries Navy Medicine and the Marine Corps searched for an alternative rehabilitative clinical model. According to Dillingham & Belandres (1998), military medical officers have made a tremendous impact in rehabilitation medicine by leveraging their corporate experience gained by treating wartime casualties. The general tenets of exercise, early range of motion, early mobilization and training, underwent development during wartime and are core principles in Sports Medicine. Almeida, Williams, Shaffer & Brodine (1999) discovered significant similarities in the epidemiological patterns of military musculoskeletal injuries reported in civilian runners. Medical researchers continue to make associations between the complementary aspects of sports medicine and military medicine as these sub-specialty disciplines have similar musculoskeletal injury components.

The British Royal Army has adopted an interdisciplinary sports medicine model for the rehabilitation of their injured personnel. LT Col Ian McCurdie, MD a rheumatologist and sports medicine specialist for the British Royal Army Medical Corps sees direct correlations between treating troops and teams.

> "Our main contribution …has been to get as many personnel fit for their role as possible in exactly the same way any sports medicine team would work to ensure that all squad members were fit to compete, we apply the same principles and practices to get our soldiers, sailors, and airman fit to fight. (Schnrring, 2003, p. 3)"

U.S. Military physicians have improved patient care by adopting a sports medicine clinical approach, permitting ADSMs to be treated in a multidisciplinary setting.

Multidisciplinary Medicine

A multidisciplinary health care team is defined as a functional unit composed of medical providers with varied and specialized training who coordinate their care to treat a patient. Multidisciplinary health care can be traced back to 1922 where Barker discusses the need for team work in the health care field (Kelly & Bradway, 1997). The Institute of Medicine (IOM) in their ground breaking report Crossing the Quality Chasm stated, "health care in the United States was in need of major reform and should shift its focus from treating acute illness to provide evidence based, interdisciplinary care for patients (2001, p. 3)." Additionally in this report the IOM recognized multidisciplinary teams as a standard of care for primary care medicine. Multidisciplinary teams have been found to improve the coordination of care, create efficiencies and cost savings in care by utilizing physician extenders for non-critical tasks (2001). Furthermore the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) considers the multidisciplinary team an item of priority focus in the accreditation process.

Open Access

Open access allows patients to seek immediate specialty medical treatment post injury, circumventing any primary care manager (PCM) interaction. Open access is a fundamental principle on which the SMART Center methodology is based upon. Critics argue, open access will lead to inappropriate care, over utilization, and moral hazard. Advocates contend, open access extends patient choices, increases patient compliance, improves patient satisfaction, promotes rehabilitation, eliminates referral, and contributes to cost savings in the private sector by avoiding a referring physician's fees and related ancillary costs.

An exploratory study by Mitchell and De Lissovoy (1997) comparing the utilization of healthcare resources for persons receiving physical therapy under open access versus those referred by physician revealed: physician referrals were characterized by 13.4% more physical therapy claims and 4.6% more office visits, with an average claim per referral of $1,232 more per patient.

Butcher et al. noted in their seminal study examining patient utilization for a primary care sports medicine clinic environment, that primary care sports medicine providers managed the preponderance of the clinic's referrals, resulting in a reduction of overall demand for orthopedic surgeons. This reduction of referrals increased access to the orthopedic surgeons permitting them to see a more appropriate case mix, decreased the waiting period for their orthopedic services, and facilitated their efficient utilization (1996). Open access is the cornerstone of the 52 Area SMART Clinic's success.

SMART Centers

In order to address the growing needs of the Navy and Marine Corps musculoskeletal rehabilitation population, Navy Medicine created the SMART Center by seamlessly integrating several deck plate medical line initiatives. The architects of the SMART methodology noticed the traditional clinical model of musculoskeletal medicine did not meet the needs of their targeted population. The administrative interface was complex and redundant: consisting of gate-keeping, specialty referrals, and extended referral times. Often ADSMs became isolated from their respective units, creating a passive dependency on medical care compounding medical disability and service attrition.

The SMART Center's clinical model fundamentally differs from traditional clinical medicine by offering each patient open access to their treatment via a multidisciplinary health care team. To realize the greatest impact, SMART Centers were initially established at Navy and Marine Corps training commands because of the sheer volume of musculoskeletal patients.

SMART Centers have been recognized for their profound impact to Navy and Marine Corps training commands for decreasing attrition and lost training days due to musculoskeletal injuries (Schor, 2002). SMART Centers have decreased use of radiological studies, and reduced the number of orthopedic consults resulting in a cost savings in the millions. Significant epidemiological research and health promotion programs also grew from the genesis of the SMART Centers. Specific SMART Center successes include:

-From 1996 to 1998, MCB Camp Pendleton's School of Infantry (SOI) 52 Area SMART Center provided a 33% reduction in musculoskeletal injury attrition, saved over 21,000 lost training days, and decreased SOI's student attrition costs by $1.25 million (Schor, 2002).

-Since July 2002, the Pearl Harbor SMART Center has successfully returned 78% of its patients to active duty status within 30 days of the patient's first SMART Center consultation. Prior to establishment of the SMART Center, this process often took more than 90 days (Noad, 2003).

-From 1998 to 2002, the Parris Island SMART Center reduced medical attrition by 49% for Marine Corps Recruit Depot Parris Island (Schor, 2002).

-From 2002 to 2003, the Camp Lejuene SOI SMART Center reduced the average number days of light duty by 200%, cut the waiting times for sports medicine referrals by 21 days, and decreased the number of students in the medical separations platoon by 40 personnel (Stuessi, 2003).

SMART Centers have proliferated throughout the DON to meet the need of Navy and the Marine Corps. Through statistical modeling this study seeks to provide quantitative evidence demonstrating the advantages of the SMART Center methodology over traditional specialty care in a defined population. The relevance of this study cannot be understated, to date only descriptive analyses of the SMART Center methodology have been found in the literature.

Methods and Procedures

Study Design

This study is a retrospective longitudinal outcome based evaluation of NHCP's clinical musculoskeletal services (MSS) from January 2005 through December 2006. This study will link independent databases with patient identifiers to create a comprehensive database representing the patient care continuum for NHCP MSS: patient access, appointment history, MEBR boards history, and clinical productivity (RVU/encounter). This study explore the entire MEBR MSS population (N=759) and examines all patients who were seen for the following ICD-9 codes; 717.7 (Chondramalacia), 718.81 (Shoulder Instability), 719.46 (Patellar Femoral Syndrome), 724.2 (Lumbago), 733.93 (Lower Leg Stress Fracture), 726.64 (Patellar Tendonitis), 836.0 (Meniscal Tear), 844.2 (Knee Ligament Sprain). Graphically this study is expressed as:

X O

The X represents the treatment and medical boards processing of this study's population and the O represents the observations of those medical and administrative processes.

Data

The Data for this study was extracted data from four distinct sources: the NHCP data warehouse, the NHCP's Medical Board Records, the MHS Data Repository, and the TRICARE Operations Center (TOC). The NHCP data warehouse is fed data from the CHCS I legacy system. Access into the NHCP data warehouse is strictly controlled by the NHCP data warehouse architect. Patient appointment encounter data were extracted from the NHCP data warehouse using the Proclarity Analytics Platform 6.0 data management software. The appointment data extracted included patient "kept", "cancelled", and "no show" appointments. For the purposes of this study appointment data was aggregated into two sub-groups "kept appointments" and "cancelled/no show appointments". Kept appointments included: established, walk-in, and procedure encounters. Categorized under the cancellation/no show group were patient no shows, patient cancellations, and encounters where patients left without being seen (LWOBS). In order to capture patient encounter data attributed to MEBRs in early calendar year (CY) 2005 or late CY 2006, MSS appointments were extracted from the CHCS database ± 1 year from the date of the MEB. Telephone consults and APV's were specifically excluded from the appointment data set because of the minimal patient contact that is involved with such encounters.

Productivity data (RVU per encounter) were extracted from the MHS repository using the M2 Datamart. The MHS data repository is fed data by the Defense Eligibility Enrollment Verification System (DEERS), Clinical Data Repository (CDR), and Expense Accounting System (EAS) IV. Access to the M2 Data Warehouse is strictly controlled through the Executive Information Decision Support Systems (EIDS). The Research Diagram (appendix D) provides a detailed explanation of the data pulls and database integration for this study.

Clinic access data were extracted from the TOC website which is designed and administered by the Office of the Secretary of Defense (Health Affairs) and the TRICARE Management Activity (TMA). The TOC directly harvests their data from the M2 Data Warehouse. The TOC provides MHS healthcare administrators data regarding enrollment, access, appointment templating, PCM capacity and assignment. Monthly clinic access to care data were retrieved from the TOC archives by querying a specific date, Defense Medical Information Identifier System (DMIIS), and Medical Expense Personnel Reporting System (MEPR's) codes.

The Medical Boards process provided all MEBR information: patient demographics, medical board's history (LIMDU and PEB), diagnoses, and clinical data. A medical board occurs at the sole discretion of a patient's medical provider based upon a patient's fitness for duty, (see appendix E) for the medical boards process. The MEBRs disposition data was solely extracted by a 100% audit of 2000+ individual medical boards' records. Due to the sensitive nature of information contained in the medical boards' records, access to the MEBRs are strictly controlled. To accommodate the scope of this project provisions were made to meet patient personal privacy requirements: a private screening room was provided, a stand alone database was used, and HIPPA standards were adhered to throughout the duration of this project.

The data obtained from this retrieval populated a 36 field Excel data base (see appendix F). Distinct relevant MEBR history from calendar years 2005 and 2006 were retrieved. The information included: patient demographics (age, race, gender, branch of service, length of service), clinical history, and medical boards history. The data collected from the MEBRs populated an analytical data cube in Proclarity Analytical Platform 6.0. Placing data in the analytical cube permitted MEBRs data to be matched to each respective ADSM's appointment history (n=39,200 appointments) see appendix H for a Proclarity Analytics Platform screenshot. All data collected for this study was imported into the Statistical Package for the Social Sciences (SPSS) 9.0 database program. This database provides the basis for all of the statistical analysis for this project.

Data Inclusion Criteria

The inclusion criteria for this study consists of patients seen by the 52 Area SMART Center, 52 Area SMART Physical Therapy Clinic, NHCP Sports Medicine Clinic, NHCP Orthopedic Clinic, and NHCP Physical Therapy Teams 1,2, and 3 during the time period of January 2005 through December 2006. Only active duty Marines and Sailors having the following ICD-9 codes, 717.7 (Chondramalacia), 719.46 (Patellar Femoral Syndrome), 718.81

(Shoulder Instability), 724.2 (Lumbago), 726.64 (Patellar Tendonitis), 733.93 (Lower Leg Stress Fracture), 836.0 (Meniscal Tear), and 844.2 (Knee Ligament Sprain) were included in this study. This study took the liberty to standardize similar ICD-9 Codes to increase sample size and minimize diagnosis variation. Table 1 displays the ICD-9 conversion process.

Table 1

ICD-9 Conversion Process

Original ICD-9 Codes	*Converted ICD-9 Code*
227.1 (Intervertebral Lumbar Disc Dislocation)	724.2 (Lumbago)
722.52 (Lumbar Disc Degeneration)	724.2 (Lumbago)
724.2 (Lumbosacral Radiculitis)	724.2 (Lumbago)
756.11 (Lumbosacral Spondylolysis)	724.2 (Lumbago)
847.2 (Lumbar Strain)	724.2 (Lumbago)
719.41 (Shoulder Arthralgia)	718.81 (Shoulder Instability)
726.1 (Rotator Cuff Syndrome)	718.81 (Shoulder Instability)
727.61 (Rotator Cuff Rupture)	718.81 (Shoulder Instability)
831.0 (Shoulder Dislocation)	718.81 (Shoulder Instability)
840.7 (Glenoid Labrum Lesion)	718.81 (Shoulder Instability)
840.9 (Unspecified Sprain/Strain Upper Arm)	718.81 (Shoulder Instability)
717.0 (Internal Derangement of the Knee)	836.0 (Medial Meniscal Tear)
836.1 (Lateral Meniscal Tear)	836.0 (Medial Meniscal Tear)
836.2 (Meniscal Tear Unspecified)	836.0 (Medial Meniscal Tear)

Table 1 *(continued)*

ICD-9 Conversion Process

Original ICD-9 Codes	*Converted ICD-9 Code*
836.3 (Patellar Dislocation)	836.0 (Medial Meniscal Tear)
717.82 (Old Disruption Lateral Collateral Ligament)	844.2 (Cruciate Ligament Sprain)
717.82 (Old Disruption Lateral Collateral Ligament)	844.2 (Cruciate Ligament Sprain)
844.0 (Lateral Collateral Ligament Sprain)	844.2 (Cruciate Ligament Sprain)
844.1 (Medial Collateral Ligament Sprain)	844.2 (Cruciate Ligament Sprain)

Data Exclusion Criteria

Initially this study identified 1050 MEBRs to be studied, to limit the scope of this study only MEBRs that initiated from the 52 Area SMART, NHCP Orthopedics, and NHCP Sports Medicine Clinic were studied. Medical boards initiated from the off base branch medical clinics (BMC's) n = 234, i.e. Barstow (12 MEBRs), Bridgeport (7 MEBRs), Port Hueneme (121 MEBRs), Seal Beach (10 MEBRs), and Yuma (84 MEBRs), were excluded from this study because a substantial component of their medical treatment were conducted remotely at these respective BMC's. Finally all records that were deemed illegible or incomplete (n = 27, 3.5% of all records studied) were stricken from this study. This group of records represents less than 4% of all records studied and it is felt that there would be negligible statistical impact by their inclusion.

All descriptive statistics were computed along with a correlation matrix of the dependent and the independent variables. Consideration was given to all variables in regard to central tendency. Throughout this study seven variables (Access, ADS, Appointments, Clinic, Productivity, RTD, Surgery) will be analyzed to validate three alternate hypotheses. All variables are defined in table 2 and a code sheet is provided and appendix I explains how each variable was coded into SPSS .

Table 2

List and Definitions of the Study Variables

Variable	*Abbreviation*	*Definition*
Aggregate Disposition Score (DV)	ADS	A clinical outcome metric calculated by summing a composite score of a patient's LIMDUs and PEB. (continuous)
Clinic Access Time (IV)	Acs	The length of time it takes for a patient's first appointment to MSS. (continuous)
Appointments (IV)	Apts	The sum of a patient's cancelled, no-show, and LWOB's encounters. (continuous)
Clinic (IV)	Clin	Either the 52 Area SMART Clinic or the NHCP Orthopedics and Sports Medicine Clinic. (dichotomous)
Productivity (IV)	Prod	A productivity metric, a ratio of average RVU's over patient encounters for each specific ICD-9 Code. (continuous)
Return to Duty (IV)	RTD	A measure to determine if a patient was returned to full duty status (dichotomous)
Surgery (IV)	Surg	A measure to determine if the medical board is associated with a surgical intervention (dichotomous).

Hypotheses

Hypothesis One

Alternate Hypothesis 1: Patients seen at the SMART Center for the following non-surgical DX's (717.7, 719.46, 724.2, 726.64, 733.93, 836.0, and 844.2) have greater access to specialty MSS than those patients seen in NHCP Orthopedics and the Sports Medicine Clinic.

$$\mathbf{H1_a}: \mu 1 \neq \mu 2$$

Null Hypothesis 1: There is no difference in access to specialty MSS between the 52 Area SMART Center and the NHCP Orthopedics and Sports Medicine Clinic.

$$\mathbf{H_{10}}: \mu 1 = \mu 2$$

$\mu 1$ = 52 Area's SMART Clinic Access

$\mu 2$ = NHCP's Orthopedics and Sports Medicine Clinics

The unit of analysis for this hypothesis is the patient and the measure is the variable access. This hypothesis will determine if there is a statistical difference between the length of time it took a patient to receive specialty MSS once the patient entered the referral system. For the purpose of this hypothesis, the timeframe a patient waits to access to specialty care is designated as the dependent variable Access. Access to specialty MSS care at Camp Pendleton is divided between the 52 Area SMART Center and NHCP Orthopedics and Sports Medicine Clinics and is generally based upon an ADSM's diagnosis, geography (22 miles between facilities), and status (SOI student or not) at Camp Pendleton.

The 52 Area SMART Center primarily serves patients from areas: 41, 43, 52, 53, and 62-64. Whereas NHCP Orthopedics and Sports Medicine serve areas: 11-16, 21-26, and 31-33 (see Appendix E Camp Pendleton Map). In order for patients in south Camp Pendleton to receive MSS specialty services, patients must first see their PCM and have a referral generated to an MSS specialty clinic. Once a referral is generated into the DOD's electronic medical record

(EMR) Armed Forces Health Longitudinal Technology Application (AHLTA) the referral is subsequently screened by utilization management and forwarded to the MSS. An orthopedic physician assistant for MSS screens each referral and appoints the patient to the appropriate MSS clinic based upon diagnosis, case severity, patient geography, provider request, and clinic availability. Access data for the NHCP Orthopedics and Sports Medicine Clinic was obtained through a data pull from the TOC website.

Specialty MSS care on North Camp Pendleton before the implementation of AHLTA in February 2006 was available on a walk-in basis at the 52 Area SMART Center. Each morning the SMART Center held a walk-in clinic for the SOI and two specific areas of north Camp Pendleton. Patients were seen based upon severity and order of arrival. Patients were also seen on non-scheduled walk-in days based upon the request of a specific area's Medical Officer (K. Stuessi, 52 Area SMART Officer in Charge [OIC], Personal Interview, September 15, 2006). After the implementation of AHLTA in February 2006 only the SOI had access to the daily walk-in clinic. Patients from all other areas were required to have a PCM generate a referral through AHLTA. Each referral was subsequently screened by the MSS utilization management team within 24 hours and pending patient contact an appointment was assigned within three working days (K. Macon, Business Manager, Personal Interview, January 17, 2006). For the purpose of this study 52 Area SMART Center's access for calendar year (CY) 2005 will be considered open access (one day). After the implementation of AHLTA in October 2006 the 52 Area's SMART Center's access was based upon the historical record keeping of SMART's Business Manager, and considered to be an average of four days (K. Macon, Business Manager, Personal Interview, January 17, 2006).

For hypothesis number one, a one way analysis of variance (ANOVA) will be used to differentiate between alternate and null hypothesis one. An ANOVA tests the statistical differences between the mean scores of two or more groups on one or more variables (Vogt, 2005). An ANOVA test results in an F-value. The larger the F-value, the better the overall model is as a predictor. Correspondingly, if the alpha (α) level is set to < .05, and the resultant p-value is less than .05, then this indicates the regression model, or regression coefficients, could be as far from zero as they are by chance alone and therefore statistically significant. A post-hoc test was not conducted due to the nature of the variables studied.

Hypothesis Two

Alternate Hypothesis 2: There is a statistical difference between 52 Area SMART Center's clinical productivity and NHCP's Orthopedics and Sports Medicine Clinics.

$$\mathbf{H_{2a}: \mu 1 \neq \mu 2}$$

Null Hypothesis 2: There is no statistical difference between 52 Area SMART Center's clinical productivity and NHCP's Orthopedics and Sports Medicine Clinics.

$$\mathbf{H_{2a}: \mu 1 = \mu 2}$$

$\mu 1$ = 52 Area SMART's Center's productivity

$\mu 2$ = NHCP /Sports Medicine clinic's productivity

This study operationally defines productivity as a ratio of the average of relative value units (RVU's) per patient encounter. This hypothesis examines the average number of RVU's per patient encounters seen at each particular clinic for each specific ICD-9 Code (717.7, 719.46, 724.2, 733.93, 726.64, 836.0, and 842.2). The productivity for each patient encounter is the unit of analysis for this hypothesis.

Albritton, Miller, Johnson & Rahn (1997) utilized a similar methodology for their study comparing faculty productivity in various clinical settings. This study identified the average number of RVU's for each half day clinic per billed encounter to quantify physician productivity between teaching and non-teaching settings. Albritton et al. found, "The resource based relative value system converts effort and practice characteristics into RVU's for different levels of care. Because RVU's reflect clinical effort rather than dollars billed, this system can be used to measure physician clinical productivity independent of financial production (1997, p.717)."

The data for this hypothesis was pulled utilizing the MHS Management Analysis and Reporting Tool (M2). The productivity scores per each ICD-9 code for each respective clinic were compared to determine statistical significance using an ANOVA. An alpha level of .05 was used to compare each respective clinic.

Hypothesis Three

Alternate Hypothesis 3: For the diagnoses (717.7, 719.46, 724.2, 726.64, 733.93, 836.0, and 844.2), the independent variable Clinic is a predictor of ADS as reported by the unstandardized regression coefficient (B), t statistic, and *p* value, indicating that the independent variable Clinic has prediction capability. In essence, the clinic a patient attended contributed to the patients overall ADS.

$$\mathbf{H_{3A}: Y_1 = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6}$$

Y_1 = ADS, X_1 = Access, X_2 = Productivity, X_3 = Clinic, X_4 =Surgery, X_5 = Appointments, and X_6 = Return to duty

Null Hypothesis 3: The independent variable Clinic is not a predictor of ADS as reported by the unstandardized regression coefficient (B), t statistic, and *p* value, indicating that Clinic has no prediction capability of statistical significance in this model.

The units of analysis for hypothesis three are each clinic's patient populations MEBRs. The metric used is the dependent variable ADS. Hypothesis three applies a linear regression analysis to create a predictive model of clinical efficacy based upon the relationships between the dependent variable (ADS) and the set of independent variables (access, appointments, clinics, productivity, surgery, and RTD).

Regression analysis is a statistical technique applied to data to determine, for predictive purposes, the degree of correlation of a dependent variable with one or more independent variables. A multiple linear regression was chosen as the primary statistical tool for this hypothesis because this study is investigating the predictive capabilities of the aforementioned independent variables on ADS. One of the strengths of regression analysis is it can be used to determine the magnitude of the linear relationships between variables, and it can be used to make predictions based on the model. Multiple regression allows the researcher to determine the best predictor(s) of ADS. By using this type of methodology, this study attempts to ascertain if there is a strong or weak linear relationship between variables. Although regression cannot be used to determine causality, it may be used to explain, through the correlation coefficient (R^2) and adjusted (R^2), how much of the dependent variable is explained by the various independent variables.

The previous two hypotheses examined differences between each clinic's access and productivity, hypotheses 3 incorporates access, appointments, clinics, productivity, RTD, and surgery into a single predictive model. Each independent variable for this model was chosen due to its relevance in regards to ADS based upon the literature, Donabedian's theoretical model of Structure, Process, and Outcome, and the availability of the data. Each variable is distinct and there were no autocorrelation between variables.

Aggregate Disposition Score

An ADS is a composite score that aggregates an ADSM's MEBR history of LIMDUs and PEBs into a single metric. The DON Manual of the Medical Department (MANMED) 2005 defines LIMDU as a period where an ADSM reports to their workspace but is excused from the performance of certain aspects of military duties as defined by an MEB. The LIMDU status permits ADSMs to receive the necessary rehabilitation and recovery time needed to return to full duty. Personnel placed in a LIMDU status require notification of their parent command, service headquarters, and Personnel Support Detachment and are not permitted to deploy. Generally ADSMs are allowed three LIMDU periods before referral to a DON PEB.

The PEB is the formal military process, used when a medical provider submits a written report recommending that an ADSM be released from active duty service because of a medical disability. This report is approved locally at the MTF by a medical board and is subsequently submitted to the DON PEB board for final approval. The PEB determines the ADSM's fitness for continued active duty service and eligibility for disability benefits.

Aggregate Disposition Score Derivation

ADS is defined as a clinical outcome metric for CY's 2005 and 2006. The ADS calculates a composite score by aggregating the number of MEBRs generated by each clinic's patient population for the defined set of ICD-9 Codes. The ADS assigns each clinic a score derived upon the number and type of MEBRs each patient has documented: PEB or LIMDUs (only MEBRs having the ICD-9 Codes 717.7, 719.46, 724.2, 733.93, 726.64, 836.0, and 844.2 were included in the ADS derivation). The PEB carries the heaviest weight (1.0), whereas a LIMDU score can be cumulative if a patient has had multiple LIMDUs (1 LIMDU = 0.4, 2 LIMDUs = 0.7, 3 LIMDUs = 0.9, [see table 1.]), see table 3.

Table 3

ADS Score Example

Name	Medical Board Type	Score
Patient 1	PEB	1.0
Patient 2	3 LIMDU	.9
Patient 3	2 LIMDU	.7
Patient 4	1 LIMDU	.4
ADS		3.0

Reliability and Validity

Data reliability and validity are crucial for a study to have statistical power and reproducible results. Face, content, and criterion validity are all addressed through the source of this study's data. All data pulled for this study originates from NHCP. According to NHCP Chief Information Officer "the NHCP CHCS I database is updated throughout each business day and is considered the most reliable source of local hospital clinical data (C. Archibald, Personal Interview, September 12, 2006)." Validity in the Medical Boards database was confirmed through a 100% examination of each patient's paper MEBR. Each record was screened, categorized, and the required data was extracted: demographics, diagnoses, clinic, provider, dates, etc., thus accounting for systemic and random (types I [alpha] and II [beta]) error.

Expectations and Limitations

To date there is nominal empirical evidence substantiating or disproving the value of SMART Centers to Navy Medicine. Significant resources have been utilized to support SMART Centers throughout the Navy and Marine Corps based upon scant anecdotal evidence. Although, at face value, centrally locating and multidisciplinary MSS and simultaneously providing open access to injured ADSMs appears to meet acid test criteria. Therefore it is expected that the majority of the independent variables studied will contribute to prediction of ADS.

Sample Size

Although this study examines the entire population of MSS throughout NHCP clemency its scope was narrowed to meet design limitations of this analysis. Only eight ICD-9 Codes were selected for study based upon case mix and commonality: similar diagnoses were converted to create more robust MEBR sample sizes for SMART (see table 1). The small sample size of the 52 Area SMART Center places stresses on the statistical analysis and reduces this study's statistical power.

Case Mix

Inherently the NHCP Orthopedic Clinic books appointments with a higher case mix than the 52 Area SMART Center or the NHCP Sports Medicine Clinic. To control for the higher case mix, this study specifically identified eight common diagnoses that require similar medical interventions and physical rehabilitation requirements.

Patient Encounters

This study invests heavily on each medical provider's ability to code accurately and consistently (departmentally) into CHCS and AHLTA. NHCP's MSS providers conduct peer review, cross train throughout the department, and receive coding training from NHCP Patient Administration Department to provide healthcare continuity to their patient population. Equally as important to this study were the patient encounter data located in NHCP's data warehouse. This data needed to be aggregated by appointment type, diagnosis, MEBR status, Clinic and patient ID, while being exportable to a SPSS. To facilitate this data transfer and mitigate data error the Proclarity Analytics Platform 6.0 retrieved all 30,000+ CHCS diagnoses data. A 10%

audit of the MEBR database (76 MEBRs) data was conducted to ensure data reliability, no discrepancies were found.

Admin Separations

According to the Marine Corps Separation and Retirement Manual (2000), "If examination by a medical officer confirms that the Marine is suffering from a physical or mental condition apparently beyond the individuals control and indicates the condition is not a disability, initiate separations proceedings." These involuntary administrative separations (ADSEP's) occur throughout NHCP MSS but are not recorded in the MEBRs. Each clinic experiences a limited number of patient administrative separations (ADSEP's). According to Dr. Keith Stuessi 52 Area's SMART Center OIC, "Historically the number of administrative separations between NHCP MSS clinics is 5% (Personal Interview, September 15, 2006)." ADSEP's occur at the Marine Corps unit level by the request of the overseeing doctor for the convenience of the U.S. Government. Currently Headquarters Camp Pendleton Base Surgeon's Office does not track medical ADSEP history. Considering the scope of this study and the distribution of ADSEPs throughout NHCP's MSS, the impact of the ADSEP is considered statistically insignificant.

Clinic Interflow

This study assumes that the patient populations for 52 Area SMART and NHCP Orthopedics and Sports Medicine Clinics are discrete. The data revealed a limited number of patients that were seen in both the 52 Area SMART Center and the NHCP clinics. This study's design criteria (selected diagnoses) as well as the size of the patient interflow factor (under 5%) assuage any affect on the outcome of this study.

Continuity of the Medical Boards Process

There are natural intrinsic and extrinsic variations that could potentially influence the MEBR process such as: provider treatment regimens, provider inclination in initiating MEBR's, provider continuity, patient compliance, patient's command involvement and compliance. These variations are expected in a study of this type and for this study's purposes are considered random variation.

Results

This study examines n=759 patients that were assigned into a limited duty status or placed into a medical board. Table 4 displays this study's patient population demographics. The patient demographics between the clinics are relatively similar, it should be noted large standard deviations exist for the variables age category and rank, indicating each clinic treated patients of varying ages and ranks. After running individual *t*-tests between the demographic variables it was determined there were statistical differences between the clinics at the $p<.05$ for Age and LOS and at the $p<.01$ for Black, Male and Female. These differences are not believed to have any practical significance, although these differences may warrant further study of injury patterns over the demographic lines.

Table 4

Patient Demographics

Clinic	**N**	**Age**		**Rank**		**Cauc**	**Blk.**	**Hisp**	**Other**
		x	σ	x	σ				
SMART	177	23.41	4.34	3.62	1.40	71%	7%	20%	2%
NHCP	582	25.05	5.21	4.14	1.41	67%	11%	19%	3%
Overall	759	24.69	5.08	4.03	1.41	68%	10%	19%	3%

Table 5 shows the descriptive statistics for each study variable. After assessing the means and standard deviations for each variable: several variables had high standard deviations in relation to their means. Several linearity diagnostics were performed to determine data normalcy: P-P plots, histograms, and the Kolmogorov-Smirnov (KS) test. These tests confirmed the non-parametric tendency of the data. Data transformation was considered but the after reviewing both the natural log transformation and the z score transformation the data did not retain its original properties.

All Pearson correlations were less than .80, indicating there was no multicollinearity among the variables. The Pearson correlation for Clinic was -.09. Pearson's *r* detects direction and magnitude. It is a negative number, so it is negatively correlated with the dependent variable, ADS, indicating that there is a relationship between low ADSs and the 52 Area SMART Center.

Table 5

Study Variable Descriptive Statistics CY 2005 and 2006 (N = 759)

Variable	*N*	Mean	± Std. Deviation	*Min*	*Max*	*r*	*p*
Dependent Variable:							
Aggregate Disposition Score	759	.68	.41	.04	1.90	-	-
Independent Variables:							
Access	759	14.78	9.36	1	28	.14	.00*
Age	759	24.65	4.94	17	49	.05	.11 ^{ns}
Appointments	759	10.60	9.35	1	101	.05	.07^{ns}
Clinic	759	.23	.42	0	1	-.09	.01*
Diagnosis Category	759	4.37	2.14	1	8	-.13	.00*
LIMDU	759	1.33	.58	.4	2	.281	.00*
Productivity	759	.84	.16	.68	1.54	-.01	.36 ^{ns}
RTD	759	1.12	.71	0	2	-.69	.00*
Surgery		.46	.56	0	2	.18	.00*

Notes. * Values for Mean and Standard Deviation are per patient diagnosis. r is Pearson *r* values for the variable's correlation with the dependent variable Aggregate Disposition Score. * indicates significance of p < .01, ^{ns} indicates no significance.

One way ANOVAs were run for both Access and Productivity against the dependent variable Clinic. Post Hoc Analyses were not conducted due to the bivariate nature of the dependent variable Clinic. Both tests reported significant differences between clinics for Access $F(1,757) = 2209.90$, $p = < .001$ and for Productivity $F(1, 757) = 891.026$, $p = < .001$.

In order to further investigate the relationships between access and productivity in NHCP's MSS clinics a series of bivariate correlation matrices were created, illustrated in Tables 6 and 7. Bivariate correlations reveal systematic variations in the values between two variables in both direction and strength. Bivariate correlation does not necessarily indicate causation but signals the amount of covariation between the variables. Table 6 identifies both positive and inverse correlations for the dependents variables Access. A positive association can be defined as; a rise in the dependent variable values that correspond with a rise in the independent variables values.

The positive associations are between Access, ADS, Appointments, LIMDU, Surgery at the p<.01 level and PEB, at the p< .05 level. The inverse associations are between Access, Productivity and Clinic at the p< .01 level, thus indicating a rise in the independent variables would be associated with a decrease in value of the dependent variable.

Table 7 compares the dependent variable Productivity with independent variables Access, ADS, Appointments, Clinic, LIMDU, PEB, and Surgery. The variables LIMDU and PEB show no association with productivity, whereas Access, ADS, Clinic, and Surgery correlate at the p< .001 level.

Table 6

Bivariate Correlation Dependent Variable Access

Variable	*R*	*P*
Dependent Variable:		
Access	-	-
Independent Variables:		
Aggregate Disposition Score	.136	.00**
Appointments	.154	.00**
Clinic	-.863	.00**
LIMDU	.112	.00**
PEB	.087	.02*
Productivity	-.65	.00**
Surgery	.19	.00**

Notes. * r is Pearson *r* values for the variable's correlation with the dependent variable Aggregate Disposition Score. * indicates significance of $p < .05$*, **indicates significance of $p < .01$.

Table 7

Bivariate Correlation Dependent Variable Productivity

Variable	*R*	*p*
Dependent Variable:		
Productivity	-	-
Independent Variables:		
Access	-.65	.00*
Aggregate Disposition Score	.136	.00*
Appointments	.2	.00*
Clinic	-.735	.00*
PEB	.003	$.93^{ns}$
LIMDU	-.40	$.27^{ns}$
Surgery	-.28	.00*

Notes. * r is Pearson *r* values for the variable's correlation with the dependent variable Aggregate Disposition Score. *indicates significance of $p < .01$.

Table 8 displays the results of the linear regression analysis. Clinic and Appointment status did not statistically contribute to the model. It should be noted that the Beta coefficients for RTD and Clinic have a negative relationship with ADS. Higher ADSs are associated with lower returned to duty rates and the NHCP Orthopedics and Sports Medicine Clinics are associated with higher ADS scores. RTD contributed to the model the most with a $t = -25.66$ $p < .001$ while Surgery had a $t = 4.129$ $p < .001$ and Productivity $t = 2.997$ $p < .001$ were lead predictors as well. The other variables are listed in descending order of contribution to the model.

Table 8

Contributions of the Predictors of Aggregate Disposition Score

CY 2005 and 2006 (N = 759)

Model	**Unstandardized Coefficients** Beta	Standard Error	**Standardized Coefficients** Beta	*T*	*Sig.*
Constant	.761	.096		7.938	.000
RTD	-.382	.015	-.667	-25.663	.000
Surgery	.0819	.020	.113	4.129	.000
Productivity	.250	.086	.101	2.997	.004
Access	.007	.002	.152	2.520	.000
Appointments	.001	.001	.044	1.627	.104
Clinic (0 Orthopedics, 1 SMART)	-.028	.056	-.029	-.499	.618

Note: Enter method of Linear Regression used here and listed in order of significance. Dependent Variable: ADS.

Four out of the six independent variables were statistically significant predictors of the dependent variable, ADS

Table 9 depicts this study's medical boards frequency by diagnosis codes, revealing that between January 2005 through December 2006, NHCP MSS in aggregate returned 30% of the patients back to full duty, while 19% of all patient's medical boards were sent to PEB.

Interestingly ICD-9 Code 719.46 (Patellar Femoral Syndrome) had the highest incidence of PEB and LIMDU per diagnoses, whereas 724.2 (Lumbago) had the lowest rate of ADSMs returned to duty.

Table 9

Medical Boards Frequency by ICD-9 Code

ICD-9 Code	#	PEB	LIMDU	RTD
717.7	29	4	29	12
718.81	99	22	94	32
719.46	209	54	200	54
724.2	170	41	165	39
726.64	211	5	29	11
733.93	47	5	46	22
836.0	44	6	43	18
844.2	130	10	125	52

Table 10 reports PEB rates for each of the eight ICD-9 Codes respective to each clinic. Notable facts from table 7 are: 52 Area SMART Clinic's PEB rates for codes 717.7 (Chondramalcia), 719.46 (Patellar Femoral Syndrome), 726.64 (Patellar Tendonitis), and 733.93 (Lower Leg Stress Fractures) are significantly lower than the corresponding PEB rates for NHCP Orthopedics and Sports Medicine Clinics. Interestingly PEB rates for ICD-9 Codes 718.81 (Shoulder Instability), 836.0 (Meniscal Tears), 844.2 (Knee Sprain) for the 52 Area SMART Clinic are substantially higher than NHCP Orthopedic and Sports Medicine Clinics, while ICD9-Code 724.2 is virtually the same.

Table 10

PEB Rate for Each Clinic by Diagnosis for CY 2005 -2006

Clinic	ICD-9 Code	PEB's	MEBR's	% of PEB's for MEBR Diagnosis
Orthopedics	717.7	3	14	21%
	718.81	18	86	21%
	719.46	49	169	29%
	724.2	28	113	25%
	726.64	4	18	22%
	733.93	5	28	18%
	836.0	4	34	12%
	844.2	6	104	6%
SMART	717.7	1	15	7%
	718.81	4	10	40%
	719.46	5	40	13%
	724.2	13	54	24%
	726.64	1	11	<1%
	733.93	0	15	0
	836.0	2	7	28%
	844.2	4	22	18%
	Total	147	740	20%

To determine if a respective MSS Clinic had predictive capability in respect to ADS a basic linear regression model was constructed. The default 'enter' method was used in order to determine the "degree of fit" or linear relationship between the multiple variables of the model.

ADS was chosen as the dependent variable for its ability to represent MEBR outcomes. The variables Access, Appointments, Clinic, Productivity, RTD, and Surgery, were selected as independent prediction variables. The ultimate regression equation as a whole accounts for 49% (R^2 = .50; Adjusted R^2 = .496) of the variance in ADS. The 50% shared variance indicates this model explains approximately one-half of the variable ADS.

Discussion

The purpose of this study was to identify quantifiable differences in clinical and administrative processes between the NHCP MSS and to determine if these differences contributed to a better healthcare delivery model for MCB CP MSS population.

Demographics

A total 759 (N) MEBR's were matched to 30,869 MSS appointments. The typical patient from the population studied was a male Caucasian Marine Corporal (E-4) having served for 3 year and 5 months. This type of patient accurately represents the overall USMC general demographics according to Marine Corps Community Services Demographic Update (2006). In this study males were the prevalent gender at 88%, while females were 12% of the population studied. Race was generally divided between three groups: Caucasian (67%), Hispanic (19%), Black (10%), and all other (4%). The population's age ranged from 17 to 49 with a median age of 23 and a standard deviation of 5 years. The population's rank was more tightly distributed with a median rank of Corporal (E-4) and a standard deviation of 1.4 pay grades. The median length of service was 41 months with a large standard deviation of 51 months.

Hypothesis One "Access"

The independent variable Access is the cornerstone to the SMART Center's methodology, providing patients medical care as a patient requires it. The literature agrees that access is a critical dimension to care.

- "Early functional treatment results in shorter sick leave and facilitated an earlier return to sports, (Karlsson, Eriksson, and Sward, 1996, p. 341)"
- "Early functional rehabilitation treatment of complete medial collateral ligament sprains produces results comparable with those achieved with surgery or immobilization while minimizing treatment- related morbidity and allowing more rapid return to sports participation. (Reider, Sathy, Talkington, Blyznak, and Kollias, 1994, p. 470) "
- "Early mobilization prevents late residual symptoms and ankle instability, early mobilization allows earlier return to work and may be more comfortable for patients. (Eiff, Smith, 1994, 83)"
- "Return to pre-injury activity was less with early functional treatment in 4 of 5 studies that evaluated this outcome. Subjective instability was less in 3 of 5 studies. Similarly, re-injury rate was less in 5 of 6 studies. (Jones & Amendola, 2007, p. 169)"
- "Delays for access to care plague our healthcare systems, these delays cause patient dissatisfaction…and may lead to worsening clinical outcomes" and "there is a cost to maintaining any waiting list; the longer the wait the higher the failure to show rate which represents unused capacity (Murray, 2000, p. 1594)"

An ANOVA revealed a tremendous difference in patient access between the 52 Area SMART Center and NHCP Orthopedics and Sports Medicine Clinics $F(1,757) = 2209.90$, $p = <$ .001 indicating far greater access for 52 Area SMART Center patients. A bivariate correlation buttressed Access's role between the variables ADS, Appointments, Clinic, LIMDU, Productivity, and Surgery; revealing associations and statistical significance at the $p< .01$ level and significance for PEB at the $p < .05$ level. The correlation indicated the following associations:

- The 52 Area SMART Center is associated with greater levels of patient access.
- As patient access increases, patient appointment cancellations and no shows appointments appear to decrease.
- As patient access increases, ADS appears to decrease
- As patient access increases, clinic LIMDU rates appear to decrease.
- As patient access increases, clinic PEB rates appear to decrease.
- As patient access increases, clinic productivity appears to increase.
- As patient access increases, clinics appear to experience a decrease in surgery rates.

It must be reemphasized that bivariate correlations are not casual but present relationships between variables in both strength and magnitude. The findings of this study coincide with the above stated literature. This research strongly supports the argument that the 52 Area SMART Center has a unique ability to provide early functional treatment through open access thus enhancing clinical outcomes by reducing the surgery rates, decreasing MEB morbidity, and decreasing the occurrence and frequency of patient appointment cancellations and appointment no shows. It can be inferred from the above analysis that through the reduction of MEB rates, the

52 Area SMART Center has a direct influence in returning ADSMs back to full duty. According to the Joint DOD Force Health Protection doctrine, the component services are obliged to "establish strategies to develop a continuum of injury care emphasizing safe and efficient RTD, and reconditioning (2004, p. 20)". The Navy Surgeon General Admiral Arthur furthers Navy Medicines role in returning ADSMs to duty by establishing naval readiness as the first of his five stated priorities for Navy Medicine in 2006 (2006).

Hypothesis Two "Productivity"

According to Wahl et al. there is a large gap in healthcare and this gap is associated with less than optimal clinical outcomes, lost opportunities for improved quality of life, and decreased productivity (2005). Triplett advocates, "Measuring the output the of services industries has long been considered difficult…No task has been perceived as more difficult than measuring the health care output of the health care sector (2006, p. 15)."

Renowned healthcare economists Cutler and Berndt (2001) in their seminal book "Medical Care Output and Productivity" clearly maintain a direct relationship between productivity and healthcare outcomes. The methodology of assessing clinical outcomes by assigning productivity benchmarks is far from novel. Previous methodologies have attempted to use the Consumer Price Index or Quality Adjusted Life Years as outcomes. Lakhani, Coles, Eayres, Spence, and Sanderson compared actual clinical and health outcomes data with productivity benchmarks to assess Great Britain's National Health System (2005).

This study attempted to capture clinical productivity data by assigning a rudimentary ratio of each clinic's RVU value for a specific ICD-9 code over the number of kept patient appointments a clinic entertained for each specific ICD-9 code. An ANOVA conducted between each clinics productivity score indicated a significant difference between overall clinical productivity: $F(1, 757) = 891.026$, $p = < .001$ with the 52 Area SMART Center having a higher RVU/Patient Encounter value than NHCP Orthopedics and Sports Medicine Clinics. A bivariate correlation matrix was constructed to evaluate the relationships between the variables Access, Appointments, LIMDU, PEB, Surgery, and Productivity. The analysis yielded statistically significant associations at the $p< .01$ level between the variables Access, Appointments, Clinic, and Surgery. These associations are as follows and are not causal:

SMART Centers are associated with higher levels of productivity.

- As productivity increases patient appointment cancellations and no shows appear to decrease.
- As productivity increases patient access appears to increase.
- As productivity increases surgery rates appear to decrease.

Interestingly productivity did not show a significant association with ADS, LIMDU, or PEB. It appears that individual clinic productivity does not have a direct impact on MEB outcomes.

Hypothesis Three "Predictive Model"

The intent of this study was to empirically discern through linear regression whether the 52 Area SMART Center offered MCB Camp Pendleton Marines and Sailors a better healthcare delivery model over NHCP's traditional Orthopedic and Sports Medicines Clinics. The findings of this study could not rule out the null hypothesis. Therefore based upon the results of this predictive model it can not be concluded that the 52 Area SMART Center offers a better health care delivery model than the traditional delivery model, as defined by ADS. This finding was unexpected; there were significant differences between the clinics in terms of patient access, clinic productivity, surgery rates, and patient appointments. This result could be explained by the use of ADS as the dependent variable. ADS does not necessarily measure the speed and clinical efficacy of clinical outcomes. Additionally ADS only measures medical board outcomes which are a fraction of each clinic's overall patient encounters.

After removing the independent variables Clinic and Appointments a second regression was calculated: the independent variables RTD, Surgery, Productivity, and Access had an explained 50% of ADS with a linear regression equation of $F(6, 752) = 125.34$ ($p < .001$). Experimentation using natural log transformation of the independent variables Access, Productivity, and Surgery, achieved an R^2 of 58%, although the decision was made to retain the natural characteristics of the original data for this model. The results of this model can be visualized through its linear regression equation.

Y(ADS) = b0 + b1*RTD + b2*SURGERY + b3*PRODUCTIVITY + b4*ACCESS + ε

.68 = .76 + -.67(1.12) + .08(.11) + .84(.10) + .01(.15) + 1.71

The variables Clinic and Appointments were not included in this model and cannot be considered a predictor of ADS. Simply stated according to this study's statistical analysis, the type of clinic and/or a patient's cancelled/no show appointments rate has little or no role in MEB outcomes. However a patient's RTD status, a patient's surgery status, the clinics overall productivity, and each clinic access to care have predictive capability for ADS. Although the independent variables Clinic and Appointments were not incorporated into the predictive model, the bivariate correlation revealed associations among ADS, Clinic, and Appointments indicating possible practical significance and interaction between the variables. Inspection of this predictive model reveals a high level of error (1.71) which is disconcerting. This error can arise from the data being non-parametric or composition of equation variables being non-linear.

Subsequent Findings

Patient Encounters

This study's population averaged 30 kept patient appointments per MEBR (74% of all appointments), and 10 cancelled or no show patient appointments per MEBR (26% of all appointments). Throughout CYs 2005 and 2006 NHCP MSS experienced 7054 cancelled/no show appointments for the set of diagnoses studied. Noteworthy was the significant difference between the 52 Area SMART Center's cancellation/no show rate of 21% and NHCP Orthopedics and Sports Medicine Clinics cancellation/no show rate of 27%. Even more intriguing from CY 2005 to CY 2006, 52 Area SMART Center had an overall decrease in patient cancellations and no show appointments by 52% (462 appointments), while the NHCP Orthopedics and Sports Medicine had an overall increase in patient cancellations and no show appointment by 38% (1379 appointments). Although patient cancellations and no show appointments did not contribute to the predictive model (see table 10) it is still quite a disturbing finding considering the time and resources made available by NHCP MSS for these appointments. Even more disconcerting is the apparent upward trend for patient cancellations and no show appointments for non SMART MSS.

A Pareto Analysis was conducted to identify which diagnoses contributed to patient no-show/cancelled appointment rate the most see (appendix J). ICD-9 Codes 719.46 (Patellar Femoral Syndrome) had 2,283 no-show/cancelled appointments, 724.2 (Lumbago) had 1932 no-show/cancelled appointments, 718.81 (Shoulder Instability) had 1332 no-show/cancelled appointment, and 844.2 (Knee Ligament Sprains) had 1323 cancelled/no show appointments. These four diagnoses consisted of 87% of the cancelled and missed appointments.

Medical Evaluation Boards

A trend analysis was performed on the distribution of PEBs throughout each of the eight ICD-9 Codes for each clinic; appendix K displays trends by histogram indicating similar PEB distribution patterns for each diagnosis. This trend analysis was relevant because it shows the similar MEBR patterns between clinics and diagnoses, adding to the validity of this study. To identify which diagnoses were responsible for the most PEBs in this study, a second Pareto Analysis was conducted see (appendix J). The ICD-9 Codes 719.46 (Patellar Femoral Syndrome) had 54 PEBs, 724.2 (Lumbago) had 41 PEBs, 718.81 (Shoulder Instability) had 22 PEBs, and 844.2 (Knee Ligament Sprains) had 10 PEBs. These four diagnoses consisted of 86% of all PEBs.

Surgery

Clinic surgery rates were examined and the NHCP Orthopedics and Sports Medicine Clinics surgery rates were found to be statistically different and higher than that of the 52 Area SMART Clinic based upon individual T-Test results (see graphical illustration in appendix L). Worth mentioning was the SMART Center's higher surgery rate for ICD-9 Code 724.2 (Lumbago) at 7% versus 3% for NHCP Orthopedics and Sports Medicine. Initially this finding contradicts a perceived notion that the MTF based clinics see a higher case mix than that of the outlying SMART Center. After careful consideration this difference might be accounted for by the unique training environment stressors placed upon SOI students in Area 52. Endurance events such as the "Crucible" force students to undergo 40 miles of forced marching during a 54 hour period of food and sleep deprivation (Powers, 2006).

Diagnoses

The ICD-9 codes that were most likely to return ADSMs to duty were:

1. 726.64 Patellar Tendonitis (46% returned to duty)
2. 717.7 Chondramalcia 41% (returned to duty)
3. 836.0 Meniscal Tear 40% (returned to duty)

It is no surprise to find ICD-9 Codes 726.64 and 717.7 returning ADSMs to duty more, but finding the surgical diagnosis 836.0 returning more ADSMs to duty over other non-surgical diagnoses was surprising. A crosstab comparison was performed and it was determined that diagnosis 836.0 had the third lowest ADS. This surprising finding can be explained, meniscal tears are generally a more acute injury, patients have a high probability of undergoing corrective surgery with minimal complications, and experiencing a relative short rehabilitation process. This study's data corroborates that explanation; ICD-9 Code 836.0 had the highest surgical rate of the diagnoses at 84%. Meniscal tears also revealed a relatively short LIMDU process with 66% of all LIMDUs lasting only six months or less.

The ICD-9 codes that were least likely to return ADSMs to duty were:

1. 724.2 Lumbago (23% returned to duty)
2. 719.46 Patellar Femoral Syndrome (26% returned to duty)
3. 718.81 Shoulder Instability (32% returned to duty)

After reviewing the diagnoses least likely to return ADSMs to duty it can be determined that these diagnoses represent insidious, chronic muscular skeletal syndromes with the highest PEB rates of all the diagnoses, 24% (Lumbago), 26% (Patellar Femoral Syndrome), and 22% (Shoulder Instability) respectively.

Conclusions

The intent of this research was to ascertain quantifiable data to determine if the 52 Area SMART Center provides a better healthcare delivery model over NHCP's traditional MSS methodology. This study demonstrated there are many factors that contribute to ADS. Unfortunately the predictive model did not show a direct relationship between ADS outcomes and the 52 Area SMART Center. Although the model did show patient access, clinic productivity, patients RTD status, and clinic surgery rates explained 50% of the dependant outcome variable ADS, with a linear regression equation of $F(6, 752) = 125.34$ ($p < .001$). However the subsequent findings produced by this study are more relevant, applicable, and warrant additional research. NHCP MSS should consider which diagnoses are more likely to lead to surgery and medical disability. Such analysis could assist NHCP MSS to design standard operating procedures, align the appropriate resources, and provide specificity in benchmarking patient care. Additionally, understanding the trends regarding missed patient appointment can allow MSS business managers to draft more efficient appointment templates; increasing clinic productivity as well as patient and provider satisfaction. Further research is needed to investigate this study findings regarding ADSM appointment compliance (high rate of cancelled/no show appointments) and the corresponding high rate of medical boards outcome scores.

Future Recommendations

It is the recommendation of this study that Navy Medicine establish a service wide morbidity database able to capture the appropriate long term clinical outcome data (PEB, LIMDU, RTD) by individual work center MEPRs code. This will allow researchers not only to study clinical outcomes but to conduct a cost benefit analysis to determine if an identifiable monetary savings exists by providing care via the SMART methodology versus traditional orthopedic care.

At the local level NHCP has just opened a second SMART Center in a centrally located area on Camp Pendleton (Area 13). This SMART Center was established to provide greater access to MSS care for the ADSM and to open appointment availability to TRICARE Prime beneficiaries for NHCP Physical Therapy services. Future studies should explore the possibility of extending SMART services to all TRICARE Prime beneficiaries. These studies should detail clinical outcomes in relation to traditional MSS and analyze cost savings as a result of recouped networked dollars.

Ethical Considerations of Data Collection

The security and privacy of each patient's information was at the forefront of this research study. Patient information was initially required to merge four independent data sources into a functional database. Subsequently all identifiable patient information has been eliminated from all material related to this study. Throughout the duration of this study Health Insurance Portability and Accountability Act (HIPAA) requirements and NHCP standard operating procedures were strictly adhered to, ensuring patient privacy and information security.

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Appendix A

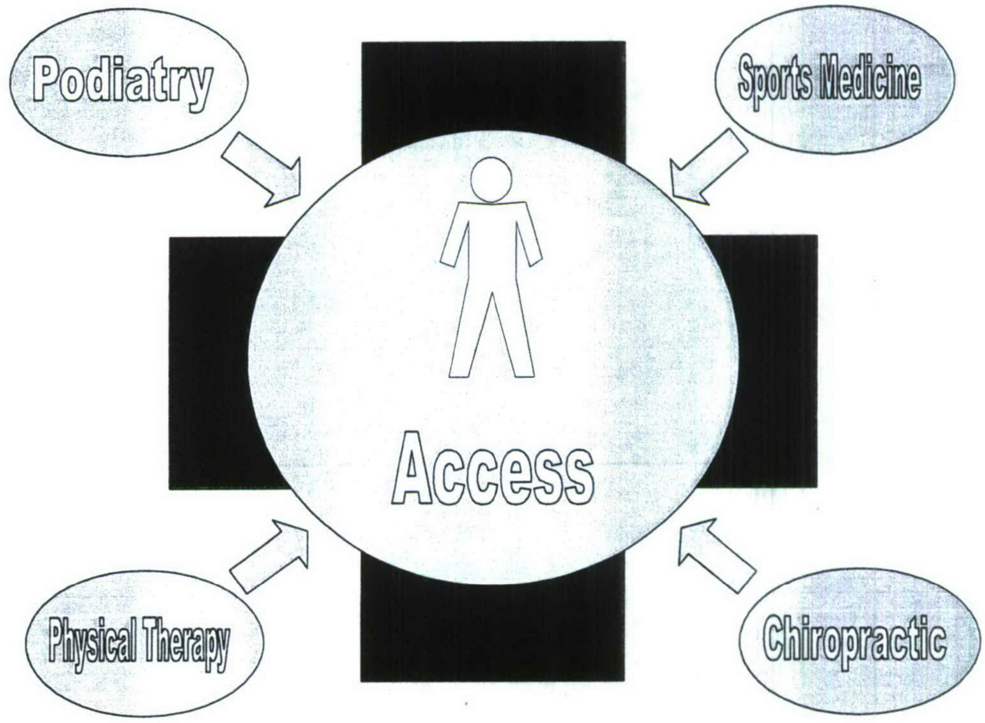
List of Acronyms

ADS	Aggregate Disposition Score
ADSEP	Administrative Separation
ADSI	Aggregate Disposition Score Index
ADSM	Active Duty Service Member
AFEB	Armed Forces Epidemiological Board
AMD	Authorized Manning Document
ANOVA	Analysis of Variance
ATC	Certified Athletic Trainer
CHCS	Composite Health Care System
CY	Calendar Year
DMIPPWG	Department of Defense Military Injury Prevention Priorities Working Group
DOD	Department of Defense
EIDS	Executive Information Decision Support Systems
EMR	Electronic Medical Record
FHP	Force Health Protection
FTE	Full Time Equivalent
GAO	United States Government Accounting Office
GMP	Graduate Management Project
GWOT	Global War on Terror

ICD-9-CM	The International Classification of Diseases, Clinical Modification
IOM	Institute of Medicine
KS	Kolmogorov-Smirnov Test
LMD	Length of the Medical Boards Process
LIMDU	Limited Duty Status
MANMED	Manual of the Medical Department
M2	MHS Management Analysis and Reporting Tool
MCB	Marine Corps Base
MEB	Medical Evaluation Board
MEBR	Medical Evaluation Board Report
MEPRS	Medical Expense Reporting System
MHS	Military Health System
MSS	Musculoskeletal Services
NHCP	Naval Hospital Camp Pendleton
PA	Physician Assistant
PCM	Primary Care Manager
PCSMP	Primary Care Sports Medicine Provider
PEB	Physical Evaluation Board
PT	Physical Training
RVU	Relative Value Unit
SOI	School of Infantry
SMART	Sports Medicine and Rehabilitation Team
TOC	TRICARE Operations Center

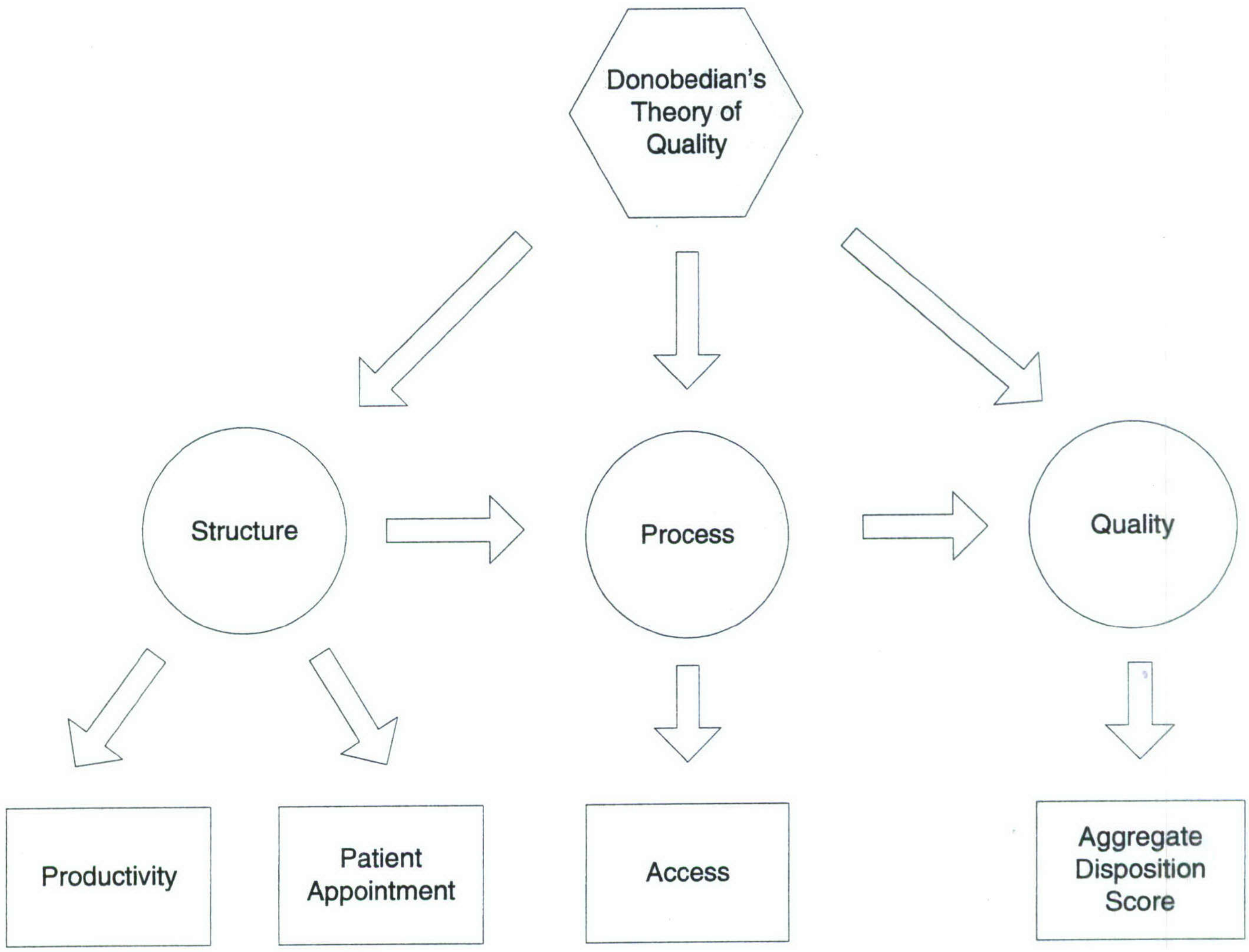
Appendix B

SMART Model "Health Care Cocoon"



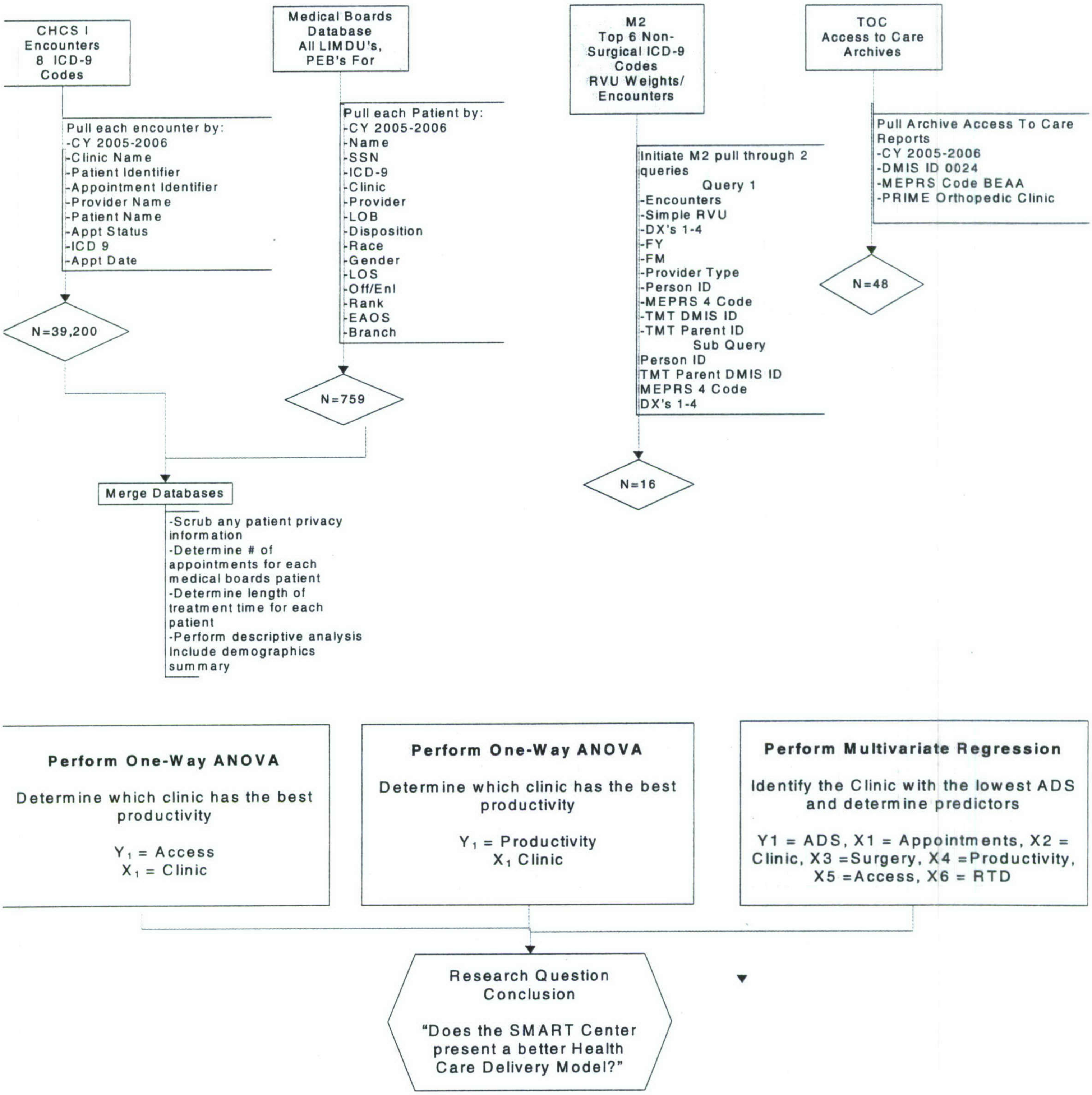
Appendix C

Theoretical Model

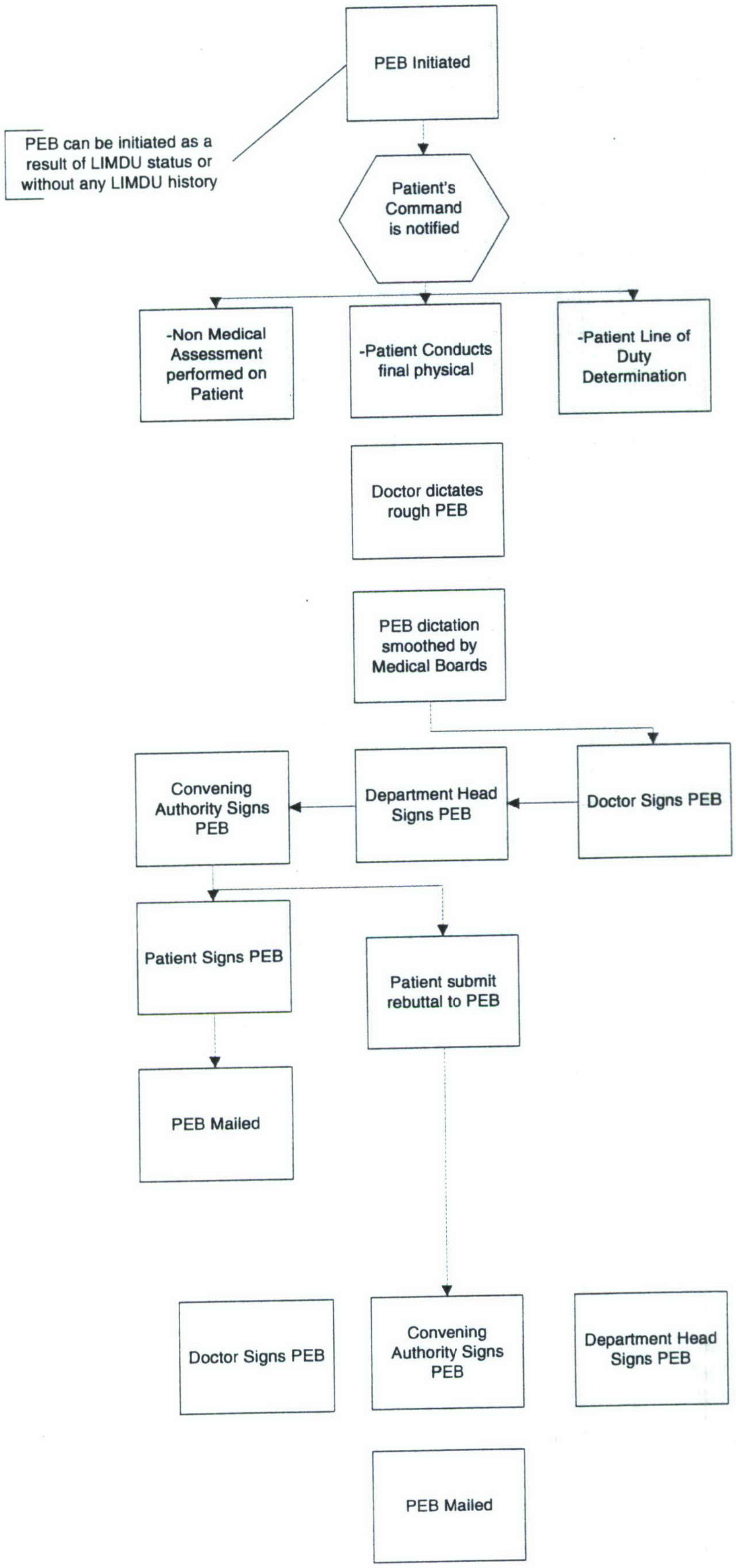


Appendix D

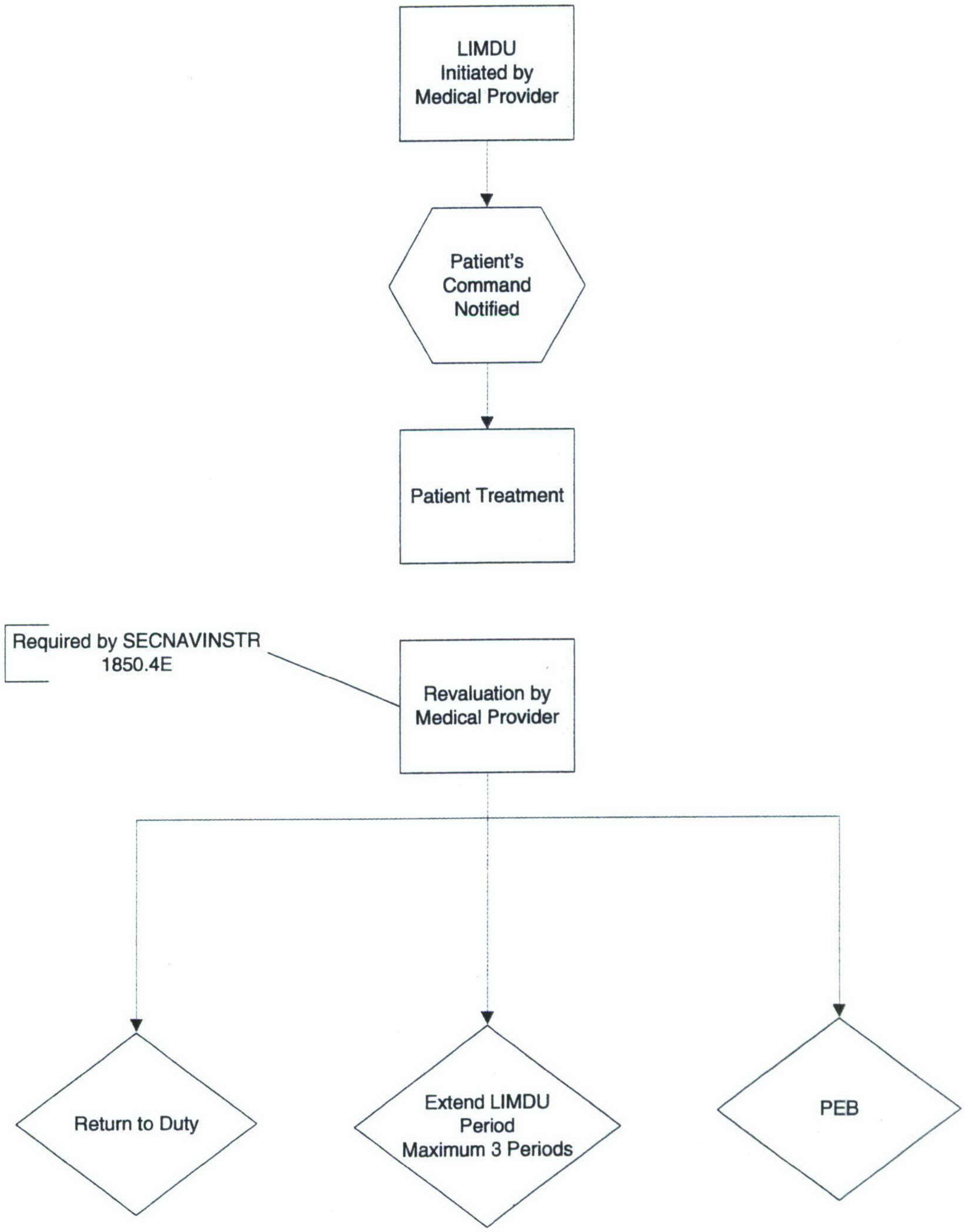
Research Diagram



Appendix E
Medical Boards Process (PEB)



Appendix E (*continued*)
Medical Boards Process LIMDU



Appendix F
Excel Database ScreenShot

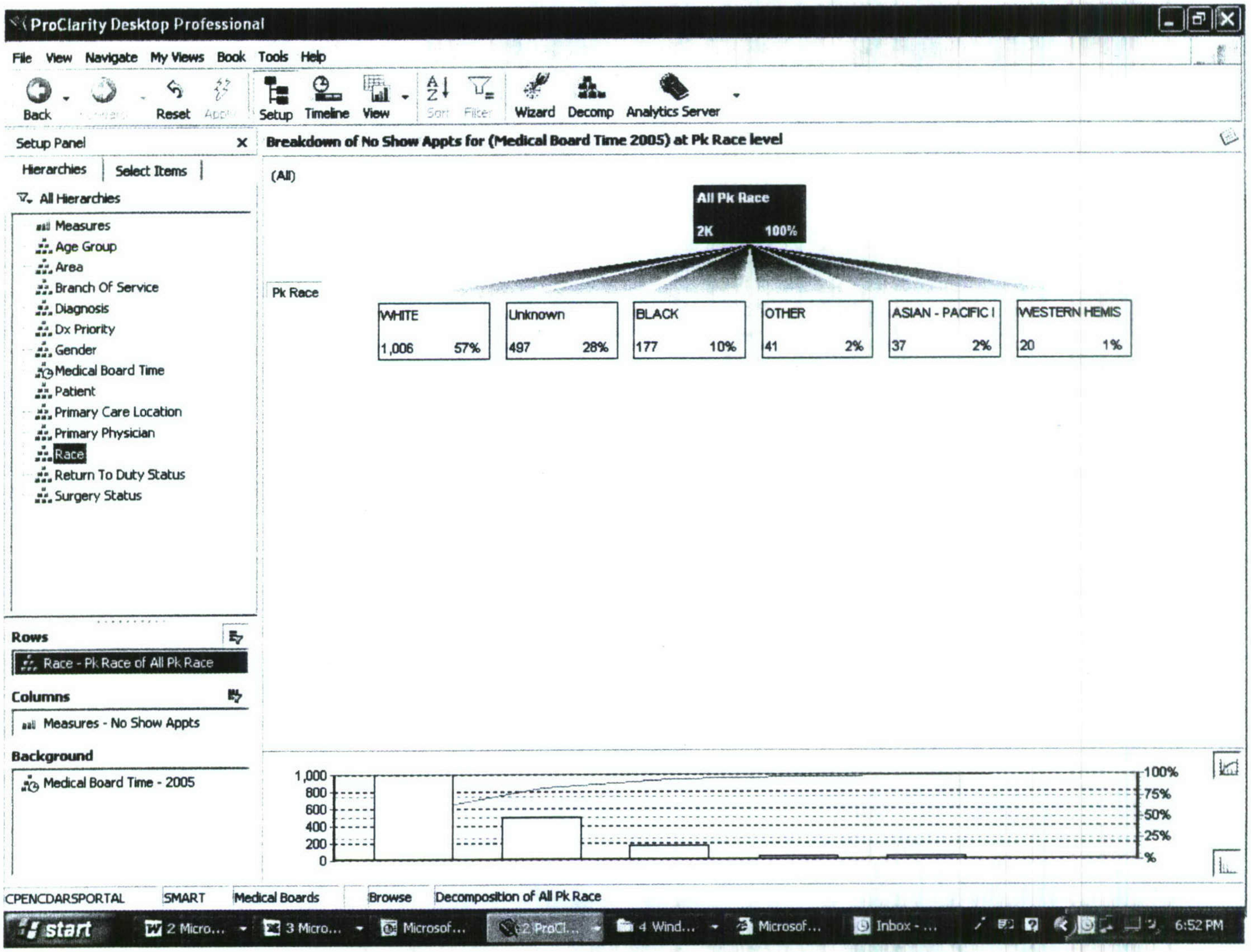
Microsoft Excel - GMP Medical Boards9

F11 24

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	
1	IEN	SMART	NHCP	Male	Female	Age	Rank	LOS	USN	USMC	Caucasian	Black	Hispanic	Indian	Asian	Oth
2	315351	0	1	1	0	32	6	132	0	1	1	0	0	0	0	
3	1064340	0	1	1	0	18	2	18	0	1	0	0	1	0	0	
4	1085207	0	1	0	1	32	3	10	1	0	0	1	0	0	0	
5	1051792	1	0	1	0	20	2	9	0	1	0	0	1	0	0	
6	1051792	1	0	1	0	20	2	9	0	1	0	0	1	0	0	
7	836429	0	1	1	0	30	3	46	0	1	1	0	0	0	0	
8	643305	0	1	1	0	25	5	90	0	1	1	0	0	0	0	
9	643305	0	1	1	0	25	5	90	0	1	1	0	0	0	0	
10	1114242	0	1	0	1	17	3	15	0	1	0	0	0	0	1	
11	945183	1	0	1	0	24	3	39	0	1	1	0	0	0	0	
12	313544	1	0	1	0	34	5	116	0	1	1	0	0	0	0	
13	534724	1	0	1	0	28	5	105	0	1	0	0	1	0	0	
14	534724	1	0	1	0	28	5	105	0	1	0	0	1	0	0	
15	918850	0	1	1	0	20	3	31	0	1	0	0	1	0	0	
16	914696	0	1	1	0	35	5	157	0	1	0	0	1	0	0	
17	891527	1	0	1	0	23	3	37	0	1	1	0	0	0	0	
18	891527	1	0	1	0	23	3	37	0	1	1	0	0	0	0	
19	643711	0	1	1	0	27	3	85	0	1	1	0	0	0	0	
20	673392	0	1	1	0	26	4	77	0	1	1	0	0	0	0	
21	817604	0	1	1	0	22	3	39	0	1	1	0	0	0	0	
22	817604	0	1	1	0	22	3	39	0	1	1	0	0	0	0	
23	841230	0	1	1	0	28	4	64	0	1	0	0	1	0	0	
24	1133543	0	1	1	0	21	3	18	0	1	1	0	0	0	0	
25	884351	0	1	1	0	21	4	52	0	1	0	0	1	0	0	
26	884351	0	1	1	0	21	4	52	0	1	0	0	1	0	0	
27	864771	0	1	1	0	25	4	39	0	1	1	0	0	0	0	
28	948252	1	0	1	0	19	3	28	0	1	1	0	0	0	0	
29	971700	0	1	1	0	18	3	41	0	1	0	0	1	0	0	
30	963287	1	0	1	0	20	3	31	0	1	1	0	0	0	0	
31	698997	0	1	0	1	23	5	85	0	1	1	0	0	0	0	
32	433972	0	1	1	0	27	6	111	0	1	1	0	0	0	0	
33	847131	1	0	1	0	21	3	41	0	1	0	0	1	0	0	

Appendix G

Proclarity 6.0 Analytics Platform Screen Shot



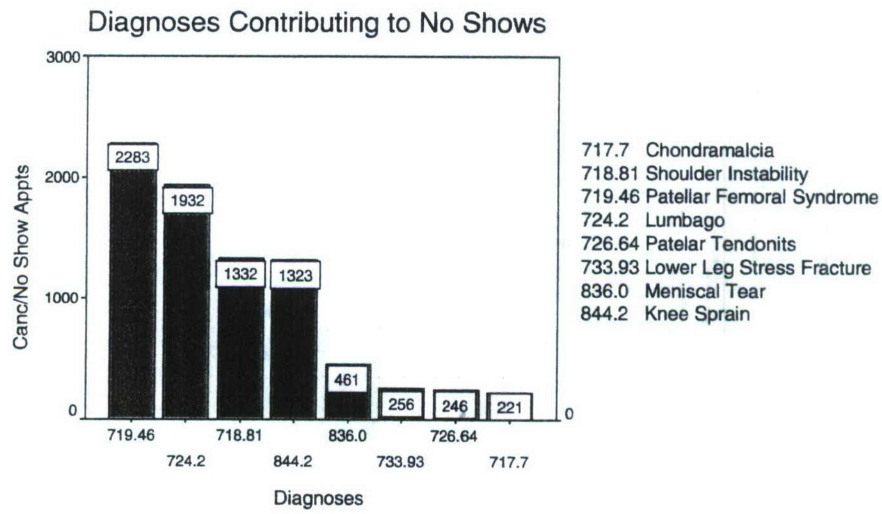
Appendix H

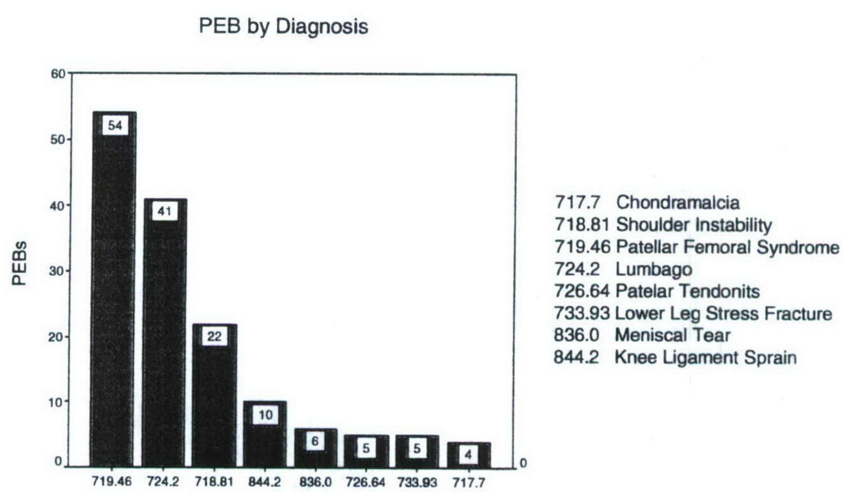
Code Sheet for Study of Predictors of Aggregate Disposition Score

Variable and SPSS Variable Code	Variable Type	Description	SPSS Data Codes
Dependent Variable: Aggregate Disposition Score (ADS)	DV: Continuous	Medical evaluation board report outcome measure.	Range from 0.4… 1.9
Access (ACS)	IV: Continuous	The amount of time in days it takes a patient to receive specialty MSS.	Range from 1… 28 days
Age	IV: Continuous	Defines each patients age	Range from: 17… 49
Appointments (APTs)	IV: Continuous	A composite score of a patient's cancelled appointments, no-show appointments, and left without being seen appointments.	Range from 0… 101
Clinic (Clin)	IV: Dichotomous	Defines the specific MSS clinic the patient attended.	1 = SMART 0 = NHCP
Individual Entry Number (IEN)	IV: Continuous	CHCS generated random patient identifier	Range from 2503… 1154039
Limited Duty Status (LIMDU)	IV: Dichotomous	Measures the presence of a LIMDU	1 = 1+ LIMDUs 0 = No LIMDUs
Physical Evaluation Board (PEB)	IV: Dichotomous	Measures the presence of a PEB	1 = PEB 0 = No PEB
Productivity (Prod)	IV: Continuous	Productivity measure based upon a patients diagnosis and the clinic attended	Range from 0.68… 1.54
Return to Duty (RTD)	IV: Categorical	Measures a patient's MEB status	2 = RTD 1 = LIMDU 0 = PEB
Surgery (Surg)	IV: Dichotomous	Measures the presence of a surgery tied to a respective MEB	1 = Surgery 0 = No surgery

Appendix I

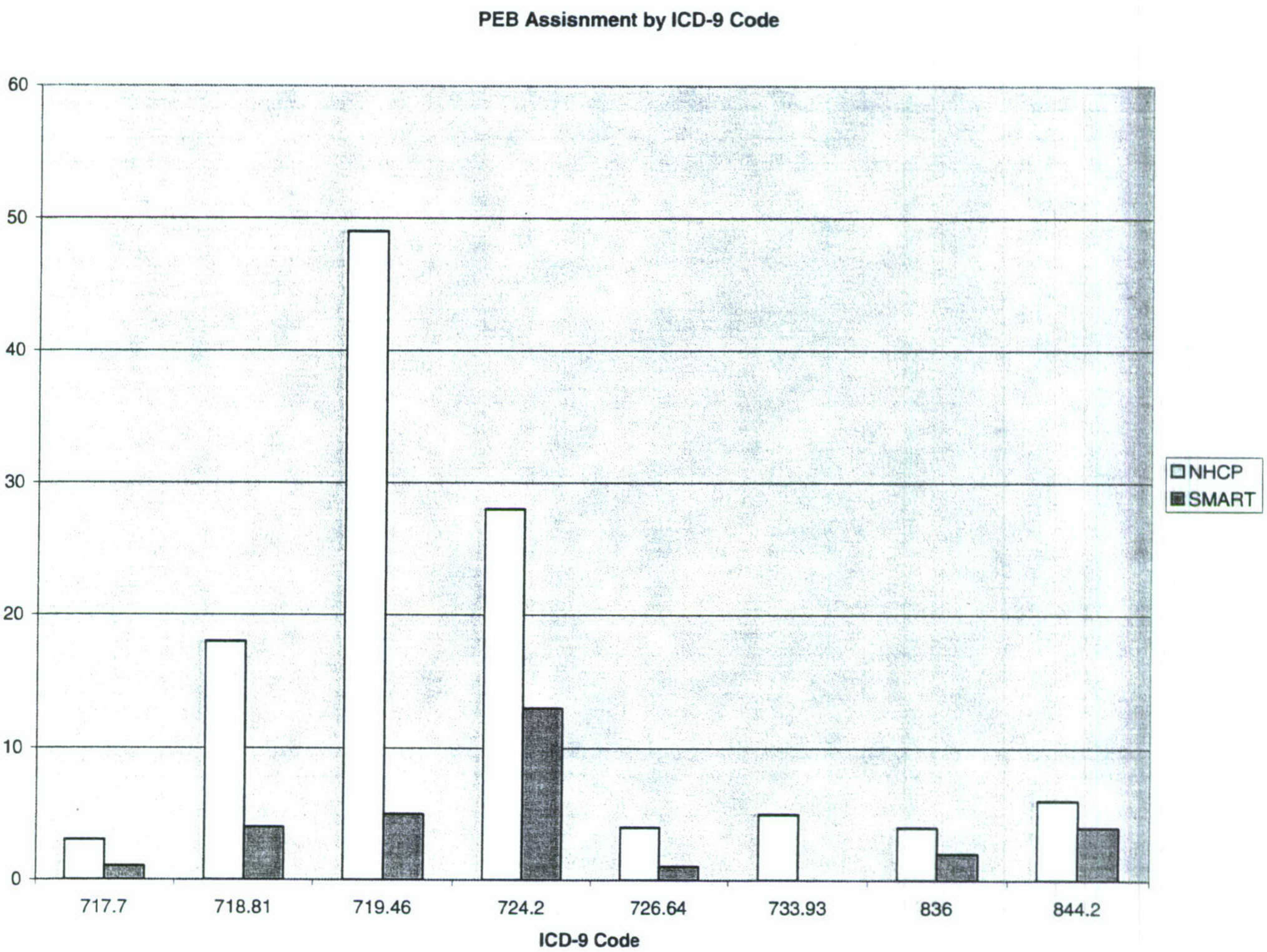
Pareto Analysis





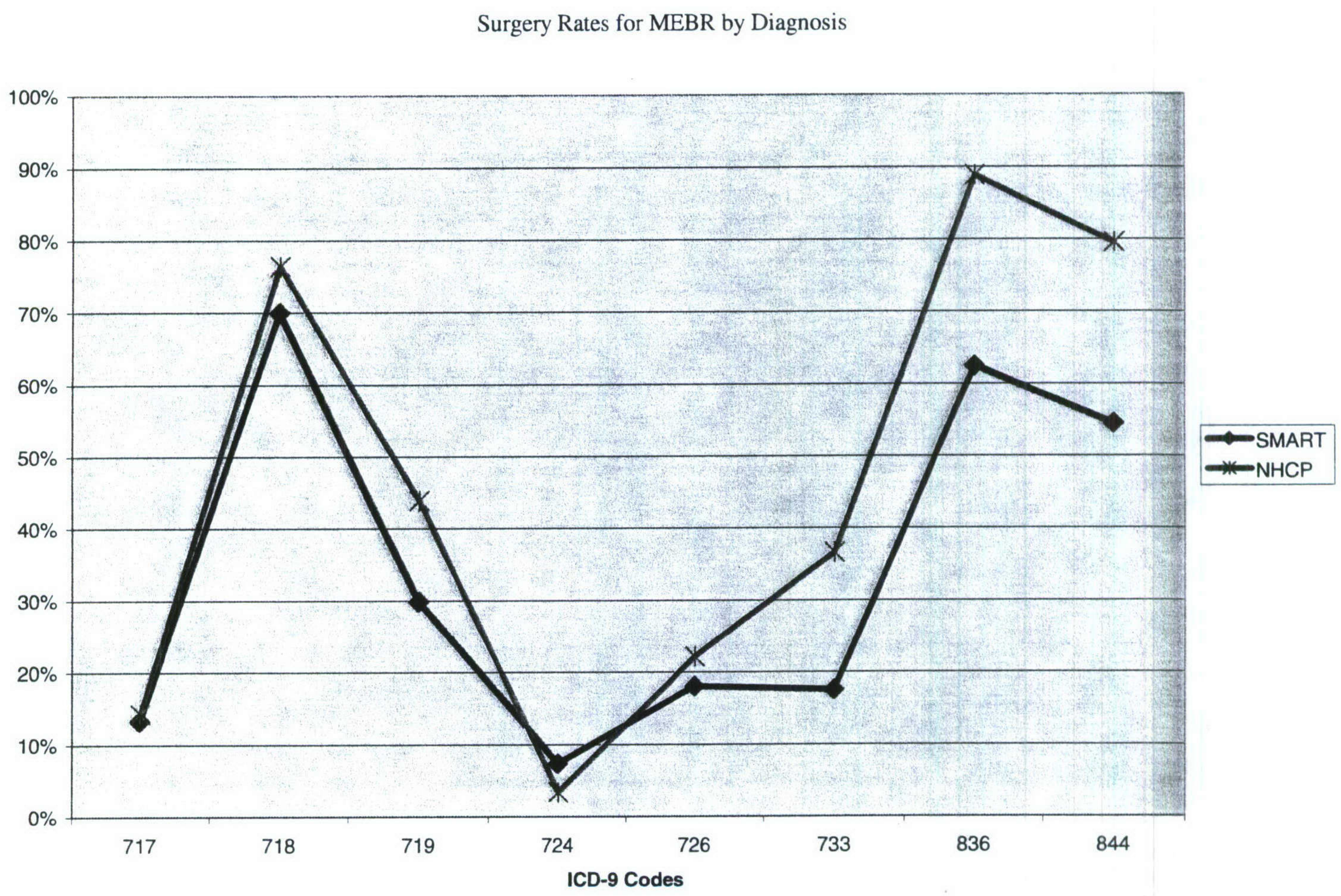
Appendix J

Trend Analysis PEB by ICD-9 Code



Appendix K

Surgery Rates for MEBR by Clinic



Appendix L

Correlation Matrix

		Clinic	APPTS	ADS	ACCS	PROD	SURG	RTD
Clinic	Pearson Correlation	1.000	-.245	-.094	-.863	.735	-.169	.013
	Sig. (2-tailed)	.	.000	.009	.000	.000	.000	.715
	N	759	759	759	759	759	759	759
APPTS	Pearson Correlation	-.245	1.000	.053	.154	-.195	.088	.007
	Sig. (2-tailed)	.000	.	.145	.000	.000	.016	.839
	N	759	759	759	759	759	759	759
ADS	Pearson Correlation	-.094	.053	1.000	.136	-.013	.176	-.687
	Sig. (2-tailed)	.009	.145	.	.000	.719	.000	.000
	N	759	759	759	759	759	759	759
ACCS	Pearson Correlation	-.863	.154	.136	1.000	-.652	.185	-.043
	Sig. (2-tailed)	.000	.000	.000	.	.000	.000	.235
	N	759	759	759	759	759	759	759
PROD	Pearson Correlation	.735	-.195	-.013	-.652	1.000	-.282	-.025
	Sig. (2-tailed)	.000	.000	.719	.000	.	.000	.495
	N	759	759	759	759	759	759	759
SURG	Pearson Correlation	-.169	.088	.176	.185	-.282	1.000	-.096
	Sig. (2-tailed)	.000	.016	.000	.000	.000	.	.008
	N	759	759	759	759	759	759	759
RTD	Pearson Correlation	.013	.007	-.687	-.043	-.025	-.096	1.000
	Sig. (2-tailed)	.715	.839	.000	.235	.495	.008	.
	N	759	759	759	759	759	759	759

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).