DATA QUALITY ASSURANCE
ACTIVITIES IN THE MILITARY HEALTH
SERVICES SYSTEM

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ABSTRACT

This paper presents data quality assurance activities in process in the Military Health Services System. It is the largest effort of its kind in the Department of Defense. The overall goal of the activities described is to implement a systematic, comprehensive, and dynamic Data Quality Assurance Plan among and across the operations of the Army, Navy, and Air Force medical departments. These three culturally distinct organizations make up the military health system. The main purpose of data quality activities is to support the deployment of the $300 million Corporate Executive Information System to the 116 hospitals and 513 clinics of the health system. High-quality data will be vital to the success of the information system. The system's planned mission will be to provide all decision support and executive information support needed by military health care decision makers. The information system will assist these leaders in managing an FY97 budget of $15.1 billion on health care for 8.3 million beneficiaries. The authors describe early development of the program and the key projects and the visionary steps required for its implementation. The paper identifies the many data quality issues facing the system, such as long-standing problems with data interoperability, misinterpretation, misapplication, lack of data standardization, and delayed data submission. The authors conclude that the project will need the support of many federal, civilian, and academic organizations to achieve success.

ACKNOWLEDGMENTS

1.0 INTRODUCTION

The U.S. Department of Defense's (DoD) Military Health Services System (MHSS) is one of the largest health care organizations in the world. The system includes the three culturally distinct branches of military service: the Army, Navy, and Air Force. Each Service has its own complex medical department headed by a Surgeon General. In fiscal year 1997, the President's Defense budget will provide $15.1 billion for medical care for a beneficiary population of 8.3 million. Patients receive care in 116 military hospitals and 513 clinics. Of this medical budget, $3.5 billion is earmarked for DoD beneficiaries who receive care in civilian institutions through the Civilian Health and Medical Program of the Uniformed Services (CHAMPUS) and TRICARE managed care support contracts.

Even in a stable environment, a health care delivery system as complex as the MHSS would be a challenge to manage. However, the MHSS is not operating in a stable environment. It is currently adjusting to the significant downsizing of military forces. Consequently, budgets are shrinking. This has required the MHSS to change its management philosophy and resource allocation methodologies from a workload-based system to a capitated, managed care operation. The new managed care concept has formed twelve Tri-Service health service regions, with Army, Air Force, and Navy treatment facilities working in partnership with large, civilian managed care contractors.

These new regional operations are requiring the military Surgeons General to rethink how they can best provide accessible, high-quality, and cost-effective health care to beneficiaries, not only in the U.S. but also to active duty forces deployed around the world. To compound this effort, the MHSS receives relentless political scrutiny and congressional oversight. These factors have caused MHSS leadership to shift its decision-making processes from the corporate level down to the local/regional level.

The Corporate Executive Information System (CEIS) is being developed as a management information system, not a clinical information system that a provider might use to manage the care of an individual patient. Other systems, such as the Composite Health Care System (CHCS) or the clinical integrated workstation (under development) will fulfill those needs. CEIS, on the other hand, will provide decision makers with information on the cost of providing care, variations in practice patterns, or differences in the cost of providing care in the military hospital versus the civilian networks. Planners will use the information system to determine the demographics of beneficiaries they are responsible for, what care the beneficiaries have historically sought, and the beneficiaries' health status. The information in CEIS is intended to allow many views, so a department head for cardiology at a

particular hospital can retrospectively view the care provided in their department by provider, by type of beneficiary, or over time.

At the highest levels of the organization, users of the system might look for variations in practice across regions or across branches of Service. They might also use the system to understand the differences in cost of care and outcome among different types of hospitals. The effects of special programs in teaching hospitals on cost and outcomes might be especially important and can be analyzed through CEIS. CEIS will also be important at the corporate level for setting budgets and determining staffing requirements. These will be necessary for tasks such as setting recruiting goals for providers of certain specialties. The overall goal of CEIS is to provide a single setting where users can obtain information which, in the past, has only been available through multiple and sometimes conflicting systems. Through this integration process and the resulting improved access to information, better decisions can be made.

As decisions move to the local level, the need for high-quality information has escalated. Information systems that provide quality data are absolutely necessary not only to manage change but to manage the delivery of health care. The Department of Defense has embarked on an aggressive program to meet the information needs of the local commanders of military treatment facilities and their support staffs throughout the world. The system they have chosen to accomplish this task is the Corporate Executive Information System. At the same time CEIS is being developed, a plan is being constructed to institutionalize data quality assurance in the MHSS.

This paper describes the project, issues, and future vision for the CEIS Data Quality Assurance Plan. Chapter 2 provides background information about the organizational environment and information systems confronting data quality assurance. A detailed picture of the plan vision is provided in chapter 3. Some examples of data quality issues facing the MHSS are presented in chapter 4, and conclusions are made in chapter 5.

The notion of a formal data quality assurance program using the concepts of Total Data Quality Management is relatively new to the MHSS. Those overseeing the task of developing and implementing a plan understand the complex environment they must operate within and acknowledge the evolutionary process that data quality assurance must follow. In that light, the reader should view this as a work in progress, with this paper describing the first steps of the journey. Many more opportunities will follow to describe later stages of the process' life, and the authors look forward to sharing those at future conferences.

2.0 BACKGROUND

As the Corporate Executive Information System (CEIS) is developed and a data quality assurance (DQA) program is implemented, it is important to understand the organizational context within which the program must operate. This understanding must also extend into the area of information systems. This section both defines the scope of the future Data quality assurance program and explains the current DQA projects that have been initiated. It will become clear that to institute a program of this magnitude requires the full support of many Department of Defense (DoD), federal, civilian, and academic organizations and that of the entire Military Health Services System (MHSS) health information management community. This belief is supported by our research and by data quality experts who have reviewed the program's goals.

2.1 Organizational Environment

A hierarchical bureaucracy permeates all elements of the federal government, including the DoD. The office within the DoD responsible for overseeing health policy, allocating resources, and monitoring effectiveness of the MHSS is the Office of the Assistant Secretary of Defense for Health Affairs (OASD(HA)).

The Military Health Services System is made up of Health Affairs, the three Surgeons General, the Services' Intermediate Commands, and hundreds of military treatment facilities located throughout the world. Within each branch of military Service, the Office of the Surgeon General is responsible for applying Health Affairs policies to the specific needs and missions of that Service. This structure has been in place for many years and has resulted in separate bureaucracies and supporting structures for each Service's medical operations.

In many cases, processes are similar among the Services, but variation is evident. This produces inefficiencies and limits opportunities to share information. The downsizing of military forces and budgets is causing the MHSS to apply innovative approaches to the delivery of health care. These changes are influencing MHSS decision-making practices.

In early 1993, the MHSS embarked on an ambitious managed care plan to improve the services it provides to all DoD beneficiaries. One of the most evident structural changes has been the adoption of TRICARE, a regional approach to managing health care delivery. By 1997, 12 geographic regions will be established throughout the continental United States and Hawaii, and in overseas locations with similar managed care operations.

Each TRICARE region has a Lead Agent responsible for overseeing the management of health care services in the geographic region. The Lead Agent is usually the Commanding Officer of the largest military medical facility in the region. The Lead Agent works with all Army, Navy, and Air Force treatment facility commanders in that region. The change to a regional concept has given the three military Services an opportunity to collaborate on providing health care at the local level. In the past, resources were assigned and health care planning decisions were emanated from the Headquarters of each Service's medical department. There was little regard for another Service's treatment facilities in the area. This is changing, and now all three Services within a region are working cooperatively on planning and operations.

Another important feature in TRICARE regional operations is that a single civilian contractor is being hired under at-risk TRICARE managed care support contracts. These are procured centrally by Health Affairs to develop and maintain a civilian managed care network for each of the regions. These are five-year contracts with one-year options. They can cost more than a billion dollars for the five-year period. In partnership with regional facilities, the contractor will augment care provided in the military facilities by establishing networks with local civilian providers and hospitals. The Lead Agents will help monitor the contractor's performance and its expenditure of CHAMPUS funds.

While the contractor in a region is at risk, adjustments are made during the life of the contract to account for inaccurate projections. Excess costs and additional savings are based on complex formulas shared by the government and the contractor. Consequently, these billion-dollar contracts rely heavily on accurate data. Inaccuracies of only a few percentage points can cause million-dollar changes in either costs or savings.

The Assistant Secretary for Health Affairs, recognizing this need for information by the TRICARE regions, established the concept of a Corporate Executive Information System that would combine and provide information from separate, local data collection systems. It would assume the mission of being the decision support and executive information support system for all decision makers at the facility, the Lead Agent, and corporate levels of the MHSS. Additionally, CEIS was also charged with eliminating duplicate functions found in eight existing MHSS systems. The overall life-cycle requirements budget for the CEIS program exceeds $300 million. The Army was selected as the executive agent to oversee the development, implementation, and maintenance of CEIS. The program office was established in February 1995.

As an integral part of the Army concept for CEIS, the Customer Service Division (CSD) was established in October 1995. Its mission is to provide help to CEIS users and to be responsible for developing and implementing a Data Quality Assurance Plan. The CSD falls within the purview of the

Patient Administration Systems and Biostatistics Activity (PASBA). The mission of developing this Data Quality Assurance Plan was assigned to the chief of the Statistical Quality Control Branch of the CSD.

A team was established to assist with writing and instituting a Data Quality Assurance Plan. The team was composed of staff from PASBA, temporary support from other facilities, and contractor support from Vector Research, Incorporated.

2.2 MHSS Information Systems

One of the primary goals of CEIS is to provide a decision support system (DSS) and executive information system (EIS) to users. It plans to do this by providing access to data collected on certain existing systems and to many different source data collection systems. However, because of the complex nature of MHSS information systems, this goal will be accomplished in two stages. The first stage will focus on field activities like the hospitals and regional offices. In addition, for the first stage of deployment, CEIS will rely almost entirely on existing data sources. The second stage, however, will add functions for corporate users at the Service Surgeon General and DoD level and will be less constrained by current data sources.

As the Executive Agent, the Army CEIS Program Office oversees program management of CEIS, but the CEIS Functional Proponent Working Group (FPWG) establishes functional and information requirements. This group, composed of representatives from each of the Services and from every organizational level within the MHSS, represents all interests during the life of the system.

Other groups, composed of more senior Service representatives, provide strategic direction for all MHSS information systems, including CEIS. Among the senior representatives are the Chief Information Officers of each Service's medical department. They are key to both the MHSS automated information system's strategic direction and to the development and implementation of supporting plans and business practices. Their insights and influence are critical to the success of any MHSS medical information system, and especially to the Data Quality Assurance Plans that support them.

The MHSS is undergoing significant change in its organizational structure, health care delivery practices, decision-making processes, and the information systems that support health care within the Department of Defense. Reliance on information is increasing, along with the realization that the quality of the data is vitally important. The CEIS Program Office leaders also realize that without high-quality, valid, reliable, and timely data feeding into CEIS, its users will not have great confidence in the system's output. The CEIS project offers an opportunity to institutionalize data quality assurance programs throughout the MHSS and to create user confidence in this $300-million system.

3.0 CEIS DATA QUALITY ASSURANCE PLAN'S COMPONENTS AND VISION

This chapter addresses the Corporate Executive Information System (CEIS) Data Quality Assurance Plan's components, including its supporting programs, processes, and steps required for the plan to be fully implemented. The Commander's Data Quality Assessment Guide [1996], a preliminary step to the development of the plan, the concept paper on the data quality for CEIS, and the implementation steps of the Data Quality Assurance Plan itself, are described here.

3.1 Commander's Data Quality Assessment Guide

While the primary focus of the project is indeed to create and implement an all-encompassing plan, Department of Defense (DoD) leaders realized and reality dictated that this process would not be completed in time for the deployment of the Corporate Executive Information System. Ideally, the plan would have been completed years ago and the concepts of Total Data Quality Management [DISA 1994, 1996a] would have become common in the Military Health Services System (MHSS). However, since this is not the case, and with deployment of CEIS looming, a decision was made by the CEIS Program Office's Executive Director to have beta site commanders conduct a quick data quality assessment of some of their key information systems and certify the quality of their data prior to the installation of CEIS.

The introduction of the CEIS presented an opportunity to address the importance of data quality to the military treatment facility commanders and staffs. The same four treatment facilities that were selected as beta sites to test CEIS were selected to test the Commander's Data Quality Assessment Guide. The purpose of the guide was to reaffirm the importance of data quality in the "brave new world" of TRICARE managed care support contracts, bid price adjustments, capitation budgeting, and business case analysis. The guide also gave facility staffs in various functional areas the opportunity to work together to address data quality issues and to start an educational process and cultural change toward improving data quality at the local level.

The guide was developed primarily by two Department of Defense civilian employees. These two individuals had a great deal of experience with the issues of data quality at the local facility level; therefore, they made an excellent team for developing a guide that was aimed particularly at local facility operations.

Because the focus of the commander's guide was on the individual facility and was intended to be an initial, simple exercise that would raise the awareness for data quality, not all aspects of data

quality were included in the metrics. For example, timeliness was not considered in the first version of the guide, but may be at a later time. One reason timeliness was not considered was that the transmission of data from the facility to the next higher organizational level was not under review. Some characteristics were not considered because not enough is currently known about what the customers of the data believe are important data quality characteristics. This information will significantly influence the development of metrics in the future.

The 12 metrics and an evaluation form were initially developed so each facility would be able to perform a rudimentary assessment of data quality at their facility and begin making the improvements. The evaluation form confirms that the facility commander reviewed the areas listed in the guide and is aware of the status of data quality at the facility. The guide also provided recommendations to improve data quality in the 12 areas. A summary of the metrics follows.

Metrics 1 through 6 compare lists of active privileged providers between staffing documents and the Composite Health Care System (CHCS) and among the various provider modules of CHCS to ensure accuracy and consistency. Metric 7 deals with nonavailability statements (NAS) validation. (Nonavailability statements are issued to verify that a medical service is not available at the local facility and therefore must be acquired through a civilian provider.) This metric ensures consistency among various information systems containing NAS data. This is critical since NASs are part of the TRICARE managed care support contract bid price adjustment process.

Metric 8 measures Ambulatory Data System (ADS) validation, testing for completeness of ADS records. Metrics 9 and 10 validate workload. These metrics compare bed days and ambulatory visits between the Medical Expense Performance Reporting System (MEPRS) and the Worldwide Workload Report (WWR) data for consistency.

Metric 11 reviews the validity of clinical pathology workload. This metric compares pathology expenses to outpatient visits for similar detailed MEPRS codes to ensure appropriate allocation of expenses. Finally, Metric 12 compares several key data elements in different source data systems to the outpatient pharmacy workload. This metric compares outpatient pharmacy workload and costs by clinic with associated outpatient visits to ensure proper allocation of pharmacy workload to supported clinic workload [U.S. Army 1996].

The initial drafts of the CEIS Commander's Data Quality Assessment Guide were distributed in mid-May 1996 to the beta test facilities. This was followed up shortly thereafter by a visit to the facilities by a "tiger team." The tiger team briefed the facility executive team and functional staff members on data quality, its significance, the importance of having the executive team's support in improving data quality, and the areas the functional staff members needed to assess data quality at the facility.

135

On May 31, additional copies of the <u>Commander's Data Quality Assessment Guide</u> were distributed to the 27 treatment facilities in Regions 6 and 11 and in Alaska (not currently in a region). Guides should be distributed to the remaining facilities in July 1996. Tiger teams will also be sent to these remaining facilities throughout the MHSS to educate their staff on use of the guide's metrics.

Little feedback has been received to date from any of the facilities on the <u>Commander's Data Quality Assessment Guide</u>. However, whereas the original philosophy was to encourage facilities to calculate and track these metrics but not report them to headquarters, we now believe that each facility should report the data quality metrics to the Statistical Quality Control Branch of the Customer Service Division to establish a baseline and to ensure that the metrics are being calculated and employed correctly. This should provide more feedback in the future.

3.2 Surgeons General Review of Concept

CEIS is designed to support decision makers at all levels of the MHSS. A system of that magnitude and any supporting programs, such as the CEIS Data quality assurance program, will be doomed unless there is support from the leadership. This means that the Assistant Secretary of Defense for Health Affairs, the Surgeons General, Lead Agents, and facility commanders will need to know what the Data Quality Assurance Plan will look like.

The CEIS Data Quality Assurance Concept Paper will be the mechanism by which each of the principal MHSS stakeholders will learn of the data quality assurance concepts to be employed in the program; it will also elicit feedback from them. The concept paper will detail the underlying model for the program and how it was derived, the structure of the supporting organizations, the roles and responsibilities of MHSS personnel, and the processes to be employed in its implementation.

This step in the program's development is critical. The CEIS Data Quality Assurance Plan must satisfy the data quality needs of all users. It cannot be perceived as the product of a small group of people imposed on the system without adequate feedback from Service representatives. The CEIS Data quality assurance program Concept Paper will provide an initial opportunity for feedback and help guarantee a successful program.

3.3 The CEIS Data Quality Assurance Plan

At the heart of the current project is development of a Data Quality Assurance Plan that will have as its goal the availability of high-quality data that users will rely on for making important health

care decisions. The Corporate Executive Information System will provide the setting in which this plan will be developed and implemented. It is still in the early stages of development. It is based on three underlying principles: (1) Data quality will be ascertained at the earliest point after its collection or processing. (2) The principles of Total Data Quality Management will form the core of the plan. (3) The plan must be in line with regulatory guidance and strategic planning for each of the Services and DoD [U.S. Army 1995].

The structure and processes of the plan are described below. Roles and responsibilities of key players in the program are discussed and brief accounts of important aspects and the proposed steps of the plan are provided. The goal here is not to provide details of the plan but to give a conceptual look from which the reader can make preliminary judgments about the plan's direction.

3.3.1 Roles and Responsibilities

The creation and implementation of a Data Quality Assurance Plan will be most effective if all those involved in the production, processing, and use of data adopt and apply the concepts of Total Data Quality Management [DISA 1994, 1996a]. At the program's core will be people working together to ensure the plan's success. The responsibilities of the offices in the DoD are as follows.

Office of the Assistant Secretary of Defense (OASD) (Command, Control, Communications, and Intelligence) establishes overall data quality assurance procedures, standards, and guidance for all of the DoD. The Office of the Assistant Secretary for Health Affairs (OASD(HA)) sets policy and provides general oversight of all Military Health Services Systems, its information management information technology resources, and related health care information management activities.

Health Affairs Defense Medical Information Management (DMIM) office oversees the CEIS Program. It coordinates all investments in infrastructure to ensure interoperability, compatibility, compliance with architecture and standards/guidance; and it develops and maintains data standards for MHSS. The CEIS Program Office coordinates its work with representatives of the Army, Navy, and Air Force and with Lead Agents to ensure that approved requirements in the dissemination and management of MHSS information are being met. It develops the life-cycle program management plan to execute CEIS, and it establishes a Tri-Service CEIS Data quality assurance program.

The Service Surgeons General establish an environment that recognizes the importance of data quality and encourages Total Data Quality Management (TDQM). They appoint qualified officers who are responsible for data quality within their medical departments. The Lead Agents will each appoint

an individual who will be responsible for data quality issues within the region and who will be the point of contact for data quality with CEIS' Customer Service Division's Statistical Quality Control Branch.

The military's medical treatment facility Commanders will "own" and will be responsible for the quality of data within their facility. They will monitor data quality metrics and establish an environment that recognizes the importance of data quality and encourages Total Data Quality Management. They will appoint an individual who will be responsible for data quality within the facility. This person will also be the point of contact with the Lead Agent and the Customer Service Division for data quality issues. The Customer Service Division's Statistical Quality Control Branch is a part of the CEIS and is the operational arm of Defense Medical Information Management in the data quality assurance process. The Customer Service Division will oversee data quality activities for CEIS. Specifically, they will be responsible for developing a CEIS Data Quality Assurance Plan and then executing that plan.

3.3.2 Steps Required to Implement the Plan

The Total Data Quality Management concept of the DoD [DISA 1994, 1996a] has been embraced by the Statistical Quality Control Branch as the model and framework for the CEIS Data Quality Assurance Plan. As the group within the CEIS Program Office responsible for overseeing such a plan, SQCB's most difficult task will certainly be implementing it. The CEIS Data Quality Assurance Plan will be composed and implemented using the following four steps. These steps reflect the vision of the authors on how the TDQM process will be instilled throughout the entire MHSS.

Step One: Establish the Environment

The first step will be to establish the TDQM environment in the MHSS. The federal government and the Department of Defense have sought to instill a Total Quality Management (TQM) philosophy throughout the organization for many years. A tenet of the TQM philosophy is the notion that it should not be considered "just another program," but instead a value that is at the core of the organization's culture. The same can be said for TDQM as it is conceived in the CEIS Data Quality Assurance Plan.

The environment supporting TDQM must be one that encourages continuous improvement, not the "quick fix" mentality that often sees the results fade when the spotlight of concern is turned off.

Teamwork, bringing process experts together from all levels of the organization and from all ranks, should be the model for process improvement. Clearly, those most able to build the proper environment are the leaders of the organization.

Leaders will prepare their organizations for a TDQM environment by conducting strategic planning for data quality management and by developing and managing the culture of the MHSS. Strategic planning starts with the DoD Data Administration Strategic Plan [DISA 1994b]. Data quality goals and objectives in the DoD plan will then be addressed for the MHSS through the Health Affairs Data Administration Strategic Plan [OASD(HA) 1994]. For example, the current Health Affairs plan identifies standard data as one of its goals that will improve data quality. In another goal, establishing an operational central repository for standard data definitions, data formats, and structures, is identified as a way to assure data quality in the MHSS.

In addition to data administration strategic plans at the MHSS level, the Army, Air Force, and Navy medical departments' information system strategic plans must consider TDQM principles. Such documents will ensure that the interests of each Service are considered and that the TDQM environment is developed within all three Services.

Strategic planning will provide the conceptual foundation for data quality and will provide a quick way to communicate this throughout the organization. Additionally, leaders must show their concern for data quality by including it in presentations to staff, agendas at conferences (such as the TRICARE conferences), and workshops and symposia, like those held by such MHSS functional groups as resource managers or patient administrators. Placing data quality topics in general medical training programs and specific data quality issues in system training should be explored. This will increase the awareness of data quality throughout the organization.

Training at all levels will certainly be a key ingredient to developing a cultural environment that fosters the continuous improvement of data quality. However, leaders must also identify people who will ultimately be responsible for data quality. Generally, these leaders will be the commanders at facilities since they oversee data creation and processing.

Awareness of the importance of data quality is something the Statistical Quality Control Branch of Customer Service Division has set as a goal and is accomplishing by implementing the Commander's Data Quality Assessment Guide. As described earlier, the guide is an integral part of the deployment of CEIS, and it focuses the treatment facility's executive staff on the importance of data quality at their site. While the immediate goal of the guide may be to highlight specific data quality issues, the wider goal is to build awareness and develop a culture of data quality.

Step Two: Identify Projects and Develop Plans

The second step will be to identify data quality improvement projects and develop project implementation plans. Specific projects will be identified and then implemented in a culture that espouses continuous improvement for quality data. Data quality projects may be at any level of the MHSS, and they will receive support from the CEIS Program Office through the Customer Service Division's Statistical Quality Control Branch.

Records will be kept at the Statistical Quality Control Branch of significant data quality projects conducted throughout the MHSS. These will be valuable resources for others who are identifying potential projects or who are looking for possible solutions to data quality problems already addressed in another project. This aspect of the Statistical Quality Control Branch's program will help eliminate redundant projects and promote efficient problem solving. Many data quality issues may be identified throughout the MHSS, and it will be important to establish criteria to prioritize issues before turning them into projects.

Sources of issues will be identified and processes established to guarantee users the opportunity to provide feedback on quality issues important to them. System change requests (SCRs) will be managed through the Statistical Quality Control Branch to identify trends that might indicate data quality problems throughout entire systems.

Analysis of help-line calls and user surveys will also provide sources for data quality issues. List servers that automate the distribution of electronic mail will also give users an opportunity to identify data quality issues and receive solutions to issues raised. As CEIS is developed and information requirements are identified by users, it will become evident which kinds of information and related data quality issues will be most important.

The implementation of MHSS program issues at the forefront of policy debate will also provide sources for data quality issues. The data needed to support Medicare subvention, managed care support contracts, and capitation allocation will deserve high-priority analysis to determine their quality.

The sources for data quality issues will be numerous. It is not likely that there will be sufficient resources to turn all issues into projects at the same time. Criteria will be needed to determine where the most benefit can be derived for the least cost. Typically, users will determine the criteria. At the DoD and corporate level, criteria may focus on broad issues that affect all facilities. Lead Agents may want criteria that focus on the specific managed care support contracts they manage. However, they may also develop criteria that emphasize data standardization among the facilities in their areas.

Finally, at the facility level, commanders will want to develop criteria that fit their local particular needs. The common theme at each level is that the user will determine the criteria.

Criteria may also differ, depending on whether the project will be a prototype effort or part of an ongoing maintenance plan. Early projects should have criteria that value high chances of success, that identify projects with the highest external failure cost, and that provide the most significant chances for improvements and returns on investment.

When evaluating data quality criteria, leaders should address such issues as access to data, its authors, and the functional and technical expertise to identify valid criteria. The cost of quality should also be considered in the criteria. These calculations should include the costs associated with prevention, appraisal, internal failures, and external failures.

Once issues have been selected as projects, plans must be made to ensure success. A plan should address the scope of the project and should include such items as a task summary (executive summary), task description, approach, schedule, deliverables, and resource requirements (people, equipment, and money). The team identified to conduct the project will obviously be crucial to its success. Membership should be composed of those who understand the processes in question.

Data quality project plans should be well documented so they can be maintained in a central repository at the Statistical Quality Control Branch. Consideration should be given to storing this information in the Health Information Resources Service (HIRS), which has a home page on the Internet, so they can be readily available to others throughout the Military Health Services System.

Step Three: Implement Projects

The third step will be to implement data quality projects. Large data quality projects will be included as annexes to the CEIS Data Quality Assurance Plan. Projects will use data quality management methods to guide teams and to provide structure. There will be a distinction between the TDQM process that addresses the entire CEIS Data quality assurance program and data quality management methods that are used for individual projects at the local level.

Functional proponents, users, and other stakeholders at all levels of the MHSS must be key players in employing the data quality management methods, and they must be actively involved in the process and understand the objectives of the methods. The overall objectives for the data quality management methods will be to assess and validate specific problems, identify root causes, and improve the quality of the data.

While these objectives are accomplished in an iterative manner, it will be important to measure the success of each iteration. Baseline assessment reports will provide an opportunity to quantify the data quality before projects begin, using data quality metrics established by the data's users. Costs and recommended improvements will also be provided in whatever baseline assessments are developed.

Four activities will help accomplish the method's objectives. These activities are define, measure, analyze, and improve. During the "define" activity, data quality requirements will be identified and metrics established by the users. Activities two and three, "measure" and "analyze," will seek to verify, validate, and assess the data quality with the goal of identifying root causes for the problems and evaluating possible improvement opportunities. In the last activity, "improve," plans will be made to implement improvements, using the familiar TQM technique, PDCA (plan, do, check, and act).

Complete project documentation will be forwarded from various teams to the Statistical Quality Control Branch for storage in a central repository available to MHSS users. Project summary descriptions and results will also be kept as an annex with the CEIS Data Quality Assurance Plan. This will provide an historical perspective of the program and facilitate evaluation of the program's effectiveness.

Step Four: Evaluate CEIS DQA Plan

The fourth step will be to evaluate the CEIS Data Quality Assurance Plan. The same philosophy of continuous improvement that is applied to the management of data quality for information systems will also be applied to the CEIS Data Quality Assurance Plan itself. This will reinforce the idea that TDQM is a business practice embedded in the culture of the organization and not "just another program." Leaders and those specifically responsible for data quality assurance throughout the organization must know the effectiveness of the plan.

Measurable objectives must be based on the strategic goals mentioned above. Continuous research in the field of TDQM will provide opportunities to improve existing approaches to data quality management. Feedback from users in the field, participants in data quality projects, and MHSS leaders will be important sources for improving the plan. The CEIS Data Quality Assurance Plan must provide mechanisms to ensure this feedback.

Given the world-wide nature of the MHSS and the advances in telecommunications technology and software, commercial, off-the-shelf (COTS) products that enhance group communications and the sharing of ideas (e.g., groupware and list servers) will be valuable for promoting user feedback.

Existing processes, such as user surveys, the CEIS help desk, and periodic studies, will be other means to determine how the organization perceives the value of the CEIS Data Quality Assurance Plan.

Results of the evaluation will be disseminated throughout the MHSS. Specific processes will be implemented to ensure that the Defense Medical Information Management office receives results of each evaluation so they can submit the results with their documentation to the DoD Data Administrator and include it in updates to the MHSS Data Administration Strategic Plan.

4.0 DATA QUALITY ISSUES IN THE MHSS

The Military Health Service System (MHSS) is a large, complex, constantly changing health care delivery system. More than 20 different major, automated, independent ("stove-pipe") facility information systems support each facility in its day-to-day operations. In addition, despite significant progress in the last ten years in standardizing medical information systems across the three Services, Service-unique information systems still exist.

Different regulations, organizational structures, policies and cultures govern the facilities of the three Services. With the size and complexity of the MHSS as well as with the varied information systems and associated policies, it is easy to understand why data quality would be an issue. Data standardization, consistency, timeliness, accuracy, and completeness are all recognized as long-standing problems.

4.1 A Data Quality Scenario

The following scenario suggests how an issue might be identified, analyzed and resolved: one of the most important components of delivering health care is recording every aspect of the care provided to a patient. This is especially true when a patient is admitted to the hospital. Providers note all diagnoses and procedures in a clinical record. This information is then extracted from the written record, coded with standard designators (e.g., Integrated Classification of Diseases, 9th Edition), and entered into the Composite Health Care System (CHCS). This process all takes place at the facility; however, the data are transmitted at the end of each month to a central repository and made available to MHSS analysts.

These data are used for many purposes at all levels of the organization. At the highest offices in the Department of Defense (DoD), they are used to determine the complexity of care being provided at a facility and thus are used to determine a Service's budget. At a regional level, the Lead Agents use the data to determine the type of care being provided within the region to determine the resources needed to meet demand. At the facility level, the data are used to analyze provider practice patterns and spot variation among providers. The local facilities can also use the information to get a better understanding of their population's health status.

But there are known problems with the data. One problem often cited is the inaccuracy of the coding. This process relies on accurately reading the provider's written notes and then determining the appropriate code to assign to the diagnosis or procedure. This code must be accurately entered into the

144

patient's electronic record. The codes are then automatically grouped and assigned an overall Diagnosis-Related Group (DRG) code, which becomes the basis for further analysis.

In addition to problems at the time of entry, data transmission can compromise data quality. Technical problems, such as incorrectly transmitted data or timeliness problems, can occur. For the analyst, trying to make decisions using partial sets of data can be very problematic.

Finally, all 120 military medical facilities have their data collected and merged into a single database. This last step in the process often highlights the differences found in the way each Service records and processes its data.

In the past, there were no formal mechanisms to address data quality problems. When a problem was identified, an attempt may have been made to solve the specific problem where it was found. A formal Data Quality Assurance Plan will ensure data quality projects are addressed in a systematic and rigorous way.

In this particular example, a set of criteria will be established to judge whether the coding problem should be turned into a project. The measurable criteria may include accessibility to data, documentation, functional and technical experts and other measures, such as who owns the data. Other, less tangible factors will also be considered, such as the potential impact of the data's quality on other projects and the political climate surrounding the data. These criteria will help determine the expected success of the project compared with other potential projects.

Cost-benefit criteria will also be important for determining which issues are chosen for projects. In some cases the costs and benefits will be hard to determine; in others, easier. For example, managed care support contracts are awarded in each of the 12 regions across the country. Each is a multi-year contract worth billions of dollars. A significant aspect of the bid price determination is understanding the population to be cared for in a region. Over the life of the contract, a shift of relatively small numbers of beneficiaries can mean significant differences in the bid price of the contract. This extreme sensitivity to shifts in populations indicates that population data will be very high on the list for data quality review. In many other cases, costs and benefits are not as well understood, but they will always be considered when choosing a data quality project.

It is conceivable (or likely) there will be conflicting criteria or disagreements about the relative importance of criteria. Ideally, consensus techniques could be employed for a group to proceed. In reality, political influences or expediencies may prevail. However, these cases will be documented to explain the issues.

If a coding project is selected, then a team of experts will be assembled to confront the problem using the data quality management methods described in chapter 3. If the problem is more systemic in

nature, then a team will most likely be assembled from each of the branches of Service and from OASD(HA). If it is a local problem (e.g., at an individual medical facility), the team will be formed at that level with assistance from the CEIS Customer Services Division (CSD) in San Antonio.

As a project unfolds, a repository of data quality projects will be reviewed to determine if similar projects have been undertaken before and if the current project can benefit from those experiences. After defining the problem, measuring and analyzing the various quality characteristics of the data, and implementing improvements to the process, the project summary will also be placed in the repository.

The approach described in this scenario is flexible. The Data Quality Assurance Plan developers realize that data quality problems could involve just a single department in a hospital or the entire military health care system. The tools and techniques will be applicable in any case and simply scaled to the scope of the problem. The results may be as simple as added training for coders or handwriting classes for providers. Or they may be as complex as a system change to CEIS that affects everybody.

No matter which of the data quality problems are included in the Data Quality Assurance Plan or what level in the organization they are found, the concepts for Total Data Quality Management (TDQM) described in this paper will seek to ameliorate them.

4.2 Potential Data Quality Issues

Described briefly below are some of the general data quality issues anticipated in the MHSS. When these issues are considered through the Data Quality Assurance Plan, they will be addressed by teams of experts familiar with data creation, processing, and use. They will decide at what level of the organization solutions would best occur. It is not inconceivable that proposed solutions will require actions from every level of the organization: from those who enter the data to those who set policies and design the information systems.

4.2.1 System Interoperability

Most of the current major standard medical information systems have been operational or at least been in the planning stages for over 15 years. Most of them are classic "stove-pipe" systems where a particular medical function recognized a need for a specific application and built an isolated system to fill that need without concern for other applications that might also be able to use the same data. The differences in hardware, software, data definitions, etc., made interoperability difficult at best. It also

promoted double entry of data and the corresponding inconsistency. Each system defined some of the most basic data elements differently, such as "outpatient visit," "bed day," "patient identification," and "provider identification." These are all well-known problems in the MHSS, and a number of efforts have been taken to resolve them with varying degrees of success. The CEIS effort itself is looked at as being the long-term solution for most of these problems.

4.2.2 Creators Versus Users

To date, most of the MHSS information systems have been built using a top-down approach. That is, the designers of the systems were primarily at headquarters levels, where they understood the corporate uses of the data but were not as familiar with the facility-level uses and problems of the data that were entered at the facility level. Due to these practices, the facilities received little value from that data. They did not feel obliged to take ownership of the data, and they had no incentive of assuring for its quality. Not only were the incentives lacking, the tools, metrics, and guidance for a facility to determine the quality of their data were virtually nonexistent. Thus, it would have been difficult for a facility to measure their data quality even if it was wanted by the facility.

One of the basic objectives of CEIS is to turn this philosophy around. The facilities are being given ownership of the data and the responsibilities that go with that ownership. In return, the facilities are being provided systems, such as CEIS, and tools and metrics so they can use their data in real time to make the critical decisions required in the current MHSS environment. The presumption is that once facilities understand the value of accurate data in their day-to-day operations, they will be motivated to improve data quality so they can operate at optimal efficiency. Anything less would be disastrous.

4.2.3 Regionalization and TRICARE

Not unlike in the civilian medical community, there have been significant changes in the last few years in the policies and philosophies of health care delivery in the MHSS. One of the major changes is the movement toward managed care. Since most data for corporate users is slated to go through the regional Lead Agent offices, this adds another level of management with its own information requirements.

Currently, seven out of the 12 regions in the United States have managed care support contracts to provide health care that cannot be provided in a military facility. Contracts for the other five regions

will be awarded in the near future. CHAMPUS-eligible beneficiaries will be given the opportunity to enroll in a health maintenance organization (HMO) or to receive their care through a preferred provider organization (PPO) or to receive care through a traditional fee-for-service arrangement.

Incorporating large managed care support contractors as partners in delivering care to military beneficiaries has generated new information system problems. Getting the civilian contractors' information systems to interface with treatment facilities' computers, particularly in the areas of enrollment, patient appointments, and scheduling poses huge interoperability data quality issues.

4.2.4 Capitation Budgeting

Concurrent with the movement of the MHSS toward managed care has been a movement toward capitation budgeting. In the past, resources were allocated to facilities based on historical workload intensity. The incentive was for facilities to deliver more care and thus receive more resources for the workload they produced. This "churn and earn" philosophy kept facility workloads high but also made the total cost of health care in the MHSS skyrocket.

DoD is now moving toward a resource allocation system based on the number of beneficiaries served rather than the workload generated. This has also caused a shift in MHSS information requirements. Whereas in the past there was little interest in per capita statistics, they have now become critical performance indicators.

4.2.5 Tri-Service Consensus

The Army, Navy, and Air Force each have their own Surgeon General who in turn has a Chief Information Officer (CIO). The CIOs have different missions, different regulations, cultures, and policies to operate within, and all with somewhat different information requirements. Whereas tremendous strides have been made in recent years to reach Tri-Service consensus on a number of information management issues, there are still vast differences. Reaching consensus on these unresolved issues and system changes is going to offer unique challenges to the institution Data quality assurance program throughout the MHSS.

4.2.6 Misinterpretation

Even when there is consensus among the three Services on data definitions, policies, and standards, there are undoubtedly going to be different interpretations of these definitions among the Services and even among the different facilities within a single Service. One of the objectives of the data quality assurance effort will be to identify and then clarify those areas subject to different interpretations through the implementation of standard business practices, education, and data elements and data definitions.

4.2.7 Misapplication

Even with clear guidance, personnel in a facility will purposely input erroneous data for the sake of saving time. For instance, when there is a 45-minute wait in the pharmacy and the pharmacy technician receives a prescription without an expense code, they can either guess the code and expedite the prescription or take the time to call the prescribing provider to get the proper code. Speed usually wins out over accuracy.

In another case, all personnel in a facility are required to fill out monthly time sheets indicating to which codes their time should be charged. Faced with 27 different time codes, many busy providers do not understand the importance of these time sheets and will "pencil whip" these reports to save time. The Data Quality Assurance Plan must address these issues by making systems more user friendly and by educating facility personnel about the importance of accurate data entry.

4.2.8 Timeliness

Due to the overwhelming duties faced by undereducated and underpaid treatment staff members, prompt data entry and reporting are not important or take a lower priority. Timely submission of data by facilities to the central repositories is an issue. Data quality improvement activities will have to answer these issues and include better education and system support if they are to improve these business processes.

5.0 CONCLUSION

The introduction and development of the Military Health Services System (MHSS) Corporate Executive Information System (CEIS) has provided a timely opportunity to introduce the concepts of Total Data Quality Management into a complex and rapidly changing environment that demands high-quality data. Leaders in the Military Health Services System acknowledge this need. However, research has shown that there are few, if any, models for an effort of this magnitude.

What results is a project with high expectations but with little historical basis for evaluating success. From the academician's view, this presents a classic opportunity to employ quasi-experimental designs to understand the variables that might lead to the successful implementation of a large Total Data Quality Management (TDQM) program [Cook and Campell 1979]. Clearly, the hope is that the CEIS Data Quality Assurance Plan will result in cost savings and more satisfied data customers. More rigorous study of this project might turn hope into solid expectations.

While the research shows limited experience in the application of formal TDQM programs in very large and complex organizations, research also reveals many organizations who wish to venture in that direction. Opportunities for collaboration with organizations of similar size and structure will be evaluated to determine if mutual benefits exist.

The journey to a Military Health Services System that considers Total Data Quality Management a fundamental precept in its business practices must begin with cultural changes. Training and education will be keys to this inculturation. The CEIS Data Quality Assurance Plan is most assuredly a work in progress. It will present many opportunities to employ continuous quality improvement methods. As this evolutionary process occurs, many could benefit from the lessons learned, and the authors of this paper look forward to sharing them with those who understand the importance of data quality.

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ACRONYMS

ADS	Ambulatory Data Systems
CEIS	Corporate Executive Information System
CHAMPUS	Civilian Health and Medical Program of the Uniformed Services
CHCS	Composite Health Care System
CIO	chief information officer
COTS	commercial, off-the-shelf (software)
CSD	Customer Service Division
DMIM	Defense Medical Information Management
DoD	Department of Defense
DQA	data quality assurance
DRG	Diagnosis-Related Group
DSS	decision support system
EIS	executive information system
FPWG	Functional Proponent Working Group
HIRS	Health Information Resource System
HMO	health maintenance organization
MEPRS	Medical Expense Performance Reporting System
MHSS	Military Health Services System
NAS	non availability statement (services not offered at a beneficiary's assigned treatment facility)
OASD(HA)	Office of the Assistant Secretary of Defense for Health Affairs
PASBA	Patient Administration Systems and Biostatistics Activities
PDCA	plan, do, check, act
PPO	preferred provider organization
SCR	system change request
SQCB	Statistical Quality Control Branch
TRICARE	Tri-Service Care
TDQM	Total Data Quality Management
TQM	Total Quality Management
WWR	Worldwide Workload Report