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CPT David L. Kelty AN

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Profound changes in the military health care system are altering the way hospital commanders conduct business. The Catchment Area Management (CAM) and Gateway To Care (GTC) initiatives effectively eliminated referral to CHAMPUS as the optimal solution to overcrowding at an MTF. This study used descriptive statistics and a case study methodology to analyze CHAMPUS expenditures for cardiovascular health-care services attributed to the Ft Leonard Wood, MO catchment area. Events studied included all CHAMPUS inpatient cardiovascular claims paid during CY 1991 (n=57) and all CHAMPUS outpatient cardiovascular claims paid during September, 1991 (n=112). Inpatient, outpatient, institutional, and market area profiles were constructed to facilitate the analyses. Government expenditures and lengths of stay (LOS) were compared for the most common inpatient procedures. Billed charges were compared for the most common outpatient service. The dominant provider of a procedure or service was compared to a group of all other providers of that particular procedure or service. The researcher noted that a minority of clients, institutions, and market areas accounted for a majority of government expenditures.

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AN ASSESSMENT OF CHAMPUS EXPENDITURES
FOR CARDIOVASCULAR HEALTH CARE SERVICES
IN THE FORT LEONARD WOOD CATCHMENT AREA

A Graduate Management Project
Submitted to the Faculty of
Baylor University
In Partial Fulfillment of the
Requirements for the Degree
of
Master of Health Administration
by
Captain David L. Kelty, AN
December, 1992

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LTC Richard Jensen shared some thoughts that have stayed with me: Achieving one's educational goals is more a matter of dogged determinism than it is academic brilliance. Words I can relate to, and hopefully live by.

Abstract

Profound changes in the military health care system are altering the way hospital commanders conduct business. In the past, military hospital commanders viewed the referral of excess demand to CHAMPUS as a viable solution to the overcrowding at military medical treatment facilities (MTFs). The Catchment Area Management (CAM) and Gateway To Care (GTC) initiatives effectively eliminated referral to CHAMPUS as the optimal solution to overcrowding at an MTF. Referral to CHAMPUS now brings with it the untoward effect of utilizing resources allocated to the MTF.

This study used descriptive statistics and a case study methodology to analyze CHAMPUS expenditures for cardiovascular healthcare services attributed to the Fort Leonard Wood, Missouri catchment area. Events studied included all CHAMPUS inpatient cardiovascular claims paid during CY 1991 (n=57) and all CHAMPUS outpatient cardiovascular claims paid during September, 1991 (n=112). Inpatient, outpatient, institutional, and market area profiles were constructed to facilitate the analyses.

Government expenditures and lengths of stay (LOS) were compared for the most common inpatient procedures

(Pericutaneous Transluminal Coronary Angioplasty or PTCA and left heart catheterization). Billed charges were compared for the most common outpatient service (office visit). The dominant provider of a procedure or service was compared to a group of all other providers of that particular procedure or service. Government expenditures and LOS differences for PTCAs and left heart catheterizations were compared between the dominant provider and all other providers. Additionally, billed charges for office visits were compared between a dominant provider of this service and all other providers. The researcher noted that a minority of clients, institutions, and market areas accounted for a majority of government expenditures. Specific recommendations were made for coordinating the care of CHAMPUS beneficiaries with cardiovascular diagnoses.

Introduction

Profound changes in the military health care system are altering the way hospital commanders conduct business. Gisin and Sewell (1989) identified two significant problems affecting the military health care system. First, demand for services by over nine million beneficiaries exceeded the capabilities of the direct care system. The second problem was created and exacerbated by the first. Specifically, excess demand was referred to the Civilian Health and Medical Program for the Uniformed Services (CHAMPUS). This practice resulted in a marked increase in CHAMPUS costs that were borne by the Department of Defense (DoD).

Previously, military hospital commanders viewed the referral of excess demand to CHAMPUS as a viable solution to the overcrowding at military medical treatment facilities (MTFs). The Catchment Area Management (CAM) and Gateway To Care (GTC) initiatives effectively eliminated referral to CHAMPUS as the optimal solution to overcrowding at an MTF. Referral to CHAMPUS now brings with it the untoward effect of utilizing fiscal resources allocated to the MTF.

Coordinated Care initiatives present MTF commanders with a new set of challenges. Increasingly, these

challenges are similar to those confronting civilian health care administrators. Despite the continued variation in U.S. practice modalities, the economic arrangements supporting these practice settings are becoming more and more uniform (Buck, 1991). Specifically, a combination of personal, third party, and government funding is becoming increasingly prevalent. Regardless of the practice setting, health care in the U.S. is moving toward the managed care model (Buck, 1991; Kongstvedt, 1989).

Lessons learned from the civilian sector will have greater applications in the military health care system. Rubenstein's (1990) article on a model for marketing in the military health care setting contends that the military has much to learn from marketing concepts in the civilian sector. Admittedly, many marketing techniques must be modified if they are to fit the military model. However, both systems have a vital interest in pursuing efficient operations and consumer satisfaction (Rubenstein, 1990).

One particularly relevant aspect of marketing is market segmentation and targeting. The DoD Medical Quality Assurance Program's guidance on peer review and coordinated care identifies defining the beneficiary

population as central to the functional concept of coordinated care (Buck, 1991). Defining the beneficiary population requires target marketing skills. In order to successfully target the market, it must first be effectively segmented. The market must be divided into distinct and meaningful groups of consumers who might require different products and/or marketing approaches. Market segmentation also requires an identification of the different bases for segmenting the market, developing segment profiles, and measuring the attractiveness of each segment. Once the market has been segmented, target marketing can occur and priorities can be established (Kotler & Clarke, 1987).

Any successful re-capturing of CHAMPUS workload or contracting with a preferred provider must be preceded by accurate segmentation of the market and target marketing aimed at the appropriate segment. Information provided by a careful market analysis is also critical to implementing a health care finder system. MTF commanders and administrators are now confronted with a need to rapidly assimilate a great deal of information regarding their individual catchment area populations. Systematic and meaningful analyses are necessary if the coordinated care initiatives are to succeed.

Statement of the Problem

MTF commanders face new and diverse challenges as a result of the implementation of the Gateway to Care (GTC) initiative. Commanders are now accountable for CHAMPUS expenditures occurring in their MTFs' catchment areas. Modifying beneficiary behavior and channeling patients to the most cost effective providers requires an indepth knowledge of health services utilization patterns as well as provider practice patterns. In the past, this information was not a required component of the commander's knowledge base. Consequently, very little information exists on these aspects of individual catchment areas. This lack of information constitutes a significant handicap for MTF commanders who are currently transitioning to Gateway to Care.

Literature Review

As indicated in the introduction, one of the new challenges confronting MTF commanders is the need to engage in target marketing. Kotler and Clarke (1987) pointed out that targeting an attractive segment of the market is the second of a two step process. First, the market must be effectively segmented. Market segmentation can further be subdivided into two distinct processes. Initially, the market environment as a whole must be assessed and defined. The outer boundaries of the market should be identified. Secondly, the appropriate market variables should be identified and the market should be segmented. Once the market has been segmented, a specific segment or segments can be targeted.

The sequencing identified above will be used as a guide in reviewing the marketing literature. First, the literature that is more general in nature and broadly focused will be examined. This will be followed by the literature that is more specific in nature and narrowly focused. Proceeding in this manner should provide a meaningful review of the marketing literature that more closely approximates the actual process of target marketing. In addition to the marketing literature,

there will be brief examinations of the literature pertaining to health care utilization and physician practice patterns.

Schroer and Penn (1987) indicate that preparing for contracting relationships requires full consideration of both internal and external factors. Increasing competition within the hospital's environment creates a need for more concentrated and on-going evaluations of the forces affecting the hospital. Marketplace assessment includes an analysis of consumers, payers, and other providers within the community (Schroer & Penn, 1987). These analyses should permit the hospital to define its potential market share and competition. Community demographics are a vital component of the marketplace characteristics. Census data can include zip code, age, gender, economic status, household size, and other available statistics. By combining this information with assumptions on payer source, service utilization patterns, and future trends, the hospital leadership can identify service demand and the appropriate marketing strategies (Schroer & Penn, 1987). Massey and Blake (1987) address the issue of estimating market boundaries for health care facilities. These authors point out that hospital executives must clearly

specify the characteristics of their markets before they can deploy their resources in an effective manner. Traditional boundary identifiers include geographic and political boundaries as well as special taxing districts, hospital districts, and emergency services districts. Massey and Blake (1987) contend that it is important to remember that market boundaries are not permanent. This lack of permanence makes on-going competitive assessments a necessity for hospital administrators.

Increasing competition in the health care environment has led to the proliferation of databases that provide hospitals and other facilities with extensive information. Perry (1989) gave examples of hospitals that made use of the Marketing Systems Library (MSL) database to estimate and project market demand. The MSL database provided both hospital-specific and external market data so that building and acquisition ventures could be evaluated in terms of benefits and risks. Competitor information, physician information and demographic information were fed into the system. The MSL provided the external market information, like market analysis, use and draw rates, and competitive analysis that facilitated market-driven projections of

future trends in case loads (Perry, 1989). Databases such as the MSL permit hospital administrators to gain greater breadth and precision in their market analyses. Additionally, segmentation of the market can be based on a greater number of variables when increased automation is available.

Kelsey and McGrath (1990) addressed database utilization from a slightly different perspective. These authors described how hospitals can target existing patients through the use of a clinical database. With a clinical database, hospitals can identify patients who might benefit from a medically appropriate follow-up. This method allows hospitals to expand selectively within their existing markets. By cross-referencing the clinical database's knowledge of disease progression and treatment side effects with information from patients' records, providers are able to identify opportunities to deliver additional services while improving the quality of care to patients (Kelsey & McGrath, 1990).

Once the market and market boundaries have been assessed and broadly defined, segmentation of the market is possible. Perry (1990) summed up the nature of the segmentation task as one that involves segmenting

consumers in the hospital's service area by health problem. The various segments are then sold hospital services and procedures to combat their problems. Perry (1990) identified 22 illness categories (segments) that were rank-ordered based on the prospect of repeat business. Asthma, back pain, back surgery, breast cancer, and chronic obstructive pulmonary disease were the top five illness categories in terms of the prospect of repeat business.

MacStravic (1989b) asserted that the focus of traditional portfolio analysis has been on individual "products" or strategic program units (SPUs). In hospitals, the SPUs correspond to programs or services such as maternity, oncology, outpatient surgery, or cardiology. Market segmentation can also be based on groups of potential customers for particular services (e.g., women, the elderly, adolescents). MacStravic (1989b) identified the difference between product and market/segment management as a matter of how success is evaluated. Product management is evaluated in terms of utilization volumes, market share, revenues, and profits. Market/segment management is evaluated in terms of customer loyalty, market share, contribution to the hospital's mission and continued viability. The

overall goal of market segmentation is to make the marketing effort more effective and efficient. The administrator's challenge is to divide the market into the number of segments that will achieve the desired purpose. As the purpose changes, so will the number and nature of market segments (MacStravic, 1989b).

Once the market has been defined and segmented, strategic planning can assist hospital executives in their targeting of a preferred market. Stewart (1988) addressed the importance of finding the right service niche. His article identified three categories of business strategies within which all strategy variations can fit: 1) niche strategy; 2) product differentiation strategy; and 3) low-cost producer strategy. Niche strategies appear to have the most relevance for current MTF commanders. Product differentiation strategies may be less applicable in the military's coordinated care environment. CHAMPUS users frequently need to be convinced that the MTF's product is similar in quality to that of civilian providers. A low-cost producer strategy does not generally appeal to consumers of health care. Consumers without a responsibility for paying for care frequently assume that high-cost health care can be equated with high-quality health care.

However, once the health care's high quality is demonstrated, the consumer will be attracted to care that comes to him or her at a low cost. Enhancing the perceived quality of care throughout the entire MTF must begin with a focused approach. For this reason, the commander may meet with more success by carefully "picking a spot" and focusing organizational strategies in a well chosen niche.

The primary challenge in a niche marketing strategy is identifying the right niche. Attempts are made to identify a high-growth niche, commonly referred to as a "question mark" or a "star." Low-growth markets are referred to as "dogs" or "cash cows" (Stewart, 1988). The benefits of a niche marketing strategy include an improved refinement of the marketing message and a narrower "reach" into the market. If a hospital has a fixed promotional budget, reducing the reach through a niche strategy allows the marketing manager to increase the frequency that the message is delivered to those within the preferred niche (Stewart, 1988). The downside to this strategy is that what the marketing manager thought was a "star" might very well turn out to be a "dog." Defining, segmenting and analyzing the market accurately are critical to choosing the right market

niche.

In contrast to Stewart's more general approach, MacStravic (1989a) specifically addressed the importance of maintaining competitiveness by focusing on a select group of customers. MacStravic's article (1989a) provided a narrower focus that highlighted the on-going nature of target marketing by referring to the process as "managing the market." Markets change and so must the marketing endeavors of the hospital. Segment management refers to serving the total health care needs and desires of a particular market segment. MacStravic (1989a) defined a segment as any subset of people who share enough in common to be treated as a whole, but differ enough from everybody else to be treated differently.

Segment management also considers the potential lifetime value of each segment and the total services its members can be expected to utilize. Once priority is shifted to a long-term focus, there is a willingness to offer some services as "loss-leaders" in order to initiate a long-term relationship with the client. It is said that it is impossible for the hospital to be all things to all people. Segment management calls for the hospital to be all things to a selected set of people

(segment) who have enough in common to make segmentation feasible (MacStravic, 1989a). Just as selecting the wrong segment can be devastating to the organization, attempting to serve too many segments can be equally disastrous. The hospital's capacity and credibility will suffer as a result of attempting to serve too many segments.

Following up on this notion of target marketing, Koska (1990) described how Parkland Memorial Hospital in Dallas, Texas targeted a specific community need. Even though primary care is not generally seen as profitable, Parkland's leadership developed a Community Oriented Primary Care (COPC) program with a 10 million dollar capital and operating budget. The program's leaders noted that the waiting time for a first appointment in general internal medicine had grown from four months to six months in their service area. This unmet demand prompted the hospital's leaders to implement the COPC as a means of being more responsive to the needs of the community. Additionally, the hospital leadership hoped that the increased access to primary care would serve to reduce demands on the overflowing Emergency Department (Koska, 1990).

The current health care literature reveals an

unmistakable trend. Health care organizations today are moving away from mass marketing and product differentiation toward a strategy of target marketing. The key step in target marketing is segmentation, which requires creative planning and critical analyses. Major segmentation variables can be categorized as geographic, demographic, psychographic, and behavioristic. The effectiveness of the segmentation depends upon the identification of segments that are measurable, accessible, and substantial (Kotler & Clarke, 1987). There is no one best strategy. The organization should consider organizational resources, product homogeneity, market homogeneity, and competitive marketing strategies. Health care executives should focus on those segments that are intrinsically attractive and those in which a distinctive quality of service can be achieved (Kotler & Clarke, 1987).

The trend towards target marketing, with its concomitant market segmentation, makes knowing and understanding the beneficiary population even more important to present-day health care executives. Assessing and defining the who, what, where, when, why, and how of health care services utilization is now a core component of every health care executive's

knowledge base. Recent DoD coordinated care initiatives have moved the significance of marketing, service utilization and physician practice patterns, into the realm of the MTF Commander.

Though frequently a subject in the literature relating to populations outside the DoD, health services utilization is now a subject of interest for those who influence health care within the DoD. The change is not so much in the presence or absence of concern relating to health services utilization by DoD beneficiaries, but rather in the focus and level of concern. In the past, concern about utilization and resource consumption was primarily a macro level issue. Today, concern about utilization spans the continuum from the macro level of the DoD to the micro level of each and every catchment area.

As early as 1973, concern about the military health care system was high enough to warrant the President's commissioning of a wide ranging study. The study was conducted jointly by the DoD, the Office of Management and Budget (OMB), and the Department of Health, Education, and Welfare. The study focused on many aspects of the military health care system, including the utilization of services by the system's

beneficiaries (Thorner, 1978). Thorner (1978) compared utilization by CHAMPUS eligible beneficiaries in northern California with utilization by members of the Kaiser-Permanente Plan and the non-institutionalized population of the United States. This author found that the use of hospital services by non-active duty beneficiaries significantly exceeded that of the members of the Kaiser-Permanente Plan. Use of outpatient services by non-active duty beneficiaries was found to be comparable with that of the Kaiser Plan. It is interesting to note that this author recommended "a restructuring of the budgeting system to a capitation system, and the placing of the CHAMPUS and direct care military facility elements of the system under the direction of regional managers, with a general tightening of management at that level" (Thorner, 1978, p 287). It is also interesting that this author excluded hospitalizations for psychiatric conditions from his study. This was done because the author found psychiatric benefits to be more liberal under CHAMPUS than in most health care plans. Some would intuitively argue that it is this very area (psychiatric services) that sets CHAMPUS beneficiaries apart in their utilization of health care services. It is not uncommon for CHAMPUS psychiatric expenditures to

represent as much as 50 percent of all CHAMPUS expenditures within a given catchment area.

Kenkel (1992) described, in less than laudatory tones, the results of an on-going pilot project at Fort Bragg, N.C. The project is a joint venture of CHAMPUS, Vanderbilt University in Nashville, and the North Carolina State Department of Human Resources, and is an attempt to re-design adolescent psychiatric services in the Fort Bragg area. The project relies on civilian providers and is designed to test whether less costly alternatives to hospitalization of dependents, such as in-home counseling and day treatment programs, would be worth the extra cost to CHAMPUS. Unlike CHAMPUS, which requires cost sharing, the pilot project offers unlimited free access to adolescent psychiatric services. It is somewhat disconcerting to this author that the military's ability to design and operate coordinated care delivery systems is being called into question as a result of this pilot project (Kenkel, 1992). The pilot project at Fort Bragg was a joint venture with civilian entities that had a financial incentive to maximize utilization. This provider incentive, coupled with the lack of any consumer disincentive, can hardly be expected to produce anything other than high rates of

utilization.

DoD beneficiaries may represent a unique population possessing characteristics that will often affect individual patterns of health services utilization. The aforementioned Fort Bragg pilot project got under way just before troops were deployed to the Persian Gulf. Abbe, Naylor, Gavin, and Shannon (1986) conducted a study of temporary paternal absence and its effect on health care utilization. This study of 38 families of sailors stationed aboard the USS Enterprise found that Navy wives who were separated from their husbands made significantly more total visits than control subjects. However, these occurrences were noted only during the period immediately after the ship's return to port. These authors also found a significant increase in visits that were deemed to be medically insignificant or for emotional problems (Abbe, Naylor, Gavin, & Shannon, 1986).

If increased stress levels can manifest themselves in more frequent visits to health care providers, then stress inducing events or conditions should be considered when evaluating utilization patterns. Rothberg (1989) cites a 1983 survey indicating increased job related stress among Army personnel. Using the General

Well Being scale categories for severe and moderate distress, 46% of an Army sample reported being distressed, while only 29% of the 25-74 year old U.S. population scored that poorly. Rothberg (1989) also indicated that the psychological well-being of Army wives was negatively influenced by military-specific stress. He concluded that the limited information available suggests that being a member of the U.S. Army may have "unhealthy" consequences.

Jensen (1990) examined the utilization of outpatient health services by Army retirees and their spouses. A survey of 496 Army retirees in southern Texas revealed that the retirees averaged 9.2 outpatient contacts per person per year, versus 5.7 contacts for adults aged 25 to 75+ in the civilian, noninstitutionalized population. The author concluded that the increased rates of utilization by military retirees was a result of the near cost-free nature of military health care. He recommended that the Army Medical Department (AMEDD) take steps to reduce the number of outpatient contacts made by military beneficiaries. One of four specific methodologies mentioned as a means to reduce utilization focused on an assessment of referral patterns and follow-up visit routines for the presence

of unnecessary visits (Jensen, 1990). This suggested methodology provides the researcher with an opportunity to turn to the literature related to physician practice patterns.

The literature related to physician practice patterns is extensive and growing steadily. However, the bulk of the literature focuses on practice pattern variations within specific medical specialties, as opposed to comparisons of practice patterns of civilian and DoD physicians. Baigelman (1991) studied a subgroup of the medical staff at one community teaching hospital. The subgroup was comprised of the 13 physicians out of a medical staff of 186 with the longest case mix adjusted average lengths of stay (ALOS). He found 5.3% of their admissions and 31.8% of their patient days to be unnecessary. The most common causes of unnecessary patient days were unnecessary observation or evaluation, evaluation or treatment more appropriately done in the outpatient setting, and unnecessary intravenous therapy. Baigelman (1991) also found that 83% of the unnecessary patient days were within the control of the physician.

Holtgrave, Lawler, and Spann (1991) examined individual differences in physicians' laboratory use and referral rates among 14 clinical faculty at an academic

family practice center. Each physician's utilization rates for the 17 most frequently ordered laboratory procedures and overall referral rates were calculated for all patient visits during one calendar year. Physicians' risk attitudes measured on a multidimensional scale were found to be good predictors of use rates for certain laboratory procedures, but not good predictors of referral rates. Physicians' risk attitudes accounted for over 50% of the variance for several of the laboratory procedures (Holtgrave, Lawler, & Spann, 1991).

Richter, Wang, Fawaz, Bynum, Fallon, and Shapleigh (1991) studied 111 cases of noncirrhotic gastrointestinal bleeding admitted to three different university hospitals. These authors found no significant differences in the management of the patients except for the more frequent use of upper gastrointestinal radiography at one of the hospitals, and the more frequent administration of cimetidine at another of the hospitals. Length of stay, transfusion frequency, use of endoscopy, and use of antacids were found to be similar across all three hospitals.

Differences in cancer screening by 40 primary care physicians in northern California was the subject of a

study by Osborn, Bird, McPhee, Rodnick, and Fordham (1991). These authors found that the best predictors of cancer screening performance were the number of medical journals physicians read on a regular basis, the percentage of visits they scheduled for preventive care, and the physician's gender. Female physicians were found to have scheduled a far higher percentage of visits for prevention than their male counterparts (42% versus 17%, $P < .001$).

Henke and Epstein (1991) analyzed 1154 outpatient follow-up encounters with rheumatoid arthritis patients provided by 66 physicians. The authors found large differences among the physicians in visit length, number of monitoring procedures used per encounter, and whether the encounter included measurements of complete blood count, urinalysis, or erythrocyte sedimentation rate. The authors concluded that differences in physician practice style had a greater impact on practice variation than patient differences or practice incentive differences (Henke & Epstein, 1991).

Purpose

The purpose of this study is to provide the GLWACH Command with the information needed to define, segment, and target its market for cardiovascular services.

Methods and Procedures

As indicated in the literature review, assessing, defining and segmenting the market must occur prior to the implementation of any target marketing strategies. This study retrospectively analyzed CHAMPUS utilization data pertaining to the GLWACH catchment area. The study focused on cardiovascular services as defined by the Office Of The Civilian Health And Medical Program of the Uniformed Services (OCHAMPUS) grouping of International Classification of Disease, 9th Edition (ICD9) codes. All inpatient claims paid by CHAMPUS during CY 1991 that had cardiovascular diagnoses codes (n = 57), and all outpatient claims paid by CHAMPUS during September 1991 that had cardiovascular diagnoses codes (n = 112), were examined. Data were obtained from the CHAMPUS Utilization Management System (CHUMS) and the OCHAMPUS. Specifically, claims data provided by the OCHAMPUS to the CHUMS enabled the researcher to construct inpatient, outpatient, institutional and zip code profiles. Access to claims data was accomplished via multiple queries of the CHUMS (Appendices A - D). An inpatient or outpatient profile was constructed for each episode of care and composite profiles were constructed for selected beneficiaries, categories of care, institutions

and zip codes.

Inpatient care comparisons were made for Length Of Stay (LOS), cost per admission, cost per patient day, and adjusted cost per patient day based on the relative weights (1992 HCFA grouper listings) associated with each admission. Data were examined in order to identify high volume/cost users and providers. The relationship between billed charges and allowable charges was also examined for all providers. Additionally, comparisons of pediatric and adult care were made based on volume and total cost. Specific types of inpatient care were examined (percutaneous transluminal coronary angioplasty or PTCA and left heart catheterization) and comparisons were made between a dominant provider and a group of all other providers. Comparisons of LOS and cost were made using means and standard deviations.

Outpatient data were sorted into one of five categories of care (office visits, laboratory procedures, radiology procedures, supplies, and other). Comparisons of volume and cost were made between the four major market areas located near the GLWACH catchment area (St. Louis, Springfield, Columbia, and Rolla). High cost/volume users and providers were identified and utilization patterns across beneficiary

zip codes were also examined. Billed charges for office visits were compared between a dominant provider and a group of all other providers. Comparisons of billed charges were made using means and standard deviations.

The ex post facto nature of this research effort has several specific implications for assessing the reliability and validity of the measures within the study. Retrospective studies such as this one are considerably weaker than experimental designs in their ability to shed light on causal relationships. Polit and Hungler (1987) contend that findings from a single retrospective study are rarely convincing and usually require confirmatory research efforts. Kerlinger (1973) identified three major limitations associated with ex post facto research: the inability to actively manipulate the independent variables, the inability to randomly assign subjects to experimental treatments, and the possibility of inaccurate interpretation of study results.

In ex post facto studies the researcher works with preexisting groups formed more out of self selection than random assignment. This self selection represents a potential threat to the internal validity of the measures within the study. Preexisting differences

between the subjects may account for variations among the outcome variable(s). By applying a standard of "reasonableness," the measures within this study should be seen as possessing sufficient face validity.

This author originally intended to make use of inferential statistics (Student's t test) in this study of cardiovascular services. After profiles were constructed for selected beneficiaries, categories of care, institutions and zip codes, it became obvious that the small sample sizes precluded the effective use of sample statistics. A case study approach that maximized the use of detailed descriptive statistical (means and standard deviations) comparisons was deemed to be more appropriate. With a limited number of cases or subjects a greater depth of analysis was possible. This greater depth of analysis has been identified as both an advantage and a disadvantage (Polit & Hungler, 1987). Greater depth permits the researcher an intimate knowledge of the subjects or cases while at the same time creating a familiarity that threatens objectivity. Polit and Hungler (1987) identify the case study method's lack of generalizability as its greatest disadvantage. This lack of generalizability is not a significant concern at present. With Coordinated Care

in its formative stages, describing and comparing various market segments must be the first order of business.

The consistency and accuracy of CHAMPUS data has implications for the reliability of the measures within this study. The primacy of the CHAMPUS claim must be considered first and foremost. The ability to transfer data and draw conclusions is limited by the accuracy and consistency of the CHAMPUS claims process. The developers of the CHUMS have identified the accuracy and consistency of CHAMPUS data as a primary limitation to applications of the new system. Because the CHUMS is in the early stages of implementation, questions of accuracy and consistency abound. It is critical that the reader remain cognizant of the system limitations associated with CHAMPUS and the CHUMS.

Results

The CHUMS query outlined in Appendix A yielded raw CHAMPUS data on 57 inpatient cardiovascular hospitalizations of 49 different patients during CY 1991. Although the 57 admissions were spread across 17 different hospitals, the seven hospitals depicted in Table 1 accounted for 82% of the admissions and 84% of the total government expenditures.

Table 1

Cardiovascular Hospitalizations CY 1991

Hospital	# Admissions	# Days	Avg LOS	Tot Govt Paid
St Louis Childrens	5	139	27.8	\$285,441
St John's, Springfield	21	139	6.6	214,814
St John's Mercy, St Louis	3	13	4.3	40,205
Cox Med Center, Springfield	2	11	5.5	35,061
Phelps Co Reg Med Center	8	43	5.4	34,499
Barnes Hospital, St Louis	2	12	6.0	29,308
Univ of MO Hosp, Columbia	6	50	8.3	21,505
Total	47	407	8.7	660,833
Total All Hospitalizations	57	465	8.2	784,178

The total government paid figures in Table 1 do not reflect beneficiary deductibles and copayments. As a result, the amount paid by the government does not necessarily represent a good indicator of charges. The billing practices of the different institutions and providers is of significant interest to MTF Commanders operating under the GTC concept. Table 2 indicates the relationship between billed charges and CHAMPUS allowable charges for both hospital bills and providers' fees.

Table 2

Amount Billed As A Percentage Of Amount Allowed

Hospital	# Admissions	Hospital Bills	Providers' Fees
St Louis Childrens	5	94%	111%
St John's, Springfield	21	161	113
St John's Mercy, St Louis	3	175	103
Cox Med Center, Springfield	2	132	113
Phelps Co Reg Med Center	8	222	116
Barnes Hospital, St Louis	2	163	115
Univ of MO Hosp, Columbia	6	332	102
Total	47	182%	110%
Total All Hospitalizations	57	175%	112%

Providers were found to be billing within a relatively narrow range (102%-116%), whereas hospital bills fluctuated widely between 94% of allowable charges by St Louis Childrens' Hospital, and 332% of allowable charges by the University of Missouri Hospital in Columbia (Table 2). Because each hospital had such a small number of admissions, institution-specific data must be viewed cautiously and only as a prelude to the gathering of additional data. Cost data for the seven hospitals with two or more admissions are shown in Table 3. The reader should remember that individual patient factors will greatly affect acuity of illness, LOS, and government cost. Government cost will in turn be affected by the individual degree of patient cost sharing occurring for each admission. The seven hospitals in Table 3 vary by size and services offered. Barnes Hospital of St Louis and St John's Regional Health Center of Springfield are the two largest hospitals in the state of Missouri, each having over 1,000 beds. Phelps County Regional Medical Center is a 222-bed facility in the one-hospital city of Rolla (pop 13,500).

By identifying the discharge diagnosis and diagnostic related group (DRG) for each admission, a

composite relative weight was calculated for each hospital. Relative weights for each DRG were derived from the Health Care Financing Administration's (HCFA's) 1992 Grouper Listings (DRG Encoder Grouper Training Manual, 1992). The adjusted cost per patient day is based on an adjusted relative weight of 1.0 for each hospital.

Table 3

Inpatient Government Cost Factors

Hospital	cost/adm	cost/day	rel wght	adj cost/day
St Louis Childrens	\$57,088	\$2,054	.5441	\$3,775
St John's, Springfield	10,229	1,545	.8565	1,804
St John's, St Louis	13,401	3,093	.5342	5,790
Cox, Springfield	17,530	3,187	.5409	5,892
Phelps County	4,312	802	.8363	959
Barnes, St Louis	14,654	2,442	.5305	4,604
Univ of MO, Columbia	3,584	430	.5855	735
Total	14,060	1,623	.6859	2,366
Tot All Hospitalizations	13,758	1,686		

The wide variations in government cost per admission and cost per patient day demonstrate the need

to gather additional information from a larger sample of patients. It is particularly noteworthy that the smallest hospital of the seven in table 3 had the second highest relative weight. Three of Phelps County Medical Center's eight admissions were for acute myocardial infarction (2) or cardiac arrest (1). The high levels of acuity for these three admissions skewed the relative weight for all eight of the hospital's admissions upward.

Eight of the 57 cardiovascular admissions were for pediatric patients. Despite representing only 14% of the patients admitted, pediatric cases accounted for 47% of total government expenditures and 33% of all inpatient days. The difference between pediatric and adult LOS is especially noteworthy.

Table 4

Pediatric Versus Adult Cardiovascular Hospitalizations CY 1991

Group	# Adm	# Days	LOS	Cost/Adm	Cost/Day	Tot Govt Cost
Pediatric	8	155	19.4	\$46,046	\$2,377	\$368,364
Adult	49	310	6.3	\$ 8,486	\$1,341	\$415,814
Total	57	465	8.2	\$13,758	\$1,686	\$784,178

More meaningful comparisons were made by examining data from patients that were admitted for similar reasons. Two of the most common inpatient procedures included PTCA (balloon angioplasty) and left heart catheterization. In order to increase the sample size, expanded CHUMS queries (Appendix B and Appendix C) were carried out to include patients outside CY 1991. CHAMPUS claims data for 14 patients undergoing PTCA were obtained. St John's of Springfield was the dominant provider of PTCA and was compared against a group of all other providers (Tables 5 and 6).

CHAMPUS claims data for 10 patients undergoing left heart catheterization were obtained using the expanded CHUMS query depicted in Appendix C. Once again, St John's of Springfield was the dominant provider and was compared against a group of all other providers (Tables 7 and 8).

Outpatient cardiovascular services data were derived from CHAMPUS claims paid during September of 1991. The CHUMS query outlined in Appendix D yielded data on 112 claims from 44 different clients. Each claim was sorted into one of the five service categories shown in Table 9.

Table 5

Hospitalizations For PTCA

n	St John's, Springfield		All Others	
	LOS	Cost/Adm	LOS	Cost/Adm
1	6	\$11,201	3	\$10,434
2	4	\$ 7,058	3	\$ 9,160
3	2	\$ 7,781	2	\$ 7,986
4	4	\$ 8,168		
5	2	\$ 8,976		
6	3	\$ 9,318		
7	6	\$ 6,480		
8	8	\$ 6,642		
9	7	\$ 6,884		
10	6	\$12,424		
11	7	\$ 7,563		
Total	55	\$92,495	8.0	\$27,580
Mean	5	\$ 8,408	2.7	\$ 9,193
s.d.	2.0	\$ 1,814	0.47	\$ 1,000

Table 6

Hospitalizations For PTCA (Summary)

Provider	# Adm	# Days	Mean LOS	Cost/Adm	Tot Cost
St John's	11	55	5.0	\$8,408	\$92,495
All Others	3	8	2.7	\$9,193	\$27,580
Total	14	63	4.5	\$8,577	\$120,075

Table 7

Hospitalizations For Left Heart Catheterization

n	St John's, Springfield		All Others	
	LOS	Cost/Adm	LOS	Cost/Adm
1	3	\$ 4,763	6	\$ 3,225
2	2	\$ 1,550	6	\$11,101
3	1	\$ 3,468	5	\$ 8,231
4	4	\$ 6,566	2	\$ 1,022
5	4	\$ 6,763		
6	1	\$ 3,291		
Total	15	\$26,401	19	\$23,579
Mean	2.5	\$ 4,400	4.8	\$ 5,895
s.d.	1.26	\$ 1,854	1.64	\$ 3,982

Table 8

Hospitalizations For Left Heart Catheterization (Summary)

Provider	# Adm	# Days	Mean LOS	Cost/Adm	Tot Cost
St John's	6	15	2.5	\$4,400	\$26,401
All Others	4	19	4.8	\$5,895	\$23,579
Total	10	34	3.4	\$4,998	\$49,980

Table 9

Outpatient Service Categories

Service Category	Clients	Services	Billed	Allowed	Paid	% Tot
Office Visits	25	29	\$1,232	\$1,053	\$471	4
Radiology	8	12	\$1,367	\$1,347	\$783	6
Laboratory	15	51	\$1,349	\$1,325	\$816	7
Supplies	8	84	\$10,382	\$10,379	\$7,461	60
Other	11	74	\$4,096	\$3,920	\$2,898	23
Total	44	250	\$18,426	\$18,024	\$12,429	100

The single most prevalent outpatient service was the office visit (ICD9 code 90050). Sixteen office visits of this particular type were made by sixteen different clients. Ten of the sixteen office visits were made to the James Clinic, a large multi-specialty

clinic with numerous locations within and surrounding the GLWACH catchment area. The remaining six visits were spread across five different providers in and around the GLWACH catchment area. Patient cost sharing can have a pronounced effect on what the government pays for outpatient services. Consequently, billed charges were used for comparing office visits. Office visit charges were compared between the dominant provider (James Clinic) and a group of all other providers. Billed charges for office visits at the James Clinic were very consistent--eight of the ten billings were for the same amount (Table 10). Billed charges for office visits at all providers varied between \$28 and \$42.

Outpatient cardiovascular services were provided by 19 different institutional and individual providers. Five of the 19 providers accounted for 82% of all billings and 89% of all government expenditures (Table 12). Sorting the outpatient data by client demonstrated that six clients accounted for 81% of the total amount billed and 88% of the total amount paid (Table 13). An analysis of where outpatient care was being rendered indicated that 68% of the clients, and 81% of the expenditures, were associated with providers in one of four major market areas in or around the GLWACH

catchment area (Table 14). Total cardiovascular outpatient claims paid in September, 1991 indicated that the 44 different clients resided in 15 different zip codes within the GLWACH catchment area. Five of the 15 zip codes were associated with claims that accounted for 97% of the government's total expenditures (Table 15).

Table 10

Billed Charges For Office Visits

n	James Clinic	All Others
1	\$26	\$28
2	26	42
3	26	42
4	37	30
5	26	35
6	26	40
7	25	
8	26	
9	26	
10	26	

Table 11

Billed Charges For Office Visits (Summary)

Provider	# Visits	Tot Billed	Mean Bill/Visit	sd
James Clinic	10	\$270	\$27	\$3.35
All Others	6	\$217	\$36	\$5.61

Table 12

Cardiovascular Outpatient Services By Provider

Provider	# Clients	Billed	Allowed	Paid	% Total
St John's Mercy, St Louis	2	\$9,825	\$9,823	\$7,375	59
St Francis, Mountain View	1	2,158	2,158	1,544	12
Univ of MO, Columbia	3	1,315	1,060	810	7
Home Med Supply, Rolla	1	1,059	1,059	682	6
St John's, Springfield	2	822	822	613	5
Total	9	15,179	14,922	11,024	89
Total Of All Providers	19	18,426	18,024	12,429	100

Table 13

Cardiovascular Outpatient Services By Client

Client #	Diagnosis	City	Zip Code	# Services	Tot Paid
5272	Ischemic Heart Dz	St James	65559	112	\$7,299
5466	M.I.	Yukon	65589	26	1,544
4940	Atheroscler. Heart Dz	Waynesvl.	65583	1	682
0586	Atheroscler. Vasc. Dz	Rolla	65401	10	553
9111	Atheroscler. Heart Dz	Waynesvl.	65583	2	485
9193	W.A.P.	St James	65559	4	378
Total (6 Clients)				155	\$10,941
Total Of All Clients (44)				250	\$12,429

Table 14

Cardiovascular Outpatient Services By Major Market Area

Market Area	# Clients	# Services	Billed	Allowed	Govt Paid
St Louis	2	114	\$9,850	\$9,843	\$7,390
Reb...	14	37	2,106	2,054	1,098
Co...dia	5	18	1,443	1,172	823
Springfield	9	22	1,566	1,441	733
Total	30	191	\$14,965	\$14,510	\$10,044
Total All Areas	44	250	\$18,426	\$18,024	\$12,429

Table 15

Cardiovascular Outpatient Services By Client Zip Code

Zip Code	City	# Clients	# Services	Tot Govt Pd	% Of Tot
65559	St James	3	121	\$7,693	62
65589	Yukon	1	26	1,544	12
65583	Waynesvl.	7	11	1,449	12
65401	Rolla	11	39	938	8
65536	Lebanon	8	20	392	3
Total		30	217	\$12,016	97
Total All Zip Codes		44	250	\$12,429	100

Discussion

Like cardiovascular services, general surgical services represent a high-cost category of care for the Ft Leonard Wood catchment area. Originally, this author had intended to analyze general surgical services and cardiovascular services. Aside from being too broadly focused, the original proposal was untenable because of certain limitations associated with the CHUMS. Unlike the Retrospective Case Mix Analysis System (RCMAS), the CHUMS can not query by the Diagnosis Related Groups' (DRGs') Major Diagnostic Category (MDC). The CHUMS requires specification of individual ICD9 or DRG codes. Within the CHUMS, if the ICD9 or DRG codes are not inclusive and can be stated as a range, then each individual code or short range of codes must be specified within the context of the query (see appendices A - D). The ICD9 codes representing general surgical services are a lengthy list of non-continuous, isolated codes. Consequently, a CHUMS query for general surgical services would be prohibitively long. For the reasons identified above, this author chose to narrow his research to include only cardiovascular services.

The small sample sizes within this study precluded the use of inferential statistics (Student's t test).

While the differences noted in this study may not have been statistically significant; LOS, cost, and billed charges differences like those noted in Tables 1, 3, 5, 9, and 10, are by no means "insignificant". The use of aggregate data and small samples served to mask some of the variability within the study.

GLWACH is in the formative stages of developing its coordinated care initiatives. Consequently, this author chose to take a rather broad swath through the CHAMPUS data related to cardiovascular services. At this stage of its development, the Coordinated Care Division (CCD) is as much seeking to isolate the appropriate questions as it is trying to provide definitive answers. This research effort will hopefully provide a springboard to be used by the CCD in undertaking further and more focused studies of the CHAMPUS data.

This study did succeed in its determination that relatively few patients, providers, market areas, and zip codes account for the bulk of the volume and/or cost. The most striking feature of the data relating to inpatient cardiovascular services is the cost and LOS information associated with the small number of pediatric patients. Though only 14% of the inpatients, pediatric admissions accounted for 47% of government

expenditures. Additionally, the average LOS for the pediatric cases was over three times the average LOS for adults (Table 4).

The total government cost associated with inpatient services is similar to that reported by the Office of the Civilian Health And Medical Program for the Uniformed Services (OCHAMPUS). The summary report by primary diagnosis for FY 1991 indicated that inpatient cardiovascular services for the GLWACH catchment area accounted for \$646,395 in government expenditures (OCHAMPUS Information Systems Division, 1992). This study examined CY 1991 and found that inpatient cardiovascular services cost \$784,178. The differences in the time period under study may account for the difference in total government expenditures. After psychiatry, cardiovascular services is the highest costing category of CHAMPUS care for the GLWACH catchment area.

This study found that outpatient cardiovascular claims paid in September, 1991 resulted in total government expenditures of \$12,429. If the month in question is representative of all months, then annual outpatient expenditures would be estimated to be approximately \$149,000. The OCHAMPUS summary report

indicated that FY 1991 outpatient expenditures came to \$107,969 (OCHAMPUS Informations Systems Division, 1992). Once again, the different time periods under study (CY 1991 vs FY 1991) may account for the differing outpatient totals.

The most noteworthy aspect of the outpatient data was the percentage of expenditures devoted to purchasing supplies (Table 9). The single month's data may have been distorted by the presence of one or two high cost clients. However, if there is typically one or two clients per month consuming high cost supplies, then this area of expenditures may require further attention. Especially, when one considers that GLWACH may be able to provide supplies to CHAMPUS beneficiaries at wholesale prices as opposed to purchasing them through CHAMPUS at the retail level. The relationship between inpatient and outpatient expenditures may also serve to point future initiatives in the right direction. If annual outpatient expenditures range between \$108,000 and \$149,000, and inpatient expenditures range between \$646,000 and \$784,000, then it may indicate that the CCD may want to initially focus its efforts on the inpatient side of cardiovascular services. In addition to being a source of greater government expenditures, inpatient

care is also a source of greater billing variability (Table 2). CHAMPUS payments are made based on allowable charges, so excessive billing may not affect government expenditures. However, this information would be pertinent to any preferred provider arrangements that are based on billed charges. Moreover, the variability in billing practices may indicate that billed charges are not a good foundation for preferred provider contractual agreements. The CHAMPUS allowable charges may represent a more appropriate starting point for preferred provider agreements.

Conclusions and Recommendations

The purpose of this study was to provide the GLWACH Command with the information needed to define, segment, and target its market for cardiovascular services. Because this study was undertaken prior to the establishment of the CCD at GLWACH, and immediately following installation of the CHUMS, this author views this study as a more than adequate first step in defining the catchment area's market for cardiovascular services.

For the purposes of clarity, all of this author's specific recommendations can be categorized under three broad headings: 1) Further Study; 2) revision of the CHAMPUS/CHUMS processes; and 3) implementation of case management. These three broad headings will serve as a means to organize and sequence the author's specific recommendations. Obviously, further study of cardiovascular services is needed. The failure to identify statistically significant differences in government expenditures for those patients receiving PTCA and left heart catheterization does not necessarily indicate uniformity in expenditures. Further study of larger samples is indicated for the aforementioned inpatient services.

The small amount spent on outpatient visits, relative to other services, indicates that the focus of further outpatient studies should be on supplies and high cost procedures (thallium scans, MUGA scans, echocardiography, cardiac rehabilitation). As the knowledge base of the CCD increases, studies should be permitted a narrower focus.

Because the accuracy, consistency, and timeliness of the CHAMPUS claims filing process greatly affects the information available to the MTFs, the process should be reviewed for opportunities to improve the accurate and consistent flow of data. The two-year window available for filing of claims means that claims data is both unpredictable in volume and flow, and less than timely when it reaches the MTF. This filing window should be reduced to 12 to 15 months in order to reduce the time between the delivery of care and its financial impact on the MTF. CHAMPUS claims with blank data fields translates into incomplete CHUMS data. Numerical CHUMS data elements left blank are interpreted as being 0 and this skews data retrieval during queries of the system. Defining and segmenting a health care market requires CHUMS records that are complete.

Each CHUMS record (CHAMPUS claim) contains a source

of care (SOC) identification code. Currently, that nine-digit code may be shared by numerous inpatient institutions, group practice clinics, and individual providers. At times, the SOC zip code can serve as a means to eliminate providers and narrow the field of probable providers. Generally, however, it is very difficult to identify a single provider responsible for a specific episode of care. This part of the CHAMPUS/CHUMS system needs to be refined in order to provide the MTF with more precise information.

The issue of the CHUMS' user-friendliness needs to be addressed. In its present form, the CHUMS requires considerable time for familiarization. A recent information paper from the Health Services Command (HSC) Deputy Chief of Staff for Information Management (DCSIM) indicated that a revised system will be fielded in the form of CHUMS III (Szurek, 1992). The new system will also incorporate use of the Financial Analysis Support System (FASS). The DCSIM has indicated that a goal of the revision is to achieve a current and more user-friendly system. Until the new system is fielded, the present system should be supported with updated data tapes. Presently GLWACH's most current CHUMS data pertains to CHAMPUS claims paid over six months ago.

The new system is not expected to be fielded until early FY 1993. The time between then and now is critical for all MTFs with CCDs that are in the formative stages of development. It is critical that the flow of data and information continue uninterrupted.

The CHUMS III should include a capability to query by DRG MDC. This would greatly simplify the process of writing the query language. Health care administrators are frequently interested in health care services relating to a particular body system or service line. As a result, CHUMS queries will frequently be divided along body systems or service lines. Adding this capability to the new CHUMS would make it more attractive to users and more effective in its retrieval of CHAMPUS data.

Some consideration should be given to how the new CHUMS will blend into the MTF's existing information management systems. Specifically, there should be an examination of how the new system will complement or duplicate the capabilities already available within the Retrospective Case Mix Analysis System (RCMAS). The RCMAS includes inpatient CHAMPUS data specific to the MTF's catchment area. As a system, it is under utilized because the data is not timely--the latest available

data pertains to FY 1990. MTF commanders should ensure that the RCMAS and CHUMS are utilized in a complementary and non-duplicative manner. Personnel should be cross-trained and duplicate overhead for the RCMAS in the Patient Administration Division (PAD) and the CHUMS in the Coordinated Care Division (CCD) should be avoided. At the Health Services Command (HSC) level, consideration should be given to blending the two systems or eliminating one or the other.

This study demonstrated that the majority of government expenditures are associated with a relatively small number of providers, clients, and market areas. Case management offers an effective means to focus resources on understanding and defining the needs of the small groups mentioned above. Further studies of cardiovascular services should identify the high cost/volume/risk segments of the market. With the average cost per pediatric cardiovascular admission at \$46,000, the avoidance of one preventable hospitalization will pay the annual salary of a case manager. By preventing some needs of the clients, and anticipating others, the case manager can channel clients to the cost effective providers. By being familiar with both the needs of the clients and the

military system, the case manager can work to keep CHAMPUS beneficiaries within the military system. In doing so, a substantial savings can be realized through avoiding hospitalizations at civilian facilities.

The CCD should work to identify CHAMPUS expenditures associated with procedures and supplies that could more cost effectively be provided through GLWACH. Understanding the who, what, where, and when of health services utilization will enable the MTF to more effectively manage its limited resources. Identifying the client, educating the client, and marketing our services will enable the MTF Commander to meet the new challenges associated with coordinated care.

Remaining true to the imperatives of coordinated care--improving access to care, maintaining the highest quality of care, and containing costs will ensure the success of coordinated care at both the DoD and MTF levels. The ordering or prioritization of the above imperatives should not be lost on the casual observer. Access and quality should be recognized as taking precedence over cost containment. Anything else represents a compromise of the philosophy and aspirations of the DoD.

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Appendix A

CHUMS Query For Inpatient Data

Informix Software using Standard Query Language (SQL)

```
SELECT  *
FROM    dtd_bills, dtd_diag, dtd_mtf, dtd_pnt
WHERE   year_paid = "91" and bills_hosp_index > "0" and
        ((hosp_diag_code between "39000" and "45999") or
        (hosp_diag_code between "55700" and "55799") or
        (hosp_diag_code between "74500" and "74799") or
        (hosp_diag_code between "09300" and "09399") or
        (drg_code between "103" and "145")) and
        (bills_hosp_index = diag_hosp_index) and
        (bills_hosp_index = mtf_hosp_index) and
        (bills_hosp_index = pnt_hosp_index)
ORDER  by month_paid
```

Appendix B

CHUMS Query For PTCA Data

```
SELECT  *
FROM    dtd_bills, dtd_diag, dtd_mtf, dtd_pnt
WHERE    ((bills_hosp_index > "0")) and
        ((hosp_proc_code = "3959") or (hosp_proc_code
        = "3601") or (hosp_proc_code = "3602") or
        (hosp_proc_code = "3605")) and
        ((bills_hosp_index = diag_hosp_index) and
        (bills_hosp_index = mtf_hosp_index) and
        (bills_hosp_index = pnt_hosp_index))
ORDER by year_paid, month_paid
```

Appendix C

CHUMS Query For Left Heart Catheterization Data

```
SELECT      *
FROM        dtd_bills, dtd_diag, dtd_mtf, dtd_pnt
WHERE       ((bills_hosp_index > "0")) and
            ((hosp_proc_code between "3721" and "3723"))
            and ((bills_hosp_index = diag_hosp_index) and
            (bills_hosp_index = mtf_hosp_index) and
            (bills_hosp_index = pnt_hosp_index))
ORDER by year_paid, month_paid
```

Appendix D

CHUMS Query For Outpatient Cardiovascular Data

```
SELECT  *
FROM    dtd_bills, dtd_cprdiag, dtd_mtf, dtd_pnt
WHERE   year_paid = "91" and month_paid = "09" and
        (bills_cpr_index > "0") and
        ((hosp_cprdiag_code between "09300" and "09399")
        or (hosp_cprdiag_code between "39000" and
        "45999") or (hosp_cprdiag_code between "55700"
        and "55799") or (hosp_cprdiag_code between
        "74500" and "74799")) and
        (bills_cpr_index = cprdiag_index) and
        (bills_cpr_index = mtf_cpr_index) and
        (bills_cpr_index = pnt_cpr_index)
ORDER  by spon_ssan
```